POTTERY SMOOTHERS FROM COLLE SANTO STEFANO (ORTUCCHIO, L’AQUILA)

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Introduction

While investigating an excavated area of about 200 square m (70-100 cm deep) archaeologists identified eight pottery smoothers: potsherds used as tools (Fabbri 2006; Angeli and Fabbri 2011). It seems interesting to highlight their presence at the site of Colle Santo Stefano di Ortucchio (Radi 1991; Radi et al. 2001), as they are, together with the site of Trasano Basilicata, from one of the two most ancient Italian Neolithic Impressed Ware sites where these tools have so far been identified (Figure 1).

In literature these types of tools have recently raised a certain interest as to their original purpose. Studies on this topic describe pottery smoothers according to a standard terminology (Binder et al. 1994; Godon and Lepère 2006; Godon 2010; Vieugué et al. 2010). Moreover they are analysed by means of both functional and experimental methods. Generally speaking the function attributed to them is that of tools used during activities of finishing pot surfaces (Skakun 1978; Anderson-Gerfaud et al. 1987; Shiffer and Skibo 1989; Hauzeur 1991; Sullivan et al. 1991; Skibo et al. 1997; López Varela et al. 2002; Van Gijn and Hofman 2008; Vieugué 2009; Maigrot and Vieugué 2010). Similar ethnographic comparisons confirm this hypothesis and suggest that pottery smoothers can be used during the finishing of pot surfaces, as well as other tools such as wood, bone or shell, sticks and pebbles (Gosselain and Livingstone Smith 2005; Gosselain 2010).

Smoothers: are they finishing tools for pot surfaces?

During pottery production, the use of tools of different materials and shapes is acknowledged throughout all phases of the chaîne opératoire. Overall, the paramount operations to produce pottery can be listed as follows: selection and/or treatment of the raw materials, clay modelling techniques, finishing and surface treatments and decoration which can be carried out prior to firing.

Modern investigation methods let us define production activities from a technological point of view and postulate reconstruction hypotheses of the operational sequence and of handcraft tradition. For example, mineral and petrographic analyses help to identify fabric groups, e.g. suggesting variables in paste preparation and firing temperature; but some questions are more difficult to answer, for example what tools were used to shape and finish the pottery? Macro-evidence studies on fractures or surfaces of pottery and sherds, including radiography, help us identify manufacturing techniques and thus acknowledge one or more handcraft traditions; which tools were used during different pot modelling phases?

Figure 1. Colle Santo Stefano, Ortucchio in the Fucine Basin (Abruzzo, Italy): map of the site location and ¹⁴C dates.
Observing tool impressions and replicating decorations by experiment are the basic grounds on which it is possible to classify decorative techniques (see Natali 2014); what can be said on the variety of tools for each phase of the operational sequence?

It is difficult to answer these questions because it is not simple to distinguish specific working areas within archaeological sites, and the tools used for these operations are not easy to identify in the archaeological record.

However, we can now assess experiments and functional analyses on surface finishing (Figure 2a) using tools made of bone (Maigrot 1997; Martineau and Maigrot 2004) and flint (Gassin 1993; Torchy and Gassin 2010). These enable the identification of tool marks on ceramic surfaces related to clay working.

Pottery smoothers - potsherds reused as and/or transformed into tools - are enlisted with other finishing and surface treatment tools. In the archaeological record pottery smoothers can be identified from the group of potsherds thanks to their worn fractures, the so-called functional abraded surfaces, characterised by use-wear traces (striations or polished areas), that can be the consequence of the tool's last use before it was discarded. Production-wear traces or evidence of a transformation into a particular shape are less likely to be preserved, as they are either erased or partly covered by later use-wear traces.

As discussed below, the Colle Santo Stefano archaeological record of pottery smoothers, even in its small number, shows evidence of both tool production and use. The studied samples were therefore suitable objects for experimental reconstruction to test the hypothesis of smoother tool production chaîne opératoire and their possible use.

In relation to pottery smoothers function, two main questions were considered in our research: are pottery smoother tools designed for surface finishing? In which pottery production phase of the operational sequence were they used?

By studying a small collection of pottery sherds used as smoothers coming from the two Italian Neolithic archaeological sites of Trasano (Angeli 2012) and Serra d’Alto (Angeli and Fabbri 2013), it was possible to acknowledge that a wide variety of wear and/or use evidence can be preserved. This variety led us to the hypothesis that pottery smoothers’ use and function were not only to be linked to a pottery production operational sequence. Different evidence may be the result of other activities (scratching, scraping, smoothing and/or polishing) carried out on a variety of materials, for different periods of time, with strength and timings that did not conform to standards.

The work on the small collection of pottery smoothers from Colle Santo Stefano led us to distinguish them having two main types of abraded surfaces: abraded surface type 1 with smoothed active surface and type 2 with striations on active surface.

*Abraded surface type 1* shows a smooth or slightly rounded active surface that can sometimes appear polished. No mechanical wear was identified: there were no *striations* or variations in the particle fraction of the mixture, which means that inclusions were not raised above the surface or removed creating holes during use. As all of the Colle Santo Stefano pottery smoothers show this kind of surface (Figure 2c), we may infer a short use of the tool or its use on a soft and non-abrasive material.

*Abraded surface type 2* is characterised by light to strong *striations* on the active surface, which is matt and extremely rarely polished. *Striations* direction can determine a motion geometry of the tool (Vieugué 2009) and suggest the use on a hard and abrasive material. Confirming this hypothesis the examples analysed below seem to establish the link between this kind of wear and that of *striations* found on semi-fine fabric pottery from Trasano (Angeli 2012), where inclusions have been raised above the surface (Figure 2d), and on *figulina* pottery from Serra d’Alto (Angeli and Fabbri 2013), where *striations* are dense, superimposed and with the same direction (Figure 2e).

**Colle Santo Stefano smoothers: corpus description**

The description of the categories for the documentation of the smoothers, were completed according to previous works and to standard terminology (Godon 2010; Vieugué 2009). The following fields were considered: type of sherd; clay fabric mixture; dimensions (length, width, thickness and weight); exterior and interior surface appearance (wear or use evidence); fracture numbers, active or functional surfaces and number of angles. Eight smoother were identified (numbered sequentially 1-8) with combinations of these specific physical features (Figure 3). In addition, Colle Santo Stefano smoothers are all abraded surface Type 1 with smoothed active surface and no striations.

Colle Santo Stefano pottery smoothers have all been made from small body sherds both straight or curved
Figure 2. a) Surface finishing using wood, pebble, flint, bone, leather and pottery smoother (experiment by Lucia Angeli and Marcella Parisi); b) forms of description for use of a pottery smoother; c) smoothed active surface from Colle Santo Stefano, Ortucchio (Fabbri 2006); d) striated active surfaces from Trasano, Matera (Angeli 2012); e) striated active surfaces from Serra d’Alto, Matera (Angeli and Fabbri 2013).
Figure 3. Colle Santo Stefano, Ortucchio pottery smoothers corpus (drawing by Raffaella Milano).
Experimental smoother production: the chaîne opératoire

The chaîne opératoire of smoother production was hypothesised from evidence of débitage observed in the archaeological record: splintering or knapping (Smoother 1), a notch (Smoother 3), and a cut (Smoother 4). Identification of these features suggested the use of Smoothers 1 and 3. Body sherds used for the experiments were selected showing similarities to the original smoothers: i.e. body sherds of fine fabric pottery (Fabbrì and Angeli 2010), with a straight or curved profile (Fabbrì 2006) and dimensions (length, width and thickness) that were the same as those measured on the archaeological smoothers.

The chosen sherds were worked into shape using the following techniques, solo or combined: abrasion/polishing, cut/incision (flint flake or blade), direct percussion, indirect percussion (a flint flake was struck with a boxwood hammer onto the potsherd) and bending. The direct percussion technique had already been tested using a pebble and a soft boxwood hammer; the experiments produced radial fractures and, in both cases, the sherd broke into three pieces, hence the method was considered not functional to shape a smoother tool (Angeli and Fabbrì 2011).

The experiments of preparing sherds for tools (Figures 5b, 6, 7) resulted in the production of 9 experimental smoothers, of which: production tests 1, 3, 4, 7, 8, 9 were subsequently used to finish surfaces on clay models; production tests 2 and 5 were abandoned; eventually, production test 6 was kept unused as comparison example for (cut) production of Smoother 4.

Production test 1 - abrasion/polishing
The fractures were levelled by abrading/polishing them against a stone (a local limestone). No effort was required for this operation; moreover the fine fabric pottery ensured a short period of time required for the action.
Figure 4a. Colle Santo Stefano, Ortucchio: forms of description for smoothers showing one of three possible production evidences: splintering or knapping on Smoother 1.

Though abrasion is functional to obtain an extended levelled surface, this technique had no comparison in the archaeological record, as this polishing evidence can easily be removed by subsequent use.

Production test 2 - cut/incision + direct percussion: abandoned
Using a flint flake, a deep cut was produced on the interior surface of a curved body sherd and then it was hit directly with a soft boxwood hammer.

The resulting fracture appeared on the other side of the sherd and it ran parallel to the cut, not along it. This technique does not seem appropriate to produce a regular sherd. Test 2 was abandoned as morphology and dimensions of the sherds were not suitable to carry on the shaping of the smoother.

Production test 3 - indirect percussion + abrasion/polishing
Indirect percussion was used on the interior surface of a curved body sherd. A regular piece snapped away, its fractures could be identified as the point of impact, where a notch appeared. Abrading the broken surface against the same stone, as in production test 1, finished the smoother.

Production test 4 - indirect percussion
Indirect percussion was used on the interior surface of a curved body sherd. A regular piece snapped away, its fractures could be identified as the point of impact, where a notch appeared. The method was repeated to reduce the sherd: two pieces snapped away, each one with its own notch.

Production test 5 - indirect percussion + incision/cut + bending: abandoned
An indirect percussion forms a sherd with a fracture not corresponding to the point of impact. The piece was cut/incised with a flint flake and was then bent inwards, but it broke. The pottery fabric was poorly compacted and it broke, which was the main cause of the failure of the test.

Production test 6 - incision/cut + bending
Using a flint flake the piece was cut and then bent inwards. The result was a perfect replica of Smoother 4 from the archaeological record, which still shows cut features.

Production test 7 - incision/cut + indirect percussion
Using a flint flake the piece was cut, then indirect striking was used. The result conformed to Smoother 1.
Figure 4b. Colle Santo Stefano, Ortucchio: description form for smoothers showing the second possible production evidence: notch on Smoother 3.

Figure 4c. Colle Santo Stefano, Ortucchio: forms of description for smoothers showing the third possible production evidence: cut and/or incision on Smoother 4.
**Figure 5a. Experimental reproduction flow chart.**

<table>
<thead>
<tr>
<th>SMOOTHER 1 ↔ Production test 1</th>
<th>Test 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SMOOTHER 1 - TEST 1</strong></td>
<td><strong>FRACRUPT B ROUGH BEFORE POLISHING</strong></td>
</tr>
<tr>
<td><strong>POLISHING</strong></td>
<td></td>
</tr>
<tr>
<td><strong>POLISHING FRATURES A AND B</strong></td>
<td><strong>FRACRUPT B ABRADED AFTER POLISHING</strong></td>
</tr>
<tr>
<td><strong>SMOOTHER 3 ↔ Production test 2 abandoned</strong></td>
<td><strong>Test 2</strong></td>
</tr>
<tr>
<td><strong>CUT + DIRECT PERCUSSION</strong></td>
<td></td>
</tr>
<tr>
<td><strong>DIRECT PERCUSSION</strong></td>
<td><strong>FRACRUPT PARALLEL TO CUT</strong></td>
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</tbody>
</table>

**Figure 5b. Production operative sequence: production test 1 and test 2.**
<table>
<thead>
<tr>
<th>SMOOTHER 3 ↔ Production test 3</th>
<th>Test 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMOOTHER 3 - Test 3</td>
<td>INDIRECT PERCUSSION</td>
</tr>
<tr>
<td>Fracture on point of impact</td>
<td>Notch</td>
</tr>
<tr>
<td>SMOOTHER 3 ↔ Production test 4</td>
<td>Test 4</td>
</tr>
<tr>
<td>SMOOTHER 3 - Test 4</td>
<td>INDIRECT PERCUSSION</td>
</tr>
<tr>
<td>Fracture on point of impact</td>
<td>Notch</td>
</tr>
<tr>
<td>INDIRECT PERCUSSION</td>
<td>Fracture on point of impact</td>
</tr>
<tr>
<td>Notch</td>
<td>Notch</td>
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</tbody>
</table>

*Figure 6. Production operative sequence: production test 3 and test 4.*
Production test 8 and 9 - abrasion/polishing
The chosen pieces’ morphologies were already very similar to the archaeological evidence. As a consequence, the only operation to be carried out was abrading the fractures on a stone (see test 1).

Use of experimental smoothers to finish pots: the chaîne opératoire

Binocular microscope analysis of the archaeological finds gave rise to a specifically planned experimental protocol: the goal was to try and obtain experimental replicas that could be compared to the archaeological data.

The experimental smoothers (production tests 1, 7, 8 to reproduce Smoother 1 and production tests 3, 4, 9 to reproduce Smoother 3) were used on parts of newly prepared clay models, such as strip handles and bases. The clay used for the models was dug from the location of the Rio Lecce stream, in Ortucchio (sample of clay number RL3B). An experimental drying curve (Martineau 2010) was used to evaluate the solidity of this clay during the tests.

The experimental use of the production test smoothers (Figure 8) has been carried out on plastic clay (24h), hard plastic/moist clay (48h) and eventually on leather hard/dry clay (72h); it did not seem useful to test the smoothers during the very first modelling stages (0h) as the plasticity and moisture content of the raw material would have not allowed a good surface contact.
<table>
<thead>
<tr>
<th>Test 1</th>
<th>Test 1</th>
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<tbody>
<tr>
<td><img src="image1" alt="Test 1 Image 1" /></td>
<td><img src="image2" alt="Test 1 Image 2" /></td>
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</tbody>
</table>

**PLASTIC CLAY 24 HOURS**

**MEMO:** CLAY IS TAKEN OFF AND IT IS REDEPOSITED ON THE ACTIVE SURFACE, CREATING A DEEP LAYER. POT SURFACE APPEARS IRREGULAR AND LUMPY.

<table>
<thead>
<tr>
<th>Test 2</th>
<th>Test 2</th>
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<tbody>
<tr>
<td><img src="image3" alt="Test 2 Image 1" /></td>
<td><img src="image4" alt="Test 2 Image 2" /></td>
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</tbody>
</table>

**HARD PLASTIC/MOIST CLAY 48 HOURS**

**MEMO:** LITTLE AMOUNT OF CLAY IS MOVED AND REDEPOSITED ON ACTIVE SURFACE. POT SURFACE IS MORE REGULAR AND SHOWS LARGE STRIATIONS.

<table>
<thead>
<tr>
<th>Test 3</th>
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<tr>
<td><img src="image5" alt="Test 3 Image 1" /></td>
<td><img src="image6" alt="Test 3 Image 2" /></td>
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</tbody>
</table>

**LEATHER HARD/DRY CLAY 72 HOURS**

**MEMO:** NO CLAY IS MOVED. USING THE TOOL PRODUCES DUST AND ON THE SMOOTHER’S ACTIVE SURFACE SOME FLAKES FALL OFF. POT SURFACE IS ABRASED AND SHOWS SHALLOW STRIATIONS.

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Figure 8. Finishing steps of the operative sequence: experimental use test 1 (plastic solidity 24h), test 2 (hard plastic/moist solidity 48h) and test 3 (leather hard/dry solidity 72h).
### POST PRODUCTION TESTS' SURFACES

<table>
<thead>
<tr>
<th>Test</th>
<th>Smoother</th>
</tr>
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<tbody>
<tr>
<td>test 1</td>
<td>SM. 1</td>
</tr>
<tr>
<td>test 3</td>
<td>SMOOTHER 3</td>
</tr>
<tr>
<td>test 7</td>
<td></td>
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<tr>
<td>test 9</td>
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<td>test 8</td>
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</table>

### TESTS' SURFACES AFTER USE SHOWING REDEPOSITED CLAY

<table>
<thead>
<tr>
<th>Test</th>
<th>Smoother</th>
</tr>
</thead>
<tbody>
<tr>
<td>test 1-24 hours</td>
<td>SM. 1</td>
</tr>
<tr>
<td>test 3-24 hours</td>
<td>SMOOTHER 3</td>
</tr>
<tr>
<td>test 7-48 hours</td>
<td></td>
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<tr>
<td>test 9-48 hours</td>
<td></td>
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<tr>
<td>test 4-72 hours</td>
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### TESTS' SURFACES AFTER USE AND WASH

<table>
<thead>
<tr>
<th>Test</th>
<th>Smoother</th>
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<tbody>
<tr>
<td>test 1-24 hours</td>
<td>SMOOTHER 1</td>
</tr>
<tr>
<td>test 3-24 hours</td>
<td>SMOOTHER 3</td>
</tr>
<tr>
<td>test 7-48 hours</td>
<td></td>
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<tr>
<td>test 9-48 hours</td>
<td></td>
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<tr>
<td>test 4-72 hours</td>
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*Figure 9. Surfaces of the experimental smoothers after tests. Legend: SM. 1 = Smoother 1.*
Experimental use test 1 – production test 1 and test 3 on plastic clay (24h)
This experiment was not functional as large amounts of clay were moved as it spread on the smoother’s surface. No use evidence was formed on the tool’s active surfaces; indeed, it was not possible to distinguish between evidence of use and abrasion obtained while shaping the tool.

Experimental use test 2 – production test 7 and test 9 on hard plastic/moist clay (48h)
Hard plastic/moist clay appeared to be most suitable for modelling pots: walls could be thinned and both interior and exterior surfaces could be levelled. Moreover, small dimensions of smoothers were extremely useful to finish every part of the pot with high precision, including rims, handle holes and the points where body and base meet. On the smoother’s active surfaces morphology modifications could be noticed: after a short period of use (between 7 and 10 minutes) flattened or rounded surfaces and smoothed angles appeared. These surfaces were smooth to touch, with a matt appearance and a rounded section.

Experimental use test 3 – production test 8 and test 4 on leather hard/dry clay (72h)
Leather hard/dry clay was unsuitable for our purposes. After a similar short period of use (between 7 and 10 minutes) the active surfaces showed clearly only small polished areas and a few small chips which came off: this has no parallels with the archaeological record. Moreover, experimental pot surfaces showed no similar characteristics to those of the archaeological data. However, it is necessary to take into consideration that the shallow striations made by smoothers on the pot surfaces may have been erased by a subsequent finishing treatment on archaeological pots.

Conclusions

Colle Santo Stefano pottery smoothers are reused fine fabric potsherds that were selected specifically for their low abrasive capacity. Both wear/use analysis on abraded surfaces and experiments carried out, led us to make a series of observations on this peculiar tool class (Figure 9). According to débitage evidence identified on the archaeological record (splintering or knapping, cutting and notching) and by comparison with experimental production replicas, it appears that smoothers’ shaping could have been done using indirect percussion and bending techniques, while direct percussion has to be ruled out.

Indirect percussion produced good results both after a cut/incipience action (production test 7) or alone (production tests 3 and 4). Furthermore, it showed that the socket observed in the archaeological record (Smother 3) could be obtained by indirect percussion alone, without a previous cut.

Bending is a good technique when used together with prior cutting (production test 6), which assures a planned and controlled fracture line on the sherd.

A selection of already pre-shaped pieces appears most likely in antiquity: some of the experiments revealed that when this happens, shaping of the tool is unnecessary, as it is already suitable in both morphology and dimensions, although it is plausible that a minimal shaping and levelling of the edges using abrasion would have been useful to even rough fractures (production tests 1, 8, 9). It is not to be denied that sherd with characteristic fractures could have been used, for instance potsherds that broke along the coil line: in this case, the fracture line is already quite even and convex, so active surfaces are ready to use.

Noticing smoothers’ active surface wear (rounded off appearance and lack of mechanical wear/striations) and comparing them with experimental tests suggests that these tools were used to model clay, particularly on pot surfaces without protruding inclusions and when the clay is hard plastic/moist (48h). It appears that Colle Santo Stefano pottery smoothers, when used in pottery production, were suitable tools to remove small amounts of clay, even surfaces and improve specific parts of the pot (i.e. handles and bases). Lack of clear comparisons between surface replicas and the original ones confirms that these sherd tools are unsuitable for fired pot surface finishing or for final surface treatments. Moreover, experiments showed that wear on active surfaces appears after a short period of time, thus consolidating the hypothesis that Colle Santo Stefano pottery smoothers were not part of a specialist’s kit, but opportunistic tools used only once and then discarded.

Acknowledgements

Our thanks and gratitude go to Professor Giovanna Radi, who gave us the opportunity to extend the research on pottery smoothers. Thanks to Jacopo Conforti and Raffaella Milano who helped us in the various phases of the present work.

References


The Old Potter's Almanack


OLD CERAMICS FIRING KILNS IN SOUTHERN RUSSIAN FAR EAST: FROM PREHISTORY TO THE RECENT PAST

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Introduction

The purpose of this article is to present our research on the history of old ceramics firing kilns in the southern part of present day Russian Far East. The research area is the Primor’e region bordering northeast China and the northern part of the Korean peninsula (Figure 1).

The earliest appearances of ceramic technology in the studied territory date to around 13,000-12,000 years ago (Zhushchikhovskaya 2011; Kuzmin 2013). Pottery-making was one of the most important crafts of local populations from the Neolithic to the Early States epoch. In the course of pottery production history, technique and technology developed gradually. As archaeological records show, the earliest kiln-like structures for pottery firing were invented in