From Bucchero to grey ware in the Po valley: experimenting with the importance of firing*

This article will describe the preliminary results concerning a wide research project on ceramic production in the Padan plain (Italy) covering the Late Iron Age as verified through experimental methodology.[1] The analysis of ceramic material from the site of Forte Urbano [2] gave important information for a set of hypotheses on production. Testing these with experiments on firing in Forcello,[3] allowed the results to be relevant to both sites.

Roberto DERIU
(IT)

1. Archaeological data

The Etruscans moved into the Padan plain north of the Po river from the end of the 7th century BC. This migration is traced by the presence of a typical pottery: Bucchero.[4] Of this, only a small percentage was actually imported the remainder being produced locally. The term "Padan Bucchero" (*Casini 2005*: 264) was coined to distinguish Etruscan production of the Padan plain from Bucchero produced in Southern Etruria. Padan Bucchero is known north of Po river from the end of the 6th century BC (*Casini 2005*: 265) and is characterised by a fine textured clay body of diverse quality with a wide colour range from black to intense or light grey (*Casini 2005*: 264). Distribution is witnessed at Forcello (*Casini 2005*: 264-265) (Mn), Bologna (*Casini 2005*: 264), Marzabotto (*Ibid.*) (Bo), Reggio province (*Malnati 1993*: 43-71), Modena province (*Malnati 1988*: 29-32), Adria (*Bonomi et alii 2002*: 201-213), S. Basilio di Ariano Polesine (*Balzani, Vitali 2002*: 115-119) and Brescia (*Frontini-Onagro 1996*: 23-71). According to the archaeological data, Bucchero was produced from the first half of the 6th century BC north of the Po river, whereas the fine Etruscan-Padan pottery expanded from the Adriatic coast to Mantova and then southwards, towards the Apennines, during the 5th century BC and gradually replaced Bucchero production.

Aesthetically there is a radical change in chromatic taste which initially was dominated by jet black Bucchero and later sees, with the affirmation of Etruscan-Padan pottery and grey wares, a wider colour range, with renewed and more standardised ceramic morphologies. The archaeological material from Forcello, for example, indicates that during the initial phases of occupation (phases F, G, H) dated from 530 to 500 B.C. (*Casini-de Marinis 2005*: 48-51) daily pottery was mainly Padan Bucchero. This gradually disappears between the 5th and the 3rd century BC, giving way to a typical grey-coloured ware which seems to be its direct derivation (*Casini 2005*: 263-266). Among the sites in which this new ceramic class is found, the Etruscan-Padan village of Forte Urbano could be extremely important to determine the processes involved in this change, as there is evidence of a vast and quite unusual grey-ware production. Forte Urbano material data could therefore be useful as a programme of experimentation (see point 2. for project's details).

It is possible that motivations for this progressive exchange of bucchero into grey ware depended on technical and economical factors connected to modes of production. To assess if this is true, a good methodology seemed to be the experimental reconstruction of the technical processes involved in the production of the original wares. In this way, we hoped to gain relevant information on **how** the change started.

The firing process and its techniques are a fundamental aspect of ceramic production. The reconstruction of an Etruscan-Padan productive structure was created and used: the aim was to distinguish practical and operative actions which could determine the ceramic class under scrutiny. The structure consists of two Etruscan-Padan kilns and is located in the Archaeological Park of Forcello (Mn). The building started in July and ended in September 2006. The first trial firings, aimed to assess the strategies embedded in the production of fine ceramic vessels and also tested the actual different possibilities in the firing process.

■ Fig. 3 The original hatch was broken.

■ Fig. 4 Test 1. Pieces of the hatch were used with clay to close the mouth of kiln "A".

■ Fig. 7 Observation of the bowls during the firing through the vent.

*Translated by Lara Comis

1 The experimental firings (July October 2006) were conducted at the Forcello Archaeological Park (Mn) and used one of the constructed etruscan kilns built by the author.
2 Modena, Emilia-Romagna, Italy. The site was occupied from the VI to the II centuries b.C.
3 Forcello was one of the first site of analysis of grey ware (*Casini-Frontini 1989*). Its occupation lasted until the IV-III century b.C.
4 The term indicates a ceramic class from Etruscan tombs of Tuscany and Lazio. Its distinctive aspect is jet black coloured sufaces and black ceramic body (*Cuomo di Caprio 2007*, pp. 437-440).

Slip provenance	Unfired colour	Reducing atmosphere: colour obtained	Oxidizing atmosphere: colour obtained
Faenza	grey	jet black	red
Bologna	reddish-brown	blackish	red
Tarquinia	reddish-orange	blackish	reddish-orange

Tab. 1 Slip: unfired colours and colours obtained in different controlled firing atmospheres.

Before describing the experiments, it is important to say that the primary scope of this project was to clarify the Bucchero production techniques because the archaeological data, as said above, reports how this class anticipates the production of grey ware. Identifying the main key-actions needed to obtain Bucchero could lead us to distinguish the technical differences or similarities which could motivate the productive strategy of grey ware.

Bucchero production is a very debated theme among scholars and archaeo-technicians: according to Cuomo di Caprio the peculiar black colouring typical of Bucchero artefacts depends entirely on firing technology (*Cuomo di Caprio 2007*: 437). During a highly reducing firing process: *"combustion in lack of oxygen causes dry distillation of the fuel through the formation of carbonic particles and carbon monoxide, a strongly reducing agent"*. In this process iron oxides (red coloured) turn into ferrous-ferric oxides (black coloured). Practical demonstrations have shown how it is possible to obtain Bucchero from common pottery clay firing at medium to low temperatures (circa 800 °C) (*Cuomo di Caprio 2007*: 438).

Even if some chemical analysis has detected a carbonic presence within the ceramic body (although it is impossible to determine when it appeared), the deliberate adding of charcoal powder to the clay body seems to be unnecessary to obtain a reducing atmosphere. This action does not consider the plasticity of the body, needed in modelling. Charcoal powder could render impossible the working of the clay on the wheel (*Ibid.*). The opposite, i.e. adding organic materials to enhance plasticity, would cause the fired pottery to present vacuoles as the components would be carbonised after the firing. It is not excluded, though, that in some ateliers charcoal powder might have been added to clay bodies which lacked iron compounds: good plasticity in the primary clay resources could balance moderate quantities of carbonic substance without hindering wheel modelling.

Some firing experiments in reducing atmosphere have demonstrated that it is possible to obtain Bucchero by inserting the artefacts with some fuel into a sealed container (made of ceramic material or metal) inside the kiln. Maximum temperatures reached between 750-800 °C and included a very slow and gradual cooling (*Cuomo di Caprio 2007*: 439).

Potter Cesare Calandrini obtained black Bucchero without real wood but with modern electric and adapted kilns (*Caruso 1989*: 40). He confirms that the colouring is not even if temperatures reach 900 °C, whereas the optimum to obtain jet black colour, sometimes with silver glints, is within the range of 700° to 750 °C (*Ibid.*).

2. Firing techniques experimental tests

The first phase of the experiments started with the attempt to find clays which would be suitable for Bucchero artefacts. A collection of clays, chosen empirically and macroscopically (presence of iron and aggregation) was made in different localities. The first was a blue clay from the *calanchi* (badlands) in the pre-Apennine area of S. Cristoforo di Faenza (Ra). It is a rather loam-like and moderately rich in iron (*Cuomo di Caprio 2007*: 9) similar to clays used in the ancient Mediterranean area. The good plasticity of this clay determined its use in shaping the bowls and to create the slip for the surfaces. Two other types of clay were used to produce slip only. The second clay, reddish brown, was collected from a layer in the Regional Park of Monteveglio (Bo), in the Apennines [5] (**fig. 1**). Finally, the third was a reddish-orange clay from Tarquinia (Vt, southern Etruria). After collecting the clays were desiccated, ground and put into an aqueous solution through different settling phases.

The slip [6] was worked from the blue clay was very shiny even when unfired. The other two were less luminous but worked perfectly well to coat the surfaces. This technique is witnessed by the archaeological material from Forcello (*Casini 2005*: 252-253) probably with the aim of strengthening the pots and to obtain waterproof surfaces.

The first firing trials were made with an electric kiln at a known temperature similar to the one described by Cuomo di Caprio (*2007*: 439) and Cesare Calandrini (*Caruso 1989*: 40) to get comparable data for the subsequent experimental firings following Coles' protocol on reducing and oxidizing atmosphere in firing experiments (*Coles 1981*: 147). To produce the most complete colour range, slips were fired with an oxidising atmosphere at first and then in a reducing atmosphere, changing the kiln facilities. Temperatures were programmed to reach 850° C in the oxidising firing and 720°C in the reducing firing (**Table 1**).

The use of the electric kiln, in which it is possible to determine the humidity and temperature aspects, is crucial in reducing the variables to test and gives important data in a short time regarding the sampling of clays used in the experiments.

The bowls were made to be fired in the smaller of the two kilns at Forcello Park.

1st firing test (19/05/2007)

Nine bowls were shaped for this experiment according to the archaeological record witnessed in the ancient occupational phases of the Forcello Etruscan village (*Rapi 2005*: 208 fig. 44, 1-4-5). At leath-

5 The reconstruction project and firing of the kilns could be immensely aided by the sampling of the clay resources within the Forcello area.
6 Slip or engobe is a mixture of clay and water used to achieve impermeability on unfired artefacts' entire surfaces or used on part of them to obtain decorative effects.
7 See for example reconstructions of Celtic kilns in http://www.gestiritrovati.com/ricerca/progetti/38.html

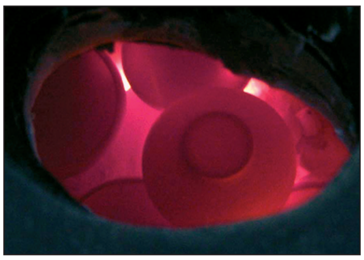
er hardness a slip was added to the surfaces distinguishing the three different kinds through a mark on each bowl. May 19th 2007 the bowls were fired in experimental kiln "A", the first attempt in understanding techniques of Padan Bucchero production (*Casini 2005*: 263-265).

The kiln used had previously been hardened through a trial firing (September 29-39th 2006) and was interpreted as a kiln for fine ware firing in the archaeological record (*Sassatelli 1994*: 247-254).

After introducing the artefacts into the firing chamber, (**fig. 2**), closing at the mouth of the kiln started (the original hatch had unfortunately been broken during the inaction of the kiln) (**fig. 3**). To resolve this problem, pieces of the hatch lying in the opening were used with a mixture of fireproof clay (**fig. 4**).

This solution, used before in other experimental kilns,[7] is very effective as it uses heat to obtain solid partitions. Thirty minutes after the firing had started, it was felt necessary to aid the draft of kiln "A" through the closing of the covered opening of the mouth of kiln "B", very close and wide enough to effect the functioning of the smaller kiln (**fig. 5**). This situation strengthened the idea that the structures could have been used at the same time.

■ **Fig. 5** Forcello Archaeological Park (MN). On the left kiln "A" used in the experimental firings.



■ **Fig. 6** Test 1. Colour shades of the artefacts during the firing.

Every phase of the firing process was evaluated through the empirical parameter of the colouring of the vases during firing (**figs. 6-7**), as the use of a thermocouple is not a reliable instrument for kilns with solid fuel added manually (*Cuomo di Caprio 2007*: 492).

After eight hours, the colouring of the artefacts ranged from a deep red to a vivid red, indicating that the thermal interval was apt for reducing (circa 750 - 800 °C).

This temperature was kept for some minutes after which a strong reducing atmosphere, needed to obtain Bucchero was created through different strategies (*Cuomo di Caprio 2007*: 439). As the reducing process can only happen in the absence of oxygen, every opening of the kiln was sealed. The same procedure used for the opening hatch was used: fictile fragments were settled with a fireproof clay mix. This action was programmed from the beginning and used pieces of fictile debris from previous firings which were selected and collocated near the relevant opening in order to hasten the process once the closing started with the vent closed first. After the sealing, one last charge of fuel was added to the mouth (circa 10 kg.) blocking most of the opening and thus enhancing the reducing atmosphere within. Fresh grass was then added to complete the blocking and to provoke more fumigation. Finally the mouth of the kiln was sealed by the process described above.

After cooling every partition made with fictile debris was still solid, being thus recovered for subsequent use. The pottery obtained was tested functionally for water-absorption and proved the temperature to have reached a minimum of 700 - 750 °.

26/05/2007

A few days after the firing, the flue and firing chamber was opened and the charge was extracted (**fig. 8**). Kiln "A" was inspected carefully and some repairs made in the joint of the foundation to the vertical part. The bowls appeared to be whole and waterproof, with a jet black colour. The colour was not even on the surfaces, proving the reduction to have be a partial. The position of the bowls on the slotted platform seems to be directly linked with the final colour. This observation leads to the distinction of two main groups of bowls in which the superficial colour corresponds to one of two level of stacking:

■ **Fig. 1** Clay source in Monteveglio (Bo) used to obtain slip.

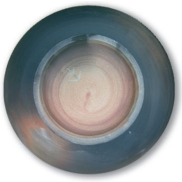
■ **Fig. 2** Test 1. Stacking raw artefacts in the kiln.

1) **bowls put first in the firing chamber, lay on their foot directly on the slotted platform:** These artefacts show an even jet black colour on every surface except from the circular inner part of the foot and in points were hot air came from the holes in the platform.

2) **bowls stacked on top of the former upside down:** In these cases the reducing effect is complete, apart from small lighter areas corresponding to the contact surfaces of the brims.

Results of the firing action

The result of the firing seems to confirm the use of a small kiln such as the reconstructed "A" for the production of fine Bucchero vessels. The black colour was obtained on



■ **Fig. 9** The "stacking disc", visible in the inner part of the feet in the form of a reddish circle. Test 1, group 1

every artefact even if the improper stacking method caused it to be uneven on certain bowls. The colour itself witnesses the success in achieving a sufficiently reducing atmosphere through the reconstructed kiln and for all three kinds of clay used. Stacking reveals some interesting strategies that could be used to enhance the results. The first group of bowls show a characteristic red circle on the bottom of their foot, called a "stacking disc" (See *Cuomo di Caprio 1985*: 143, 146; *Cuomo di Caprio 2007*: 528-529) (**fig. 9**). It is a very common "flaw" in the original black-figures or black-and red-figure pottery, very clear in the areas where the artefact was not exposed to the carbon monoxide which gives the black colour. The stacking disc forms in the inner part of the foot when that area is covered by the foot of the upper stacked vessel. In our examples, though, the disc has formed only within the foot of the first stacked bowls because they were put directly on top of the slotted platform. The lack of reduction within the foot points out that stilts or props which can be put between the vase and the slotted platform might help in aiding the circulation of air, as there is no trace of the stacking disc in the original Bucchero bowls.

■ **Fig. 8** Test 1. Bowls from group 2 extracted after the cooling.

■ **Fig. 10** Test 1. Bowls from group 2 show an even black colour on all surfaces.

Stilts can be very elaborate objects, cylindrical or ring-like and could be slotted to let carbon monoxide pass through and reach all the surface of the vase. It is possible that these stilts were discarded pots or potsherds on top of which the unfired bowls were placed. Moreover, group 2 bowls placed on top of the others upside down, in which the reducing process is complete, seem to indicate the need of the stilts (**fig. 10**). Some ethnographic examples of kilns similar to the reconstructed one (solid fuel kilns used in Apulia until last century *Cuomo di Caprio 2007*: 533) indicate that stilts were also used in oxidising firings.

2nd Firing Test (07/07/2007)

Based on the first firing, there was another test using kiln "A" with the aim of replicating and optimising firing strategies for Bucchero, with a bigger charge (28 bowls stacked on four layers, with a total weight of 17 kg, **fig. 11**) and using the fired partitions from the former firing to seal the openings. Only two of the different slips cited above were used, the faentine one (grey) and the Bologna one (reddish-brown).

It was thought that the higher number of vases and the use of already fired partitions would aid the reducing process. The bowls stacked neatly into the firing chamber should slow the flame draught which caused uneven coloured surfaces, while partitions should hasten the process of sealing, necessary to obtain a reducing atmosphere. Unfortunately it was not possible to evaluate the cause-effect actions in the reducing process as in the climax of the firing the hatch that sealed the firing chamber cracked from the wall of the kiln and started to separate, with a consequent loss of heat. This problem was probably caused by an inefficient clay seal. The repair happened immediately, sealing the fissures on the sides of the hatch with new fireproof clay. The hatch was re-fixed to the wall, but the great pressure and heat prevented the perfect sealing of the chamber and definitively damaged the reducing atmosphere obtained in the firing. The extracted charged showed how the atmosphere was a mixed reducing-oxidising. Reduction was present in some bowls stacked in the two upper layers, presenting a superficial grey-dark grey colour, but in no case reaching the jet black of the first experiment.

The inner walls of the firing chamber were black in correspondence with the upper stacking layers, signalling a stronger concentration of reducing gases in the highest part of the kiln (**fig. 12**). In the other bowls the colouring tended to a light yellow, orange, red or brown, getting very close to the typical chroma of fine Padan-etruscan ware (*Casini 2005*: 252-253) (**fig. 13-14**). Since in both firing experiments the same slip was used, it is possible to confirm that the diverse colouring of the vessels (black in the first experiment, yellow, orange, red and grey in the second one) depends on the firing technology and not on the clay body used.

The existing main differences between the slips used after the firing relate not on the colour of the bowls but on the shining intensity. This attitude can in some extent be determined by the specific density of the clay suspension used. In the first experiment the three different slips lead to the same black colour, but with appreciable differences in the shine. Even if the second and partial reducing firing saw only two slips used, it produced a wide colour range, evidently caused by the single position of the artefact within the firing chamber and not the unfired slip. The stacking of the bowls, in fact, was made alternatively putting different slip covered artefacts in the same layer. As said above, the highest levels were grey-dark grey, and the lower (I and II) ones yellow, brown and red.

Outcome of the firing action

These first experiments show how, while keeping the same clay bodies, but using different firing methods one can create distinguished ceramic classes. The procedure used for the first experiment partially showed how accurate the proce-



■ **Fig. 11** Test 2 (left). Unfired pottery stacked in the kiln. ■ **Fig. 12** Test 2 (middle). The same bowls after the cooling. Note different shades of grey on the topmost ones. ■ **Fig. 13** Test 2 (right). Fired bowls after the extraction from the firing chamber.

dure has to be to obtain a good quality Bucchero. In the second test, on the contrary, lack of a consistent reducing atmosphere showed how it is possible to obtain in one single firing action all the colours typical of the Etruscan-Padan ware and of the fine grey ware. In conclusion, one could deduce that to achieve such colourings, the atmosphere should have been kept intentionally in a state of non complete reduction. This hybrid atmosphere had been caused by an accidental factor: the collapsing of the closing hatch at a very advanced state of the firing process. But it is possible that this condition could be obtained on purpose, for example leaving fissures when closing of air draught passage after the firing climax. Further experiments could use local clays to obtain important data on this process.

Firing in a complete reducing atmosphere, as needed and standardised to produce Bucchero, is therefore more complex compared to the strategy of "partial reducing": it was probably the simplicity of the actions involved in the latter which can partially explain the predominance of new colours beside jet black in later Etruscan productions.

Another element which can justify the gradual replacement of Bucchero as daily pottery by Etruscan-Padan bowls and grey ware could come from an higher functionality of the latter productions, probably stronger because of the higher temperatures reached in the firing. It is possible that in the production of Bucchero the temperatures reached would not be as high as in oxidising or partially reducing firings. The reducing process has its optimum outcome when it is governed in the phase of temperature descent after 700 °C. It might be possible that, to reach this optimum, higher temperatures were not reached at all or only for a short time.

The colour range of the second experiment does not need such temperature control nor a perfect sealing of the kiln. At this state of research it is anyway not possible to assert definitive opinions on the functional yield of Bucchero against Etruscan-Padan or grey ware bowls. An experimental program of testing their functionality, archaeometric analysis should be carried out on the originals to assess the firing temperature.

Finally, even if the functional analysis would not return data on relevant differences between Bucchero vessels and fine Etruscan-Padan ceramic, in the light of the operative implications evidenced by the firing process, the second methodology results is more than adequate to face the increased production related to the Etruscan migration, as it is actually simpler.

Notes on technical analysis of Bucchero and grey ware from Forte Urbano

If on one hand etruscan-padan sites north of the Appennines show clear links from morphology and clay body used for Bucchero, on the other hand the first experiments made seem to confirm, through the firing technique analysis, another and fundamental productive link between Bucchero and grey ware.

These considerations show a neat concordance with the not so common archaeometric analysis published on grey ware firing temperature (for Padova *Gamba-Ruta Serafini 1984*: 12). Temperature ranges seem to be quite low, between 500° and 850 °C, not so different from what was observed during the optimal Bucchero firing. It has to be said that scarcity of archaeometric research does not allow for any absolute parallels. Possibly, a comparative study on experimental and original artefacts could contribute to the state of research.

Observations on grey ware, taken from first experiments made with the reconstructed kilns of Forcello, are therefore to be considered as a work-hypothesis and purely preliminary to a continuous programme of experimental investigations in which the strategies settled during the first experiences could be actually verified.

The partially reducing firing technique above described, even if easier in the protocol compared to the Bucchero one, is governed by precise actions criteria which, according to the primary experimental tests, seem to be different only in the management of the final operations (see above par. 1).

Further experiments on grey ware production

The first phase of a specific research on grey ware should therefore have its centre on the sampling of clay

■ **Fig. 14** Experimental bowls from test 2 exhibited in Forcello Archaeological Park (MN).

sources which could be comparable with the resources used near the site of Forte Urbano. Once the components of the clay bodies is clear, some firing tests could be made in electric kilns and with a controlled partial reducing process. This procedure could lead to the analysis of the technical production through known parameters, following in this case Coles' protocol (*Ibidem.*), already utilized in the first experimental tests for Bucchero production (*Ibidem.*). The final part should schedule a complete series of experimental firings on grey ware production: repetition and verification of the strategies used on the base of the results made each time could in the end give evidence apt for methodologies to produce grey wares systematically.

Growth of the experimental research on a continuative base starting from Bucchero analysis and aimed to clarify production technology for grey ware could explain, through new definitions of productive parameters, the extraordinary diffusion of this ceramic class in northern Italy and could also fill important lacunae which deeply affect the knowledge of ceramic production in the Iron Age.

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Summary

Les céramiques à pâte grise dans la Vallée du Pô : une expérience sur l'importance des modes de cuisson

Cet article présente les premiers résultats d'un vaste programme d'expériences menées sur la production de céramiques dans la plaine padane (Italie) pendant le Second Age du Fer. L'analyse du matériel trouvé sur le site de Forte Urbano avait permis de produire quelques hypothèses sur leur méthode de conception et une cuisson expérimentale s'est avérée instructive pour ces deux sites archéologiques et a permis de mieux comprendre la production de vaisselle à pâte grise.

La première démarche a été de trouver de l'argile la plus proche possible de celle utilisée pour les céramiques retrouvée et de la tester en atmosphère réductrice ou oxydante. Neuf bols furent alors réalisés et cuits dans un four reconstitué pendant huit heures en cuisson réductrice. Après un refroidissement de plusieurs jours, les bols extraits du four témoignent que leur couleur dépend de leur position sur les soles du four. Il apparaît également que la taille du four utilisé devait être relativement réduite. Une deuxième cuisson expérimentale devait permettre de reproduire en l'améliorant cette expérience, avec une charge de céramiques plus importante. Une rupture accidentelle de la chambre de cuisson a interrompu le processus de réduction et a engendré une perte rapide de chaleur. Cet imprévu a permis d'observer les résultats d'une cuisson en atmosphère oxydo-réductrice, donnant un pannel de couleur large mais très différent des noirs obtenus lors de la première cuisson. L'expérience démontre bien qu'avec la même argile, il est possible d'obtenir des céramiques très différentes, suivant les modes de cuisson.

Von der Bucchero-Keramik zur Grauware in der Po-Ebene: Experimente zur Bedeutung des Brandes

Der Artikel stellt die ersten Ergebnisse eines experimentalarchäologischen Programms vor, das seinen Schwerpunkt auf die Keramikherstellung in der Po-Ebene setzt. Das vorrangige Ziel dieses Projektes war es, sich über die Produktionstechniken Klarheit zu verschaffen, indem die wesentlichen Schlüsselmethoden zur Herstellung von Bucchero-Keramik herausgearbeitet wurden. In einer ersten Phase wurde versucht, geeignete Tone zu finden und diese dann unter messbaren Konditionen zu brennen, um miteinander vergleichbare Daten zu erhalten. Die Autoren führten dazu zwei Brennversuche in rekonstruierten Öfen durch. Beim ersten Brand bekamen alle Gefäße eine schwarze Farbe, was anzeigte, dass eine ausreichend reduzierende Atmosphäre erreicht wurde. Der zweite Brand hatte zum Ziel, die Brenntechniken zur Herstellung von Bucchero-Keramik zu rekonstruieren und zu optimieren, und dies bei einer größeren Befüllung des Ofens. Während des Brandes zerbrach das Siegel der Ofenluke, was zu einem Verlust der reduzierenden Atmosphäre und der Temperatur führte und dadurch verschiedene Farben der Gefäße entstanden, die mit diesem einen Brand die Bandbreite der typischen Gefäßfarben etruskischer Keramik erzeugten. Diese ersten Experimente zeigten, auf welche Weise – mit den gleichen Tonen und Gefäßformen, aber verschiedenen Brennmethoden – gut unterscheidbare Keramikgruppen produziert werden können.

■ **Dr. Roberto Deriu**, member of EXARC, graduated at the Art Institute for Ceramics in Faenza (Italy) in 1991, and in Conservation of Cultural Heritage at the University of Bologna, degree thesis in History of Handicraft Production and the Culture of Materials. In 2003 he founded Gesti Ritrovati and started dealing with experimental archaeology and organising experimental exhibitions in co-operation with cultural associations and schools.