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CERAMIC ALTERATION ANALYSIS ON ROMAN POTTERY: DETERMINING TAPHONOMY AND USE

In this paper, I introduce the concept of ceramic alteration analysis of Roman pottery: an approach to ceramic study that I have undertaken in an attempt to understand the daily use of cooking and serving vessels in Republican Italy. My broader research employs detailed ceramic study to determine cooking and eating practices; the examination of ceramic alteration is an important component of this research. The methods described here were part of a study I carried out between January 2011 and June 2012 on pottery from the towns of Musarna, near Viterbo, and Populonia, on the Tyrrhenian coast near Livorno.[1] This paper explains why and how I have chosen to implement this approach, and presents a few examples of typical results that I have observed.[2] The purpose of this paper is to make some recommendations about the opportunities, concerns, and limitations inherent in the study of ceramic alteration in the hopes that this type of information will continue to be recorded and published by others in future. The broader application of alteration analysis to other datasets from other contexts would mean that the methods of recording could be refined, and the following observations further confirmed.

Alteration Analysis and Function

The problem with understanding pottery function solely through the study of vessel morphology and clay body is the enormous potential ceramics have for non-ideal use, multi-functionality, and re-use. The direct attribution of vessel form to vessel function assumes that the vessels ancient users were choosing always reflected the vessel's "optimal performance characteristics," that is, people were using vessels which were most appropriate for their needs both in terms of the quality of material and size and shape.[3] Prudence Rice and Daniel Miller both warn of the oversimplification in this one-to-one correlation. Miller's 1985 census of users of cooking pots in a village in India demonstrates that although vessel use was relatively standardized, the vessels used to do certain tasks were not always the most efficiently-designed ones for the job. Rather, the choice of ceramic form was rooted in social and ritual norms. When talking with people in the village, it became clear that they did not know why they used the pots they used, although many claimed that they were the most appropriate shapes.[4]

An approach which is under-used in the study of Roman vessels is ceramic alteration analysis: the observation and study of post-production alterations that the vessel has undergone whether through gradual repeated wear or a discrete event. The term "ceramic alteration" is increasingly used in place of the term "use wear" because it includes the study of the alteration of materials arising from both use and non-use. Use-alteration analysis of ceramics reveals "intentional interaction between people and the pottery," while analysis of non-use alteration reveals alteration resulting from taphonomic or post-depositional circumstances.[5] Traces of alteration can be combined with observations made about form to determine use.[6] Use-alteration analysis also has the potential to reveal multi-functionality, including both contemporaneous multiple uses of one object as well as the use of an object for its non-intended purpose. The principle behind use-alteration analysis is similar to the idea of *chaîne opératoire* as we reconstruct the choices or unintended consequences which the human user makes through the identification of patterns in the traces of wear.[7]

Alteration analysis has had its most explicit and systematic exploration within the sphere of behavioural archaeology.[8] The principles of alteration analysis have been applied in many small-scale studies examining lithic tools, ochre, and ceramic vessels.[9] Originally, several scholars noted the difficulty of doing alteration analysis on fragmentary ceramic sherds and suggested that it could only really be applied to

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[2] Here I reveal only *exempla* of my ceramic findings. The quantitative analysis of my results, subjecting my data primarily to analyses of variance, chi-squared tests, and logistic regression in order to see correlations between various observations, appears in my forthcoming doctoral dissertation at the University of Michigan.

[3] Ericson et al. 1971; Braun 1983; Rice 1990.

[4] Miller 1985, 51–68, 158, 197.

[5] Skibo 1992, 42–44.

[6] Hally 1986; Rice 1990.

[7] Grace 1996, 218–219.

[8] Schiffer 1989; Schiffer/Skibo 1989; Skibo 1992.

[9] For lithics and ochre see e. g., Semenov 1964; Hayden 1979; Grace 1996; Hodgskiss 2010; Li/Shen 2010. For ceramic studies, see below.

Fig. 1. Closed-form vessel from Musarna with blackening on upper half (#4735, author).

Fig. 2. Closed-form vessel from Musarna with interior powdery charring (#4735, author).

museum-quality, whole, vessels. Studying alterations on whole pots allows for the understanding of localized abrasion and it also aids in the understanding and separation of use and non-use alteration.[10] Unfortunately, the circumstances in which we excavate whole vessels are limited and we seldom recover such vessels from everyday non-funerary, non-ritual contexts.[11] The possibilities for alteration analysis on ceramic fragments are many, and with some creativity, reasoning, and some well-preserved vessels as a guide, it can be fruitful. There are two main spheres in which to observe use-alteration of ceramics: abrasion and fire damage.

Fire Damage

Discolouration from fire has been classified and treated inconsistently in the archaeological literature of the classical Mediterranean. Scholars have used terms like "fire clouding,"[12] "fire blackening,"[13] "traces of burning,"[14] "burning marks,"[15] "sooting,"[16] and "scorch marks"[17] to refer to blackening on archaeological ceramics. In fact, discolouration from fire contact is actually the result of several different processes.[18]

Ceramics exposed to fire have patches of black which basically consist of deposited carbon. The nature of this blackening, its opacity, and its location on the pot are the results of the intensity of the cooking heat, the location of the heating source, and the moisture of the pot interior.[19] Experimental archaeology has been useful for clarifying the cause and nature of different types of blackening. These can be defined most simply as sooting and charring.[20] Soot is a by-product of fuel combustion.[21] There are three particular sources of blackening on the vessel exterior: distilled resins from the wood, oxidized resins which then carbonize, and free carbon.[22] According to sooting experiments undertaken by American archaeologists, free carbon, the last material to be deposited on the ceramics, wipes off the surface very easily and therefore is unlikely to remain on washed or certainly archaeological ceramics.[23] The material that becomes imbedded in the ceramic body and leaves it black seems to be carbonized resin that manifests itself in various ways depending on the moisture conditions and porosity of the

10 Bray 1982, 136; Skibo 1992, 45.

11 Cécile Batigne Vallet conducted a limited alteration study of Imperial common ware from the necropolis at Musarna noting that it would be interesting to compare vessels from a funerary context to those from a non-funerary context. Batigne Vallet 2009, 111, 117–123.

12 Beck et al. 2002, 4; Rice 2005, 235; Welch/Scarry 1995, 410.

13 Dyson 1976; Moorhouse 1978, 5.

14 Dyson 1976; Fentress 2010, 147, n.11.

15 Lis 2006, 12.

16 Ikäheimo 2003, 76–78; Rotroff 2006; Ikäheimo 2010, 158–159; Fentress 2010, 147.

17 At Cooking, Cuisine, and Culture: the Archaeology and Science of Kitchen Pottery in the Ancient Mediterranean World (34th Classical Colloquium at the British Museum, December 2010) the term "scorch marks" was used often in discussion, instead of "burning marks" or "sooting" which many of the participants used in their papers. On "burning" marks see, W. Gauß et al., A. Steiner, and B. Lis. On "sooting" see the papers by G. Schörner, and S. Fourrier, forthcoming in the conference proceedings.

18 Welch/Scarry 1995. This is the only report of blackening of archaeological ceramics which distinguishes between different types and sources of fire damage.

19 Skibo 1992, 148.

20 Ibid. 152–153.

21 For fuel sources in the Roman period, see Veal 2012.

22 Hally 1983, 7.

23 Ibid. 8; Skibo 1992, 154; 159.

Fig. 3. Base interior (a) and exterior (b) from Musarna (#5681, author).

Fig. 4. Internal redslip cookware pan from Musarna (#4975, author).

pot.[24] This sooting, released from the combustion of flame of the fuel, appears on the exterior of vessels. A commonly-known example in the Roman context is the blackening of the exterior of one side of a jug with one handle.[25] This blackening pattern suggests that the fuel source was on the handless side of the vessel.

When we observe other patterns of blackening on the exterior of vessels we can understand the relationship between the fuel source and the vessel. For example, a closed-form pot from Musarna is blackened on its exterior in an even streak all the way around its upper half (**fig. 1**). Its base and lower half do not have discernable traces of black. From this we can conclude that this vessel sat directly in a bed of charcoal on a flat, perhaps masonry stove. The charcoal was giving off carbonized resin which has become imbedded in the ceramic body, but the part of the vessel which sat within the charcoal was not exposed to this matter in the air.

On the interior of cooking vessels, blackening results from the charring of food as it loses moisture. In this same pot, the interior lower half has a thick black residue which is powdery to the touch (**fig. 2**). This further suggests that the location of heat is underneath the pot. There are two possible origins to this pattern of blackening: the foodstuff at the base of the pot may dry out and carbonize, or water with organic matter in it may have been absorbed into the pot and then burnt during the next heating episode.[26] If the interior blackening is around the belly of the pot, rather than on its base, one likely scenario is that the pot was been seated next to the source of heat and was periodically rotated, thus the charring would have originally been only on one side of the interior, put developed into a swathe all the way around the vessel.

Conclusions about blackening patterns are not always straightforward because we do not always have nearly whole vessels, but with the accumulation of this type of information we can begin to extrapolate. For example, fragmentary bases can be quite suggestive (**fig. 3a** and **3b**). While the exterior of this base suggests that it sat directly in charcoal, its interior blackening pattern, lacking any trace of black on its interior

[24] Ibid. 162-168.
[25] See, e. g., Bertoldi 2011, 90 fig. 76a.
[26] Skibo 1992, 148–151. Technically, interior depositions cannot be of pure carbon, but also of some un-carbonized lipid material.

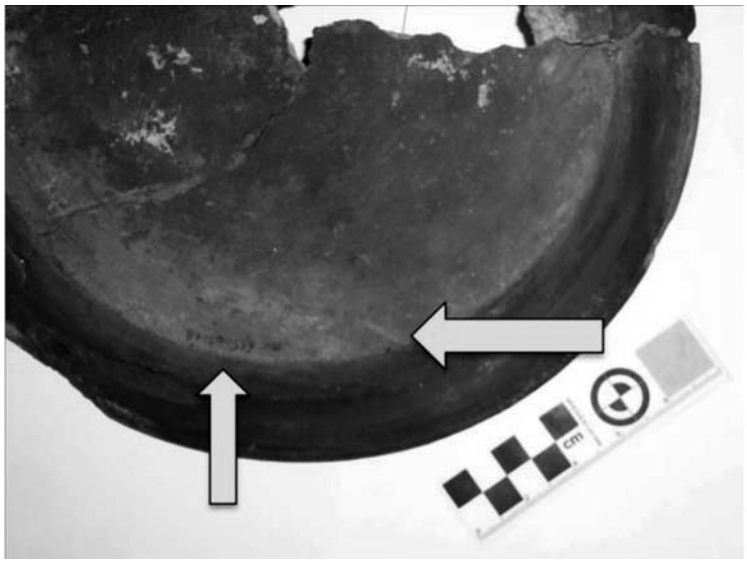

Fig. 5. Lighter exterior patches on pan suggesting its placement on a stand (#4975, author).

Fig. 6. Interior blackening (a) and exterior spalling (b) on cooking vessel from Musarna (#4715, author).

floor, suggests that the source of heat was not below, but beside it, and the vessel was rotated. This demonstrates the need to consider both the interior and exterior conditions of the vessels when drawing conclusions about cooking methods.

We can use another very well-preserved pan from a 1st century BCE deposit in Musarna to imagine a vessel being elevated above a fuel source on a cooking stand (**fig. 4**). Here the exterior is entirely black, but we have 3 faint rectangular patches which suggest that there was a place which was not so exposed to the soot (**fig. 5**). This same distribution of blackening appears often, but not always, on internal red slip ware pans as well as on tripod cooking pots.

Another significant source of discolouration from fire is the oxidization of the ceramic body. Oxidization occurs when a vessel or portion of vessel is exposed to high close heat, and can burn off soot from previous cooking episodes. Oxidization appears as a lack of sooting in the middle of an otherwise blackened area, or often as a patch which is lighter in colour than the rest of the clay fabric surface. Especially when such an exterior lightening corresponds with an interior blackening, it indicates that the pot sat very close to a heat source, or perhaps in or on the heat source.[27] This oxidization can also be associated with spalling, or surface flaking of the ceramic material. A closed-form pot from a late 2nd century BCE deposit in Musarna has a thick layer of carbon on the interior and at the same spot on the exterior, a lighter flaky surface (**fig. 6a.b**).

Abrasion

Abrasion is the removal of the surface of ceramic material in the form of linear scratches, patching, chipping, or pedestalling. Pedestalling is when the ceramic matrix has been worn away but the more durable mineral inclusions remain creating a surface where these inclusions seem to protrude

[27] Skibo 1992, 156; 159.

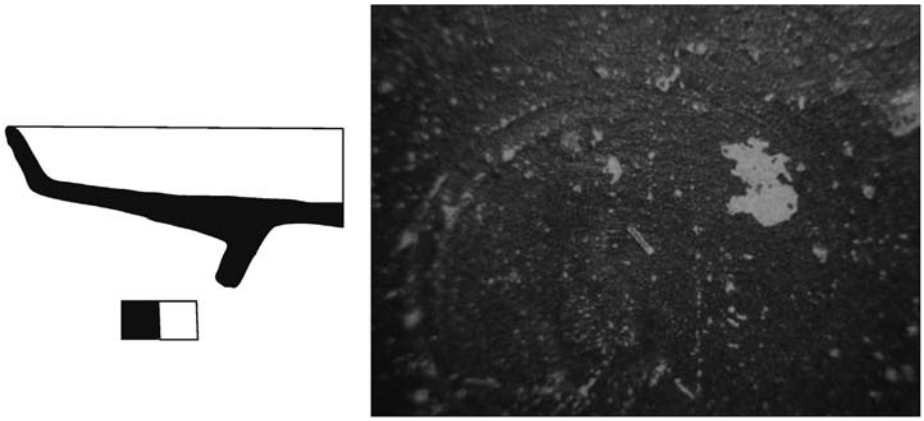

Fig. 7. Linear abrasion cutting through slip on black gloss plate from Musarna (photo at 20 times magnification) (#4976, author).

as if on pedestals.[28] The Roman mortarium pedestalled around its interior grit is a commonly-reported example in the classical world.

The most obvious source of abrasion on ceramic vessels is tool use. Utensils used for cooking and eating have prolonged and repeated contact with the interior and sometimes the exterior surface of vessels used for food preparation, cooking, and serving. James Skibo's investigation of pottery use by the Kalinga people of the Philippines suggests ways in which we can use abrasive marks to interpret vessel function, cooking practices, and frequency of use. He noted that pots which were used to cook vegetable and meat had heavier interior rim and neck abrasion than pots used to cook rice, yet rice pots have a more confined neck opening. Skibo observed that people accessed the contents in the vegetable and meat pots, for both stirring ingredients and for serving, more often and repetitively than they did the rice pots. Throughout the cooking and serving process, a utensil was only put into the rice pot when the rice was being served.[29]

Traces of tools on serving vessels can also suggest use. Dorothy Griffiths completed a study of 18th century CE lead-glazed ware in Canada and noted linear scratches across on the interiors of plates and short nicks and scratches on the interior walls of tea cups. She interpreted these marks as the result of knives and forks on plates and repeated stirring of teaspoons in tea cups.[30] In the dataset from Musarna and Populonia, there are many vessels with thin localized linear abrasion. Scratches appear completely removing the slip as on a plate from Musarna (**fig. 7**), or only decompressing the sintered surface as in a fragment from Populonia (**fig. 8**). These are both flat plate-like forms. The wearing of pottery surfaces and visibility of these traces differs according to the composition of the pottery.[31] Scratches may be easier to see on vessels with a smoothed and uniform surface than on pottery with rougher and more heterogeneous surfaces. While Michael Schiffer and James Skibo suggest that "decompression of the surface" manifested as scratches would be unlikely to affect vitrified or glazed surfaces;[32] the observation of ceramics in my research suggests that scratches are, in fact, visible on slipped sintered surfaces.

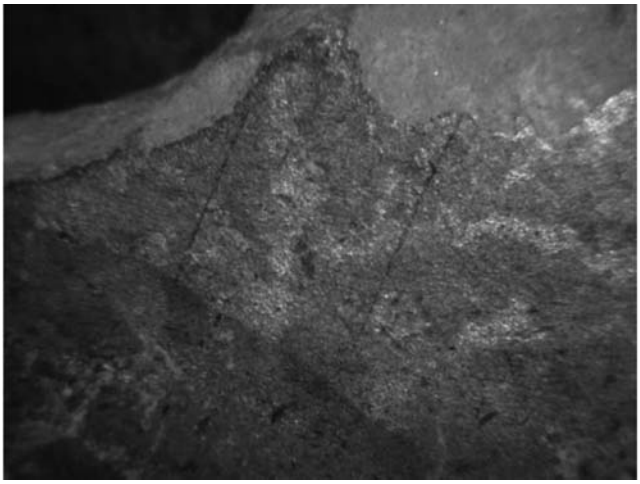

Fig. 8. Linear abrasion compressing slip on black gloss plate from Populonia (photo at 20 times magnification) (#3135, author).

When we focus on deeper more bowl-like open forms, there is also alteration visible on several specimens in my dataset. A typical pattern in bowl forms is the central interior slip is totally gone and the wheel marks of the interior similarly have their slip worn off (**fig. 9**). The slip is often worn in parallel lines along the interior wall.

Indirect or unintentional abrasion is also a very frequent source of alteration on pottery. This is abrasion which comes from occasions of distribution or storage: activities like dragging a pot along a surface, or placing vessels on shelves or banging against other pottery.[33] Dorothy Griffiths attributed wear on the base and exterior side of her lead-glazed vessels to the ways that they were stacked and leaned in storage. She also noticed the correlation between the amounts of different types

[28] Ibid. 112–113; Schiffer/Skibo 1989, 103.
[29] Skibo 1992, 132.
[30] Griffiths 1978, 71; 75.
[31] Schiffer/Skibo 1989, 102–103. In the case of these two examples, the fragment from Musarna is a local black gloss production, while the fragment from Populonia is likely Campana A production.
[32] Schiffer/Skibo 1989, 103.
[33] Ibid. 112. Among the Kalinga people, see Skibo 1992, 112–113.

Fig. 9. Typical abrasion pattern on black gloss bowl (#3790, author).

of abrasion. Plates with more knife cuts on them also had more worn foot rings, perhaps suggesting a longer use-life.[34]

Palimpsest and Visibility

The problem of palimpsest, that is, of repetitive traces of wear overlapping and masking each other, needs to be handled and interpreted on a sherd by sherd basis. Find context, the hypothesized use-life of the form, and comparison of different examples of the same form all need to be taken into account when observing or ruling out palimpsest. The blackening we saw around the belly of the pot on the interior and exterior of the base fragment above is an typical example of palimpsest. The same principle should be adopted for the masking of one type of alteration by another type, for example, soot at the bottom of a pot cushioning it from abrasion.[35]

Considering taphonomy

Distinguishing between use-alteration and alteration which occurs as the result of post-depositional processes or taphonomy is an issue with which proponents of the potential for use-alteration have been grappling.[36] We can consider the effects of both accretion and attrition on our ability to "read" the sherd. For accretion, staining and the adhesion of mineral crust have the largest potential to mask alteration, but also to contribute to the understanding of the post-depositional circumstances of the stratum in which the material was found. For attrition, observing the "the degree of rounding", especially at the edges of the fractures, is one way to consider how much post-depositional movement sherds have undergone.[37] We can also consider whether abrasion carries across fractures which likely happened at the moment of discard or post-depositionally. For example if a scratch goes across the fracture of two sherds when they are joined, it is reasonable to understand it to be a scratch resulting from use rather than dismissing it as a scratch from post-depositional movement. Observations of sherd condition can be combined with the index of brokenness and sherd size.[38]

The selection of contexts which contain sherds which are not badly damaged is an important feature of my alteration study since I am primarily interested in use-alteration. By recording all of the attrition and accretion on ceramics, I can decide whether to include fragments in my use-alteration analysis. For example we can compare two fragments from Populonia, the first from a beaten earth floor, the second from the fill of a small pit, to consider the feasibility of understanding alteration from use (**fig. 10a** and **10b**). The first has heavily eroded edges and a lot of slip removed from its exterior even more than its interior. The second has sharp edges and only interior slip removed substantially. This suggests that material from the beaten earth floor might be less-reliable for the study of use-alteration because it seems to have undergone more post-depositional movement.

[34] Griffiths 1978, 73–74.
[35] Skibo 1992, 122.
[36] Schiffer/Skibo 1989, 101.
[37] Beck et al. 2002, 6
[38] Orton 1993, 176. This concept is similar to the method in zooarchaeology of considering the Fragment Fracture Index. Orton 2010.

Fig. 10. a. Badly-eroded black gloss plate from Populonia (#977, author). – **b.** Black gloss bowl with interior abrasion from Populonia (#670, author).

Conclusions

The vast Roman ceramic corpus, the increasing refinement of typologies, and the myriad scholars handling Roman pottery mean that the application of alteration analysis to other datasets in the Roman world could produce a huge amount of new data about Roman pottery use, durability, and discard. Such a dataset could contribute to answering questions like: how long do certain wares stay in circulation versus others? How much slip could be worn off of a vessel before an ancient user stopped using it? Details of alteration have the potential to contribute to broader questions about the circulation and consumption of material in the Roman economy in the same way that ancient repairs have suggested the preciousness of certain fine wares at the outskirts of the empire.[39]

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[39] Guldager Bilde/Handberg 2012; Jervis/Kyle 2012.

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