Metallurgy in ancient Lecce: new evidence from the excavations of Piazzetta Epulione and Piazzetta Castromediano

C. Giardino¹, A. Quercia²
¹University Suor Orsola Benincasa, Naples
E-mail: claudiogiardino@katamail.com
²University of Lecce, Dipartimento di Beni Culturali, Via D. Birago, 64 73100 Lecce (Italy)

Abstract
Recent excavations made by University of Lecce in Piazzetta Epulione and Piazza Castromediano (Lecce) have produced structures and artifacts related to metal-working. Most of the evidence dates back to the Roman period; traces of metallurgical activity can also be traced to the periods preceding and following the Roman period. Iron slags and semi-finished objects have been found in Piazzetta Epulione. Of particular interest are the vetrified slags related to the tuyeres, which were probably connected to smithing works. Archaeometallurgical analyses (microscopy and XRD) of objects found in the excavations support the hypothesis that the metallurgical workshops of Lecce were involved in the production of iron.

Piazzetta Lucio Epulione: the archaeological evidence
Piazzetta Epulione lies in the south-eastern part of the historical centre of Lecce, just south-east of the Roman theatre; the area is located in a part of the modern town where archaeological evidence was already discovered, between the end of the 19th and the first half of the 20th century. Preventive archaeological investigations took place in 2001, during works of maintenance of the city sewer system; they led to the discovery of archaeological deposits in section. Archaeological excavations started in 2002 in an area of 215 square metres; they brought to light a stratigraphy that underlined the continuity of occupation of the piazzetta from the 8th century B.C. up to the contemporary age and they allowed to acquire an interesting page of the history of Lecce (fig. 1).

The earliest metallurgical evidence dates back to the Messapian phase (4th-3rd centuries B.C.). It deals with findings coming from layers identified in the eastern part of the excavation, where it was possible to deepen the dig up to Messapian levels. They are, in most of the cases, layers of accumulation (units 246, 270), that obliterate the remains of a Japigian hut datable between the end of the 8th and the 7th century B.C. (fig. 1, n. 1); the aforesaid layers can be attributed to the period between the second half of the 4th and the 3rd century B.C., according to the finds. Despite the few evidences, it is possible to hypothesize that metalworking took place in the area of Piazzetta Epulione already between the 4th and the 3rd century B.C. (A.Q.)

The excavation of the forges
Piazzetta Epulione area was interested by the presence of a metallurgic workshop, active in iron manufacturing during the Roman period (fig. 1, n. 2). In an area placed near a road, endowed with a wall of delimitation (unit 7), with a pedestrian sidewalk (units 38 and 144) and with a roadway for the vehicles (unit 122) - datable between the second and the first half of the 3rd century AD - a series of evidence like a sequence of plans of burnt clay, layers of ash and remains of hearths, overlapped between them and characterized by abundant iron slag were recovered to the west. The layers were delimited to north by an east-west wall built with blocks. The presence of adjustments and alteration of medieval and post-medieval period makes rather difficult a general interpretation of the evidences related to this workshop. (A.Q.)

Starting from the upper layers, the remains of a hearth of semicircular shape was discovered (unit 253); the were covered by an accumulation layer dating back to the late antiquity (Fig. 2). This hearth is laid down on a reddish and very compact plan, whose characteristics are related to the high temperatures reached (unit 254); most of the slag and semi-finished iron products came from this level. This layer could be interpreted as a working plan for metallurgical activity, to which the forging hearth was functionally connected. It was flanked by two pits of quadrangular shape, whose walls were filled with stones (units 257, 259), in which a pair of anvils bases were probably inserted; a small pit filled with discarded material was found next to them (unit 255). (AQ, C.G.)

The removal of this level brought to light a layer of local crushed limestone ("tufina") in the central part of the area (unit 272). It covered a hearth for all its extension; this layer presented thermal alterations produced by the contact with the underlying structure. This hearth, probably a second forge (fig. 3), had a rough rectangular form slightly lengthened to the west, and it was composed by two different layers, divided by an alignment of small fragments of stones and "tufina". To the west the unit 282 was composed by a very soft, dark grey soil (more compact to the centre),
mixed up with fragments of calcarenite, thermally altered, and anthracological finds; to the east the unit 283 had lengthened form, reddish and very compact. Probably the metal was heated to high temperatures in the western side of the forge and it was subsequently cooled in the eastern part. The upper layer of tufina (unit 272) sealed the forge when it was not in use any more, even if it cannot be excluded that this layer had a role in the metalworking processes.

Other possible bases of forges were found under this level; they had different dimensions and they were made by burnt clay and pressed calcarenite (units 289, 291, 292). The largest one (unit 289) had the same dimension as the forge unit 282-283, that was just above; it was characterized by chromatic gradations (from dark-grey to red), according to the distance from the fire. The bases were built on a compact floor (unit 273) that was probably the occupation surface of the productive area; the same floor was detected to the west (units 139 and 194), for about 7 m long.

The data allow to affirm that the area was used for iron processing; the hearths and the bases in burnt clay can be interpreted as forges. The productive area underwent small transformations in the spatial organization during the time. In fact the lower burnt clay layers (units 282-283, unit 289) did not change their position, while the upper hearth (unit 253) was shifted slightly to the south.
The productive area was delimited by walls made by square limestone blocks different in dimensions, badly preserved because of medieval and modern interventions; therefore the general interpretation is rather complex. The best preserved wall was identified to the north (unit 58); it presents two rows of blocks. The floors and the plans of the productive area leaned to it: to the south the wall unit 172 and to the west (orthogonal to the last one) the unit 171. Another portion of wall (unit 173) was identified to the west, perhaps related to the same structure. According to the alignments of the walls hypothetically it is possible to reconstruct a rather large building, of about 55 square metres (10 m long, 5.5 m wide). Probably it was divided into two rooms: the eastern room for productive activities, while the western one – smaller and with a tile covering - had not industrial structures and could have different functions (commercial and/or residential?).

The few pottery found in the levels of use fixed the chronology of the smithery activity between the late second and the first half of the 3rd century A.D.; it was, therefore, contemporary to the adjoining road, that was probably functional to the productive structure.

Some slag were found in the preparation layer of the most recent pavement of the road (unit 37), dated to the middle of the 3rd and the beginning of the 4th century A.D.

An intense metallurgical activity held in the area of Piazzetta Epulione during the Late Antiquity. A certain number of metallic slag were found in the accumulation
layers and in the discards (units 40, 53, 79, 128), in close association with a great amount of pottery. This pottery was discarded to level the Roman road and the surrounding area. The pottery11 fix the chronology of this intervention between the 5th and the 7th century A.D. (A.Q.)

The forges of Piazzetta Epulione: the archaeometallurgical evidence

As a rule, the forges have a very simple shape; often they were made mostly by clay, because they were not permanent structures. Therefore their identification can be rather difficult in archaeological excavations. The reuse of the area limits generally their evidence to more or less regular spots of burnt surfaces that are surrounded and filled by ashes, charcoals and slag.

Forges were used in two different processes, that took place after iron ore smelting. The first operation was to refine the bloom in to a semi-finished bar; the smelting furnace produced, in fact, a spongy mass, the bloom, that was composed by iron mixed with charcoal remains and slag. A second, later process transformed the bar into finished implements. Both processes do not need the reduced atmosphere, that is necessary in the smelting activity; in fact, the blacksmith have only to heat the iron, in order to allow the hammering (Giardino 1999, pp. 205-207; Giardino et al. 2003, p. 643).

According to Diodorus of Sicily, sometimes the bloom was splitted into smaller parts, which were then sold (Diodorus, History 5.13.1-2).
The archaeological identification of smithing hearts can be difficult; key finds are slag. The Roman forges have generally an elongated elliptical plan, usually 1-2 m long; they were occasionally constructed of clay and stone and they have occasionally an internal clay lining (Schrüfer-Kolb 2004, pp. 31-32, Fig. 17).

The two forges of Piazzetta Epulione did not work at the same time; nevertheless they both can be date period between the end of the second and the first half of the 3rd century A.D. These forges represent a rather rare archaeological evidence in the Italian Peninsula, because the paucity of similar remains in Italy.

The most recent forge (unit 253) appeared partly damaged, but it can be reconstructed as a hearth of coarse elliptic shape, measuring nearly 100 x 50 cm. Unfortunately, nothing of the upper structure was preserved, a part from few scorified clay fragments; they are an indication that the forge walls were made (and probably lined) by clay. Using the different traces of combustion in the soil as a guide, it is probably possible to distinguish two different and separate areas inside the forge. In one side the tuyere was placed; therefore the highest temperatures were reached in this area. The other side was located at a certain distance from the air outlet: this was the area where the manufactured objects had the opportunity to cool slowly.

A similar space organization can be reconstructed also in the oldest and largest forge, measuring 130 x 90 cm (unit 282-283); it was preserved better than the previous one. Evidence of the walls were not preserved, except few fragments of vitrified burnt clay.

An irregular dark spot was found very close to the first forge; a concentration of anthropological remains distinguished this unit (unit 254): it could be the storage place for the charcoal used as fuel.

Two pits (unit 257 and 259) were discovered near this forge. Most likely the anvil was located in one of them (probably the unit 259).

It is also possible that the two pits housed a couple of anvils, typologically different, used for specific purposes in metal production. The blacksmith’s stèle from the oppidum of Le Bure near Saint Dié (Vosgi) offers a good iconographical example of the co-presence of more anvils in the same workshop: three different anvils are represented on it (Cima 1991, p. 184).

Anvil have to be very close to the forge, because the iron must be hammered when it is incandescent. If the interpretation of the pit unit 259 is really, as supposed, an anvil base, the anvil stayed less than a meter from the smithing hearth.

The small pit unit 255 found near the forge could be used to discard the residues. Agricola’s pictures from De Re Metallica (Agricola 1556, book IX) show late Medieval and Renaissance blacksmith’s workshops where pits for discarded materials close to the forges were in use.

Many Roman relieves, generally of funerary character, represent the blacksmith’s workshop. A marble slab from the Domitilla’s Catacombs in Rome represents two artisans; it is dated to the 1st century A.D. The first craftsman works at the anvil, where he is hammering a bar kept with the tongs; the second blacksmith stay at the forge, operating at the bellows.

Unlike the evidences from Lecce, in this relief the fire is placed on a raised base and it has a kind of wall (perhaps made by bricks) on the back, to protect bellows and blacksmith from the overheating.

The forges found in Rome, on the Capitoline Hill, were rather similar to the structures from Lecce, Piazzetta Epulione, but they are rather more ancient: they belong to levels contemporary to the construction of the temple of Jupiter (Giardino, Lugli 2001, p. 327). (C.G.).

**Functional interpretation of the slag**

A large amount of slag was found in the excavation of the blacksmith’s workshop of Piazzetta Epulione. They represent, together with scorified clay and tuyeres, important evidences to detect the processes involved in iron making process.

A correct interpretation of these evidences needs to com-

---

**Fig. 4. Slag related with tuyeres, found in Messapian levels (4th-3rd century B.C.) (unit 246).**

**Fig. 5. Whetstones from Piazzetta Epulione, Messapian levels.**
bine archaeometrical data, obtained by the structural analysis of the finds, with the information coming from the careful study of the archaeological contexts. Sometimes the results of archaeometrical investigations can be ambiguous: smelting slag process can physically and chemically resemble the slag produced during the smithing operations, especially if the analysed specimens are small and broken, as it happens with the finds from the blacksmith’s workshop of Lecce (Giardino et al. 2003, p. 641).

The first evidence of metallurgical activity in Piazzetta Epulione come from the Messapian levels (4th – 3rd century B.C.). Two vitrified clay fragments were found in unit 246; one of them has a rough cylindrical shape and can be interpreted as the imprint left by the tuyere, or else as a slagged fragment of the tuyere (fig. 4).

Two whetstones came from the same unit; they were used for finishing the metal objects (fig. 5). Because of the few remains, it was not possible to establish if iron or copper alloys (or both) were manufactured on the site in the Messapian time.

Clear evidence of iron metallurgy come from the Roman layers (second and first half of the 3rd century A.D.); light, glassy and not magnetic slag were found; they are related with the sintering process of the clay from the forges induced by high temperatures.

Two large concavo-convex slag are particularly meaningful; they both came from unit 254 (Fig. 6). These slag are different in dimensions and weight (g 181 and g 378 respectively); both magnetic, the smallest one shows a lower magnetism. They are the remains of smiting hearth bottoms. It can outlined that the lower surface is rather smooth in both slag; this is an indication that the blacksmith kept the hearth constantly clean. The blacksmith therefore acted in order to maintain the job under control, because he wanted to produce objects of a certain quality: systematic cleaning of the hearth improves the visual control of the temperature and reduced the risk to contaminate the iron with other materials (Fluzin 1999, p. 75).

A small iron ingot (weight g 125) was found in unit 37, which can be dated between the second half of the 3rd and the beginning of the 4th century B.C. This find is probably one of the forges products, a semi-finished bar ready to be exported to other workshops, or transformed in the same place into a finished implement (Fig. 7).

Fragments of small semi-finished bars were recovered in the unit 128 also, belonging to the Late Antiquity levels (5th – 7th century A.D.). Numerous residual shapeless slag (unit 40), together with a concavo-convex slag (unit 39), were found also in contemporary levels; they suggest the continuation of the metallurgical activity for some centuries in the area of Piazzetta Epulione (C.G.).

**The metallurgical evidence from Piazzetta Castromediano**

Other evidence, concerning metallurgical activity in Lecce, come from an excavation made in Piazzetta Castromediano, a site located in the eastern part of the historical centre of Lecce, just north of the Roman amphitheatre. In 2002, works for the maintenance of the city sewer system brought to light archaeological levels and structures. Therefore the digging area was enlarged; a series of archaeological excavations took place in an area of about 3600 square metres between 2002 and 2004. The place interested by the research was so large that it was not possible to complete the investigations up to the bedrock.

A complex stratification was found attesting the occupation from the Iron Age up to nowadays (Fig. 8).

The earliest metallurgical evidence can be dated to the Late Roman phase (3rd-4th centuries A.D.): slag coming from a level of discard (unit 819) that obliterated the remains of the earthen floor of a north-south road, dated to the 2nd–3rd century A.D., according to the associated pottery. The road was paved with small stones and was flanked by a sidewalk (unit 828) delimited by limestone blocks. Other slag come from a level of discard (unit 717) belonging to the same phase (end of the 3rd – beginning of the 4th century A.D.). This layer was cut by a small circular cooking hearth built with small shapeless stones (unit 728). It can be dated to the medieval period.

Other indications of metallurgical activity were found in
the 16th century filling of a lacus olearius of republican age (2nd - 1st century B.C.); they can be referred to a later occupation phase of the area. (C.G., A.Q.)

During the excavation, some slag were found; they are connected with a late Roman forging activity like at Piazzetta Epulione.

A peculiar interest had a concavo-convex slag found in unit 819 (Fig. 9). Unlike the 2nd-3rd century A.D. samples recovered at Piazzetta Epulione, this one shows an irregular lower surface. It means that here the blacksmith did not pay much attention to the cleaning of the forging hearth; besides, the presence of green lumps still attached to the surface is an indication that the forge was used, perhaps desultorily, not only for iron, but also to melt copper alloys too. (C.G.).

The ore sources

Where the iron worked in Lecce was smelted is still a matter of discussion; this problem is connected with the location of the mining areas.

Puglia is commonly regarded as a region lacking in iron ore deposits that could be used in antiquity.

It is possible to hypothesize that the raw material was imported from other regions, like Calabria, Sicily, Etruria, the Eastern Alpine area or also, on the other side of the Adriatic Sea, Albania, Macedonia, Bosnia or Serbia (Gliozzo, Arthur in press, p. 8).

Iron ore deposits exist in Apulia and especially the Salento area, in form of bauxites ore outcrops; a very large one is located south-east of Lecce, and it covers a vast area between S. Donato and Santa Maria di Leuca (Cotecchia, Dell’Anna 1959, p. 5; Crescenti, Vighi 1964, pp. 288-307). Recently the bauxite was exploited, starting from the middle of the nineteenth century, as mineral to extract the aluminium. Nevertheless bauxites contain in fact high percentages of iron, that can also reach 30-40% (Boni 1972,
Laterite is a kind of rock very similar to the bauxites found in Puglia and this ore was usually smelted to obtain iron in Central Africa; iron metallurgy existed in that country at least from the first millennium B.C. (Fluzin et al. 1995, pp. 56-58; Quéchon, Person 2000, pp. 9-11; Bocoum 2000, p. 16; Serneels 2005, p. 1). It is therefore possible that, as happened for the African laterites, the Salentine bauxite too was exploited in antiquity as iron ore.

Until Nineteenth century, bauxite was considered a useful ore for aluminium and iron, according with its content (D’Achiardi 1883, p. 399). As a matter of fact, iron was smelted from bauxites in modern times, by the Bourbons’ government, just before the unification of Italy (L. Baldacci, letter of 19/05/1909, in Mosso 1909, p. 316; Costa 1864, p. 369).

A bauxite nodule was found at Piazzetta Epulione in layers dating back to the 4th-3rd century B.C. (unit 270) (Fig. 10). It was analyzed by X-Ray Diffraction and observed with the metallographic microscope, and it is very similar to those recovered in the Salentine ore deposits (Figs. 11, 12).

The few data available indicate that Roman smithing sites were located in Puglia in the cities of regional importance, where probably iron production was one of the industrial activities carried out on the site. In these cities, like in Lecce, professional blacksmiths’ workshops were established.

If the hypothesis of ancient iron smelting starting from the local bauxite ore is correct, the Roman iron production in Apulia has some similarities with models observed in other parts of Europe as well. In Roman Britain – where Roman iron production is relatively well known - smelting sites are correlated with the major ore outcrops, because smelting was undertaken close to the ore deposits. Professional smithing sites are placed in small towns or in the major cities, with important population concentrations (Schrüfer-Kolb 2004, pp. 44-48, pp. 131-132). According to this model, we could perhaps have to expect to find the smelting place in the fields of Salento, not too far away from the bauxite ore deposits.

More detailed field work, strictly linked to archaeometallurgical analyses, is needed to identify and to study the metallurgical sites in Puglia region. The examination of the evidence from Lecce is a first, basic step to the comprehension of the complex network of Roman productive activities.
ACKNOWLEDGMENTS

Our first debt is to prof. Francesco D’Andria, who gave to us the possibility to present this preliminary study. The excavations at Piazzetta Epulone, directed by prof. F. D’Andria, within the Project of Urban Archaeology “Lecce Sotterranea”, and financed by the Municipality of Lecce, are developed in collaboration with the Archaeological Superintendence of Puglia (dott. Luigi Tondo, Operational Office of Lecce); they were conducted by a team of archaeologists from the Department of Cultural Heritage of the Lecce University, coordinated by Alessandro Quercia. The graphic documentation of the excavation was elaborated by Fabrizio Ghio. The excavation at Piazzetta Castromediano were also directed by Prof D’Andria. A team of archaeologists from the Department of Cultural Heritage of the University of Lecce took part to the digging, coordinated by Caterina Polito, in cooperation with the Archaeological Superintendence of Puglia and financed by the Municipality of Lecce within the Project of Urban Archaeology “Lecce Sotterranea.” We are grateful to Caterina Polito, who supported the excavation documentation of Piazzetta Castromediano. The aerophotograph of Piazzetta Castromediano was realized by Corrado Notario. We should also like sincerely to thank Umberto Savarese and Lorena Scarpato for inking the drawing Fig. 18. Our thanks are also due to Francesca Silvestrelli for the English translation of the text.

Endnotes

Some Messapian graves were found in the surrounding areas (particularly in the streets F. Di Aragona and Conti di Lecce and the church of St. Matteo); they are dated to the 4th-3rd century B.C.: Giardino 1994, pp. 199-200, nn. 210-217.

The excavations were directed by prof. F. D’Andria, within the Project of Urban Archaeology “Lecce Sotterranea”.

A short synthesis about the phases of life of the Piazzetta appeared in D’Andria 2004, p. 54. Preliminary notes about the excavations are in Quercia 2003 (for the post-medieval phase), Quercia 2005 and Quercia in print.

The level of the road was raised again later, adding a new pavement (unit 57) that enlarged the roadway, covering the sidewalk. This intervention can be dated between the middle of the 3rd and the beginning of the 4th century A.D., according with the pottery.

Currently, in Salento, some blacksmiths smooth the metals using cakes of tufina. We thank Antonio Mangia for the information.

The largest blocks are 100 cm long and 30 cm wide; the smallest are between 70 to 30 cm.

The west closing wall was not found; it cannot be excluded that it was never built and that the productive area leaned out on the road; the wall unit 58 is tied up to the wall that delimited the road (unit 7).

Another plan made by tufina was recovered behind the angle of the walls units 171 and 172; it had with evident traces of combustion (unit 239), cut by a circular pit (unit 240) filled with the remains of a discarded hearth, as attested by the reddish colour of the filling (unit 241). The scarce diagnostic material into the pit dates generally the activity of the hearth in middle-imperial age (2nd-3rd century A.D.).

The floor of this room (unit 194), was covered by the tile roof collapse (unit 212); the collapse chronology cannot be determined because of the small amount of pottery found.

African A/D and C Sigillata and African kitchen pottery are documented.

References

AGRICOLA, G., 1556. De Re Metallica libri XII. Basilea.
GIROZZO, E., ARTHUR, P., in press. Archeometallurgical study of Byzantine and Medieval slags from the Salento (Southern Apulia, Italy): new evidence and open problems.

African D Sigillata (types Hayes 87A and 104B) and Eastern Late Roman C (type Hayes 3) are documented, together with Eastern (Late Roman 2 and 4) and Africans (spathieia, Keay LXII) transport amphorae, plain and painted pottery, and kitchen ware.

The excavations were directed by prof. Francesco D’Andria.

A short synthesis of the living phases of the area in D’Andria 2004, pp. 54-55.

Analysed slag come from the upper part of the filling (unit 256).

Metallurgy in ancient Lecce
C. Giardino, A. Quercia


