



“With a Little Help from My Wheel”: Wheel-Coiled Pottery in Protogeometric Greece

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“WITH A LITTLE HELP FROM MY WHEEL”

WHEEL-COILED POTTERY IN PROTOGEOMETRIC GREECE

To Jerry

ABSTRACT

In this article, we reconsider manufacturing techniques of Protogeometric ceramic production in central Greece. Contrary to the established notion that wheel-throwing was the exclusive technique used to produce Protogeometric fine-ware pottery, we argue that at least part of this ceramic category was not wheel-thrown but wheel-coiled. Informed by a macroscopic study of surface and breakage features, as well as the results of our experimental project, we present the evidence for Protogeometric wheel-coiling based on three assemblages from the sites of Mitrou, Halos, and Lefkandi. The potential significance of our findings for understanding ceramic production in Early Iron Age Greece is pointed out and possible directions for further research are suggested.

INTRODUCTION

It is a well-established belief in current scholarship that fine pottery of the Protogeometric (PG) period in Greece was thrown on a potter's wheel.¹ Moreover, throwing ceramic vessels on a *fast* turning wheel, as opposed to a *slow* one, is in certain quarters still considered to be one of the technological innovations of the era.² More than 30 years ago, however, Eiteljorg

1. Lemos 2002, pp. 27–84, 199. We are extremely grateful to Maria Cholova, Caroline Jeffra, and Jerolyn Morrison for their helpful remarks and for sharing their expertise on wheel-coiling characteristics during the various stages of our research. The present study would not have been possible without the support of Abraham van As, former director of the Laboratory of Ceramic Studies in Leiden. Many thanks are due to Jill Hilditch, Antonis Kotsonas, Ayla Krijnen, Bartłomiej Lis, Aleydis Van de Moortel, Jeremy B. Rutter,

Vladimir V. Stissi, Jeltsje Stobbe, Salvatore Vitale, and the anonymous *Hesperia* reviewers for their useful comments on the research and on the manuscript. The research has been funded by the New Perspectives on Ancient Pottery project (director Vladimir V. Stissi, University of Amsterdam), the Mitrou Archaeological Project (directors Eleni Zahou and Aleydis Van de Moortel, the Ephorate of Antiquities of Phthiotida and Evrytania and University of Tennessee, Knoxville, respectively), and the Laboratory of Ceramic

Studies in Leiden (Leiden University). This article is dedicated to Jeremy B. Rutter as the *ἀπαρχή* or “first fruit,” of his endless help, support, and inspiration.

2. E.g., Boardman 1998, p. 13; Thomas and Conant 1999, p. 68; Osborne 2009, p. 43. The use of the faster potter's wheel in the PG period as one of the technological innovations was mentioned by Lane (1948, p. 20, cited in Desborough 1952, p. 120) and strongly argued for in Desborough 1972, p. 145. See also Desborough 1964, p. 262.

persuasively showed that the morphological change from the saggy and more globular shapes of the so-called Submycenaean pottery to the taller, ovoid vessels of the ensuing PG period could not be related to the speed of a potter's wheel.³ He went as far as to argue that the very distinction between fast and slow wheels, in a context of wheel-throwing, should be abandoned.⁴ While concurring with his reasoning, we would like to go one step further and claim that at least part of the standard PG fine decorated pottery was not thrown on the wheel at all. Examination of PG pottery from Mitrou, Halos, and Lefkandi, all in central Greece, complemented by an experimental pottery study, has provided evidence indicating that certain fine ceramic categories were wheel-coiled instead of wheel-thrown.

WHEEL-THROWING VS. WHEEL-COILING

The pioneering work of Roux and Courty drew attention for the first time to the distinction between wheel-throwing and wheel-coiling.⁵ Wheel-throwing is a technique in which a lump of clay is centered on a wheel and transformed into a vessel by the use of rotative kinetic energy (RKE).⁶ Wheel-coiling, on the other hand, is a manufacturing process that combines the coil-building technique with RKE. In the latter technique, the rough shape of the pot (termed "roughout") is hand-built from assembled coils and later transformed or finished on the wheel.⁷ Despite substantial differences between the two techniques, the resulting appearance of the finished products may be quite similar.⁸ This similarity may be seen in shared features such as parallel horizontal striations and rilling, axial symmetry, and string-cut marks at the bases of ceramic vessels.⁹ In other words, the features just mentioned are polysemic in character, not being limited to a single technique. Because of the use of the potter's wheel to transform the coiled roughout, wheel-coiled pottery can be easily misidentified as merely wheel-thrown.¹⁰

Under the right circumstances, however, the two techniques can be distinguished by closer examination of macroscopic surface features such as coil seams (often not quite parallel to the rilling), variation in wall thickness due to discontinuous application of pressure during manufacture of the roughout, or significant undulations in compression zones due to the deformation of stiff coils.¹¹ The presence and form of these traces will depend not only on the particular wheel-coiling method,¹² but also on the skillfulness of the potter.¹³ The potter can obliterate all traces of coils if

3. Eiteljorg 1980; see also Berg 2013, pp. 116–117.

4. Eiteljorg 1980, pp. 447–449. See also Gelbert 1994, p. 61.

5. Roux 1994; Courty and Roux 1995; Roux and Courty 1998. In two seminal papers, Roux and Courty applied the term "wheel-fashioning" to the technique of shaping a coiled roughout on a potter's wheel. More recently, however, Roux used "wheel-coiling" instead to describe the same manufacturing technique (see Roux and de Miroschedji 2009) and it is this term

that we will be using in this article.

Compared to the former term, "wheel-coiling" has the advantage of characterizing the particular primary hand-building method and it is thus considered more precise.

6. Rye 1981, pp. 74–75; Courty and Roux 1995, p. 22.

7. Roux and Courty 1998, p. 748.

8. Courty and Roux 1995, p. 18.

9. Roux 1994, pp. 49–51; Courty and Roux 1995, pp. 17–18; Roux and Courty 1998, pp. 751–752.

10. Courty and Roux 1995, p. 18.

11. Courty and Roux 1995, pp. 26–30; Roux and Courty 1998, pp. 751–753; Jeffra 2011, pp. 115–150.

12. Roux and Courty established four different methods of wheel-coiling, differentiated by the particular stage of the manufacturing process during which the RKE was used. Based on their experimental material, they were able to set a number of criteria for recognizing the four methods in ancient material as well. See Courty and Roux 1995; Roux and Courty 1998.

13. Gelbert 1994, pp. 70–72.

he/she feels the need and possesses the ability to do so; wheel-finished vessels preserving traces of the coil-building process can therefore be viewed as pieces with flaws.¹⁴ This means that when dealing with high-quality, well-finished products, especially in sherd material, the rate of recognizable wheel-coiled fragments will necessarily be very low.

Recognition of wheel-coiling as a ceramic technology intermediate between hand-building and wheel-throwing is by no means new to Aegean studies. The technique has been documented on pottery from Middle Bronze Age Crete¹⁵ and on Early Helladic (EH) III pottery from Lerna in the Argolid.¹⁶ Likewise, it seems that wheel-coiling was a common practice in Middle Bronze Age mainland Greece as well.¹⁷ What is more, Berg has recently called for a reassessment of our ideas concerning the use of the potter's wheel in the manufacturing process (wheel-coiling vs. wheel-throwing?) in Mycenaean Greece.¹⁸ We will argue that our own study of the PG material presented below extends the use of wheel-coiling further into the post-Mycenaean period.

In the existing scholarly literature, the majority of Greek PG fine decorated pottery is invariably referred to as wheelmade.¹⁹ Since the distinction of wheel-throwing and wheel-coiling as two separate ceramic technologies is a relatively recent development in Aegean studies, and thus far has been applied only to Bronze Age pottery, these authors must equate "wheelmade" with "wheel-thrown."²⁰ The findings from Mitrou, Halos, and Lefkandi necessitate a significant departure from past scholarship and will in turn force us to rethink long-held assumptions about the paradigm of ceramic production in Early Iron Age (EIA) Greece. Upon the first discovery of a few PG sherds with clear traces of the wheel-coiling technique we decided to set up a small project with the following aims: (1) to identify the most relevant features for recognizing wheel-coiling among this particular body of material; (2) to assess the range of shapes produced by this technique; and (3) to assess the geographical extent of this technological tradition. The results of our analysis of both ancient and experimental material are presented below.

WHEEL-COILING IN CENTRAL GREECE

The initial recognition of the wheel-coiling technique on PG pottery was made a few years ago at Mitrou, a tidal islet located off the shore of Tragana in East Lokris, central Greece (Fig. 1). In 2004–2008, the site was systematically excavated by the Mitrou Archaeological Project, a collaborative program of the Ephorate of Antiquities of Phthiotida and Evrytania and the University of Tennessee, Knoxville.²¹ The excavation

14. Roux and Courty 1998, p. 752.

15. Knappett 1999, 2004; Berg 2009, 2011a, 2011b; Jeffra 2011, 2013.

16. Choleva 2012.

17. Spencer 2007; Berg 2013, p. 117; Maria Choleva (pers. comm.).

18. Berg 2013. For evidence of

wheel-fashioning methods on Late Bronze Age Kos, see Vitale and Trecarichi 2015.

19. See, e.g., Catling and Lemos 1990, p. 11; Sipsie-Eschbach 1991; Lemos 2002, pp. 27–84; Papadopoulou 2005, pp. 416–418.

20. Papadopoulos (2003, p. 8)

explicitly uses the term "wheel-thrown" when referring to the PG Athenian ceramic test pieces, and seems to use "wheelmade" synonymously.

21. See Van de Moortel and Zahou 2006, 2011, 2012; Van de Moortel 2007, 2009.

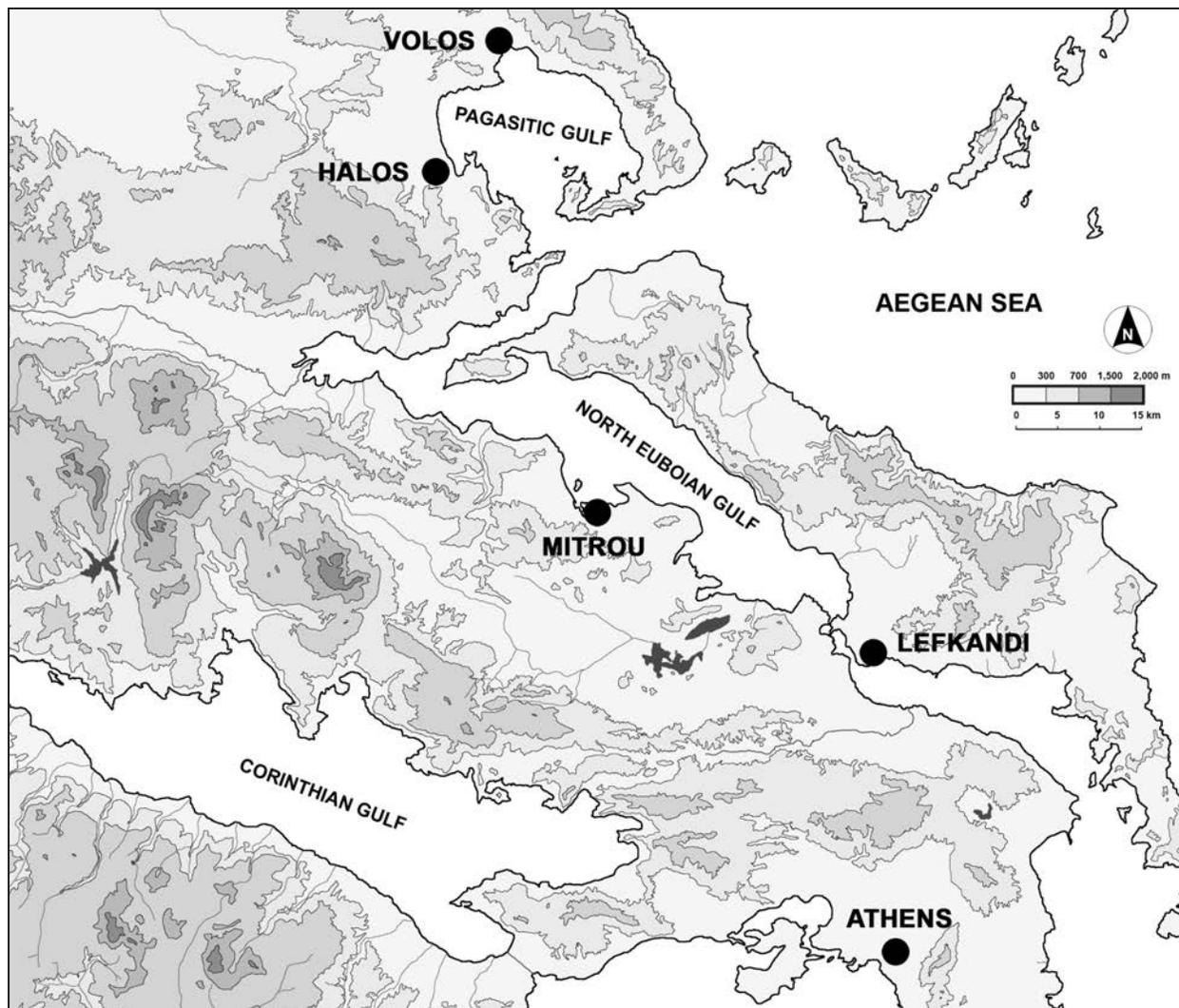


Figure 1. Map of central Greece, showing locations of sites mentioned in the text. B. Lis, Š. Rückl, and L. Jacobs

has stratigraphically documented an unusually long time span of continuous occupation, ranging from EH IIB to the Late Protogeometric (LPG) period. Moreover, Mitrou is a rare example of an EIA site with ceramic material spanning the entire PG period in both settlement and funerary contexts.²² Morphologically and stylistically speaking, however, the pottery does not deviate in any significant way from the central Greek stylistic tradition—the so-called Euboian koine²³—and, therefore, it can be taken as representative for the majority of coastal sites in central Greece. It is no surprise, then, that (in accordance with the general academic consensus) all the decorated fine pottery from Mitrou was initially interpreted, without any hesitation, as having been wheel-thrown.²⁴

The bulk of the material from Mitrou presented below was excavated within the interior of building A, an apsidal structure located in the

22. The PG pottery from the site is currently being prepared for final publication by Štěpán Rückl.

23. Lemos 2002, pp. 212–217.

24. Instrumental to the present research was a short visit by Maria

Choleva to the Mitrou storeroom in the summer of 2010. At that time, Choleva was a Ph.D. candidate in the Department of Prehistoric Archaeology at the University of Paris I, Panthéon-Sorbonne, supervised by Gilles

Touchais. Applying Choleva's criteria for identifying wheel-coiling techniques, Rückl was able to identify some of the PG pottery as wheel-coiled.

northeast excavation sector.²⁵ The building was constructed at the end of the Early Protogeometric (EPG) or the beginning of the Middle Protogeometric (MPG) period;²⁶ in an early stage of the LPG period²⁷ it was destroyed by fire.²⁸ A few examples of wheel-coiled pots from PG cist tombs at Mitrou have been included in this study as well, expanding the range of shapes produced using this technique.

In the second stage of our research, we examined ceramic material from Halos and Lefkandi to determine whether the technique newly identified at Mitrou could be documented within a wider geographical context. A pottery deposit from an MPG kiln (Kiln 1) in Halos (southern Thessaly) comes from the northernmost region traditionally associated with the Euboian koine,²⁹ and it is thus important for assessing the geographical extent of EIA wheel-coiling in central Greece.³⁰ The MPG assemblage from Toumba-Lefkandi on Euboea has been chosen for its significance within EIA ceramic studies.³¹ With its 45 m long and 10 m wide apsidal structure, Toumba is unquestionably the most impressive PG site in Greece.³² The pottery from the building, well published and highly varied in terms of shapes and types of decoration,³³ serves as an index for what is and what is not considered part of the Euboian koine style. In other words, Toumba-Lefkandi is the Euboian koine site par excellence, which, at the same time, represents the southernmost well-preserved MPG assemblage of the koine region. Moreover, whereas both Mitrou and Halos were probably rather small settlements during the PG period, Toumba-Lefkandi gives us the opportunity to analyze an assemblage from one of the largest known PG settlements.³⁴

MACROSCOPIC ANALYSIS

Most of the PG fine decorated pottery is of high quality, displaying great care and skill on the part of the potters. Well-smoothed vessel interiors and smoothed and often polished exteriors are very common, with the result that any traces of possible primary manufacturing techniques other than wheel-forming are quite unlikely to be visible. The use of a thick paint as a coating on largely monochrome pots, often masking (to a certain degree) irregularities of the wall surfaces, makes such recognition even more difficult. The low incidence of surface features related to wheel-coiling, therefore, should not be a surprise.³⁵

In spite of these rather unfavorable conditions, the available evidence from the three sites suggests that wheel-coiling as a manufacturing

25. Van de Moortel and Zahou 2011, p. 292; 2012, pp. 1137–1138.

26. Tsokas et al. 2012, p. 427.

27. This conclusion is based on an extensive study of the ceramic material by Rückl (2012).

28. Jazwa 2012.

29. Lemos 2002, pp. 212–217. For preliminary publications of the kiln, see Nikolaou 2006, 2011.

30. Many thanks are due to Elisavet Nikolaou and the Ephorate of Antiquities of Magnesia for allowing one of the

authors to work on this important body of material, and to Ayla Krijnen for her help with the processing of the assemblage.

31. We are most grateful to Irene Lemos and the British School at Athens, as well as to the Ephorate of Antiquities of Euboea, for allowing us to study and publish the ceramic material from the Toumba building.

32. Popham, Calligas, and Sackett 1993; Mazarakis Ainian 1997, 2006.

33. Catling and Lemos 1990.

34. For EIA Halos, see Malakasioti and Mousioni 2004; Stissi, Kwak, and de Winter 2004. For the character of the PG settlement at Mitrou, see Rückl 2008.

35. In the course of our work, it has already become clear that positive evidence for the wheel-coiling technique is visible on less than 1% of all fine decorated fragments; for the remaining 99% we simply cannot say which technique was used.

TABLE 1. NUMBER OF INDIVIDUAL VESSELS WITH DEFINITE EVIDENCE FOR WHEEL-COILING TECHNIQUE (PER SITE)

	<i>Mitrou</i>	<i>Halos</i>	<i>Lefkandi</i>	<i>Total</i>
Cup	1	–	–	1
Skyphos	2	1	3	6
Krater-bowl	2	1	3	6
Krater	1 (pedestal)	–	5	6
Small closed shape	2	–	–	2
Medium closed shape	–	–	3	3
Large closed shape	6	3	21	30
Unidentifiable closed shape	–	–	1	1
Total	14	5	36	55

TABLE 2. DISTRIBUTION OF REGISTERED FEATURES MENTIONED IN THE TEXT (BY SITE)

<i>Feature</i>	<i>Mitrou</i>	<i>Halos</i>	<i>Lefkandi</i>
Coils	no	yes	yes
Coil seams	yes	yes	yes
Preferential horizontal breakage	yes	yes	yes
Compression undulations	no	yes	yes
Irregular topography	yes	no	yes
Differential wall thickness in horizontal plane	yes	not measured	not measured
Small irregular cracks	yes	yes	yes
Type 1 coil overlaps	yes	yes	yes
Type 2 coil overlaps	yes	yes	yes

technique was used to produce a wide range of shapes of the PG ceramic repertoire (Table 1). Although large closed shapes account for the majority of the examples, wheel-coiled open vessels such as skyphoi, krater-bowls, and kraters are represented as well. Moreover, finds from the PG tombs at Mitrou provide us with clear evidence that wheel-coiling was used even for small closed shapes, such as small jugs or oinochoai, of which there are two examples. In this section, we list the most obvious traces of the technique as observed on the PG material from Mitrou, Halos, and Lefkandi (Table 2). The following list of features indicative of wheel-coiling is based both on our experience with the material and on the previously published work of other scholars.³⁶

COILS

We begin our survey with the most obvious features. In very rare cases, the coils from which a vessel has been built before being finished on the wheel are still visible on the surface because of minimal subsequent modification. This feature is represented by only two examples: a belly-handled amphora

36. Gelbert 1994; Roux 1994; Courty and Roux 1995; Roux and Courty 1998; Boileau 2005; Jeffra 2011; Choleva 2012.

Figure 2. Coils visible on the interior of a belly-handled amphora from Toumba-Lefkandi (Lefkandi 451); arrows indicate seams between individual coils. Not to scale. Catling and Lemos 1990, pls. 6:a, b, 61; photo Š. Rückl. Courtesy British School at Athens

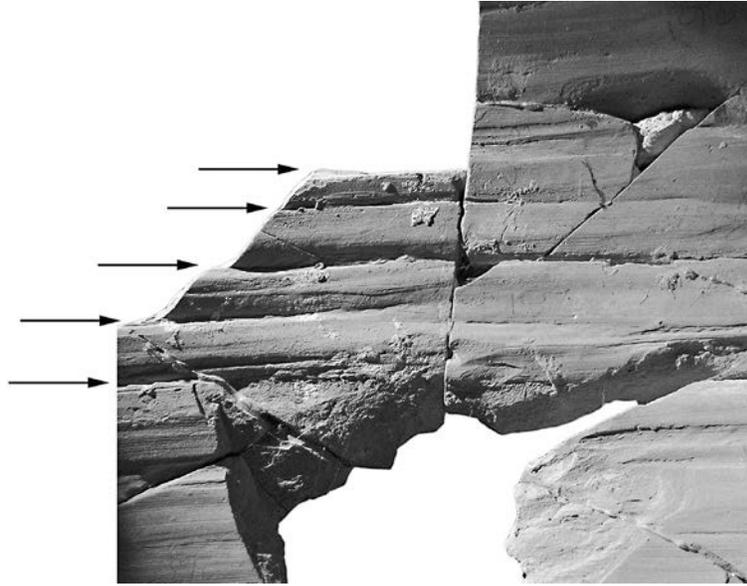
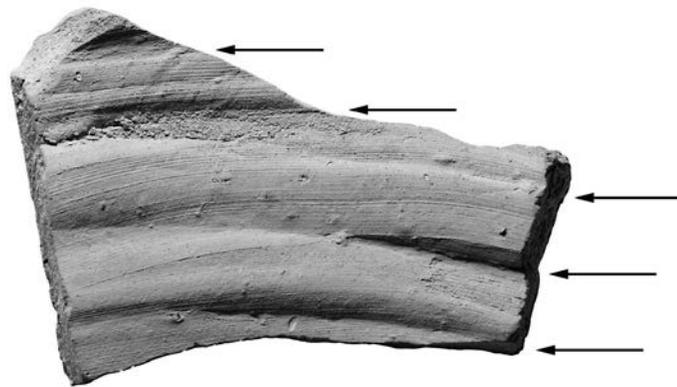


Figure 3. Coils visible on the interior of a large closed shape from Halos (HK1-B-002); arrows indicate seams between individual coils. Scale 1:1. Photo M. Kalíšek



from Toumba-Lefkandi (Fig. 2) and a fragment of a large closed shape from Halos (Fig. 3). In both cases, the coils have been only slightly flattened, largely retaining their original shape. Moreover, due to their incomplete joining and negligible degree of modification, the coils' stacking is clearly recognizable. On the other hand, fine horizontal parallel striations indicate the use of a wheel as a secondary forming technique. It should be pointed out that the coils are noticeable only on the interior surfaces. The external walls are very well finished, and this has obliterated the original traces of primary coiling.

The belly-handled amphora from the Toumba building can serve as a “sourcebook” of wheel-coiling traces. Due to the differential degree of finishing of the interior, the walls display an astonishing variety of surface features ranging from coils and coil seams to smooth surfaces with parallel horizontal rilling, which could be incorrectly interpreted as a sign that the vessel was only wheel-thrown. This amphora is an exemplary piece not only of a wheel-coiled vessel, but also of how deceptive surface features can be on well-finished wheel-coiled pottery, especially when we are dealing only with fragments of vessels.

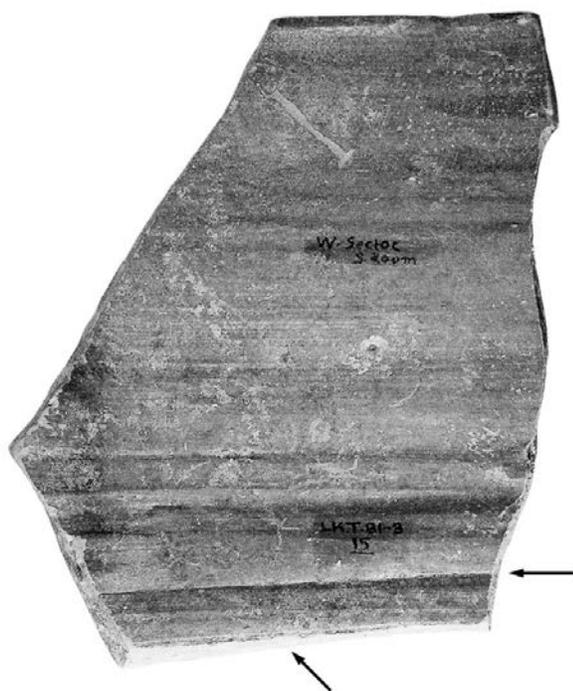


Figure 4 (*above, left*). Coil seams visible on interior of Catling's Group I neck-handled amphora from Halos (HK1-F-014). Scale 2:3. Photo M. Kalíšek

Figure 5 (*above, right*). Incompletely obliterated coil seam on neck interior of hydria from Toumba-Lefkandi (Lefkandi 476). Scale 1:1. Catling and Lemos 1990, pl. 29; photo Š. Rückl. Courtesy British School at Athens

Figure 6 (*left*). Coil seam (horizontal arrow) and preferential horizontal breakage along coil seam (oblique arrow) on interior of krater from Toumba-Lefkandi (Lefkandi 342). Scale 1:2. Catling and Lemos 1990, pls. 19, 57; photo Š. Rückl. Courtesy British School at Athens

COIL SEAMS

Due to incompletely joined coils and a lack of sufficient surface smoothing, coil seams/joins can be observed on wall surfaces, appearing as narrow horizontal grooves between the coils (Figs. 4–6).³⁷ In cases where a join is more significantly smoothed, the seam can be recognized by an acute angle between the two convex areas.³⁸ Often, the coil seams are not parallel to the wheel-rilling, though this is not always the case. Occasionally, a downward “spill” or overlap of one coil over another can be observed. Considering the narrowness of the grooves and their situation between coils, it is highly unlikely that such features could have been created during the wheel-forming process either by an inclusion that was dragged along the surface or by the potter's fingers.

37. Courty and Roux 1995, pp. 27–28; Jeffra 2011, p. 117. For Group I amphoras, see Catling 1998.

38. Jeffra 2011, p. 117.

PREFERENTIAL HORIZONTAL BREAKAGE (ALONG THE COIL JOINS)

The coil joins represent potentially weak parts on wheel-coiled vessels. In cases where the coils were not joined well enough, this may result in horizontal breaks along the lines of their contact (Figs. 6–8). Although it has been noted that breakage patterns are influenced by a number of factors,³⁹ horizontal breaks, especially when positioned between two horizontal ridges (probable coils), seem to be a good indication of the wheel-coiling technique (this has also been confirmed by the replication experiment; see p. 309, below).

Figure 7. Preferential horizontal breakage on monochrome skyphos from Toumba-Lefkandi (Lefkandi 117); left arrow indicates remainder of broken-off coil. Scale 4:3. Catling and Lemos 1990, pl. 47; photo Š. Rückl. Courtesy British School at Athens

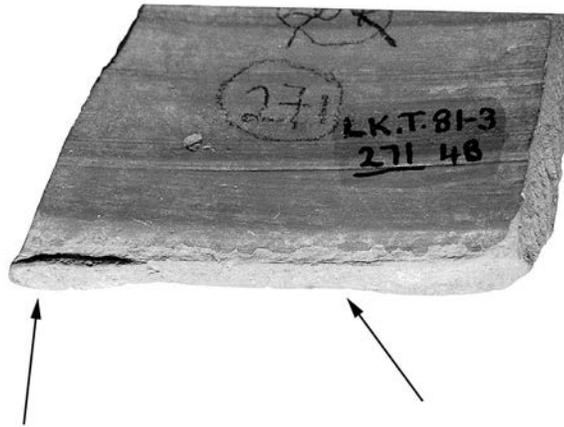
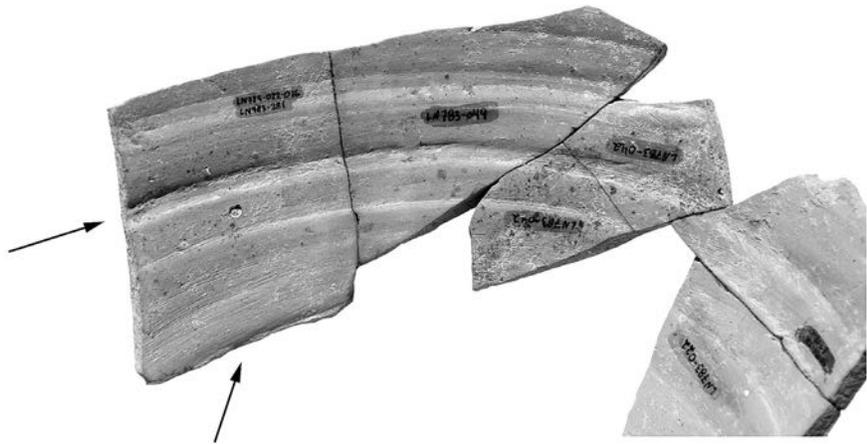


Figure 8. Coil seam and preferential horizontal breakage on interior of large closed shape from Mitrou (LN783-022-016). Scale 1:2. Photo Š. Rückl



COMPRESSION UNDULATIONS

On the interior walls of necks of closed shapes, irregularities in the form of restricted but prominent swellings have been noticed (Figs. 9, 10). These features, the majority of which are obliquely oriented, are probably the result of stiff coils (less plastic due to low water content) being only slightly changed and displaced during compression or collaring with the help of RKE.⁴⁰ During this process, palm pressure is exerted on both sides of the

39. Van der Leeuw 1976, p. 245; Courty and Roux 1995, p. 18; Jeffra 2011, p. 124.

40. Courty and Roux 1995, p. 30.



external wall. This operation pushes the coils both inward and upward, creating the impression of twisting, which makes the coils and coil joins visible again.⁴¹

IRREGULAR TOPOGRAPHY OF SURFACES

As with the previous feature, irregular topography of interior surfaces is mainly due to the stiffness of imperfectly joined coils and the resulting incomplete obliteration of the coils when modified with RKE. These traces are especially visible on the interiors of the bases of large closed shapes (Fig. 11:a, b). Although it is possible to form a vessel base with a flat disk and build the coils on top of this, at least some of the bases from Lefkandi (seven examples) were apparently coiled from the start. The incomplete modification of the coils resulted in irregular surface topography and striations that were not parallel to the grooves and ridges.



Figure 9 (*above, left*). Compression undulation on neck interior of a large closed shape from Toumba-Lefkandi (Lefkandi 504). Scale 3:4. Catling and Lemos 1990, pl. 30; photo Š. Rückl. Courtesy British School at Athens

Figure 10 (*above, right*). Compression undulation on neck interior of a large closed shape from Halos (HK1-D-004). Scale 3:4. Photo M. Kalíšek

Figure 11 (*below*). Irregular topography on the bottom interior of large closed shapes from Toumba-Lefkandi: (a) Lefkandi 595; (b) Lefkandi 599. Scale 1:2. Catling and Lemos 1990, pl. 69; photos Š. Rückl. Courtesy British School at Athens



a



b

41. Courty and Roux 1995, p. 30; Roux and Courty 1998, p. 750; Jeffra 2011, p. 116. Compression undulations should not be confused with fine

torsional ripples or “stress lines.” The latter are the result of the same collar-ing operation and are common on both wheel-coiled and wheel-thrown

pottery; see Courty and Roux 1995, p. 30; for a good illustration, see Schreiber 1999, p. 176, fig. 20:15.

DIFFERENTIAL WALL THICKNESS IN HORIZONTAL PLANE

Due to the unequal thickness of coils, and thickening where coils join or terminate, wall thickness can vary significantly on wheel-coiled vessels. Despite the use of the wheel as a secondary step in the forming process, the RKE is usually not sufficient to distribute the clay mass evenly along the full height and circumference of the walls. It has been pointed out, however, that even purely wheel-thrown pottery can exhibit differential wall thickness in the horizontal plane due to improperly centered clay, moisture discontinuities, air bubbles, and tempering material.⁴² In this respect, varying wall thickness alone cannot be taken as a decisive sign of wheel-coiling until this phenomenon is documented in considerably greater detail with one or more experimental replication data sets (see p. 311, below).

SMALL IRREGULAR CRACKS

Small cracks of irregular shape are a relatively common feature in wheel-coiled pots, most frequently encountered on interior walls (Fig. 12:a, b). Judging by their smooth edges, the cracks must have appeared prior to firing; they are most likely the result of the clay having low plasticity or being too dry or “short,” as potters usually put it. Although such cracks were first interpreted tentatively as a feature related to wheel-coiling, it became clear that only an experimental replication project could confirm such a hypothesis.

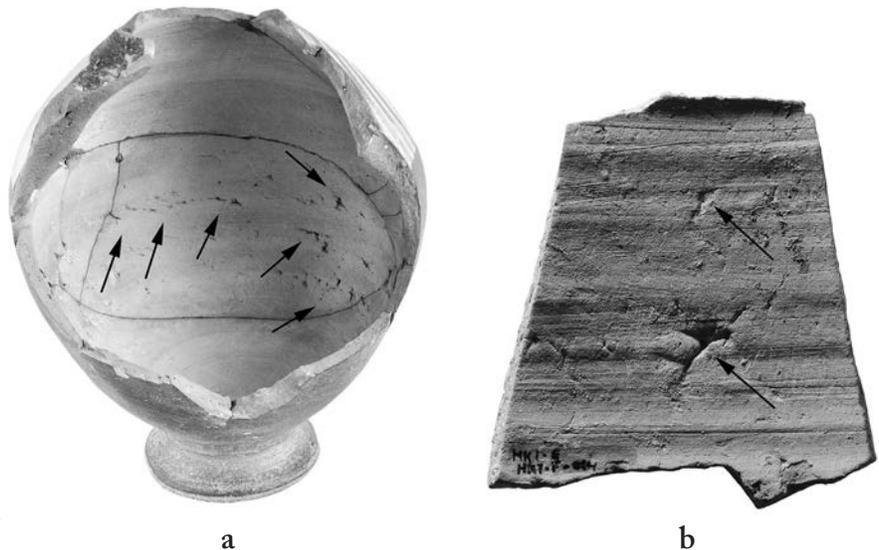


Figure 12. Small irregular cracks on interior surfaces of small closed shapes: (a) Mitrou LM783-011-011; (b) Catling's Group I amphora, Halos HK1-F-014. Scale (a) 1:2; (b) 2:3. Photos A. Cirulis and M. Kalíšek

COIL JOINS VISIBLE IN SECTION

As soon as it was recognized that PG pottery at Mitrou could be wheel-coiled, special attention was paid to breaks as potentially significant areas for recognizing the wheel-coiling technique. It was supposed that when coils had not been joined properly, their interfaces would be visible in the cross-sections of vertical fractures. Considering the well-finished surfaces of the PG vessels and the resulting low incidence of surface features indicative of the technique, this idea seemed especially promising.

42. Jeffra 2011, p. 125.



Figure 13. Type 1 coil overlaps: (a) on break of an amphoriskos from Mitrou (LN783-132-012); (b) on a large closed shape from Mitrou (LN783-474-011). Scale 4:3. Photos A. Cirulis

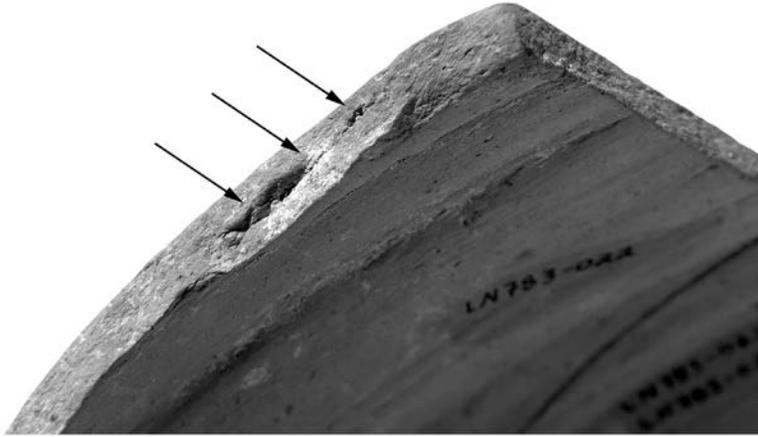


Figure 14. Type 2 coil overlaps on break of a large closed shape from Mitrou (LN783-022-016), showing large voids. Not to scale. Photo Š. Rückl

Two types of what were initially called “coil overlaps” have been identified. Type 1 refers to a break that displays a large overlap, defined by a long narrow void, running obliquely from the external surface toward the interior (Fig. 13:a). Frequently, the void is entirely missing, yet the “stepped” structure of the break provides a visual impression of two largely overlapping elements (Fig. 13:b). The second type (Type 2) is characterized by large voids, usually in the middle of the wall section and running parallel to the surfaces of the wall. These voids are visible both in vertical and horizontal breaks (Fig. 14). Type 2 breaks feature uneven but smooth surfaces on both internal sides of the void, where coils seem to have been pressed against each other prior to firing, but were not joined properly. Since these features had never been mentioned in the relevant literature, it was decided to test this assumption in an experimental project.

THE EXPERIMENT

METHODOLOGY

The experimental project was conducted in the Laboratory of Ceramic Studies in Leiden, under the supervision of Loe Jacobs. The experiment was aimed at elucidating those features that were so far considered ambiguous for the identification of the wheel-coiling technique, namely the differential thickness of walls in the horizontal plane, small irregular cracks, and the possible coil joins visible in the sections of breaks. In addition, because PG pottery is often extremely well finished, we tried to create smooth surfaces

on a number of pots and to obliterate any possible traces of coiling. This part of the experiment was meant to show the ambiguous nature of features usually considered to be indicative of wheel-throwing. For that purpose, a potter's wooden rib was used to even the outer and/or inner walls.

In total, 20 wheel-coiled pots were made by the authors, one of whom is an experienced potter, the other a beginner. Roux and Courty have differentiated four wheel-coiling methods according to the stage in which the wheel enters the manufacturing process.⁴³ In Method 1, the coils are built, joined, and thinned by hand and the resulting roughout is shaped on the wheel. In Method 2, coils are built and joined without the help of RKE, but the thinning and shaping is done on the wheel. Method 3 refers to hand-built coils joined, thinned, and shaped with the help of RKE, while in Method 4 the coils are joined, raised, thinned, and shaped on the wheel. Method 4 basically represents fashioning each coil with RKE one at a time.⁴⁴

The majority of our experimental vessels (17) were built using Method 2. The choice of method was guided by our assumption that coil overlaps are more likely to occur when using Method 2, due to the downward/upward joining of the coils before wheel-finishing. In this way, the overlaps were thought to be created prior to the use of RKE to transform the roughout and to be further emphasized by the process of wheel-finishing. Method 3 was used to make three vessels (i.e., the coils were formed by hand and joined, thinned, and shaped with the use of RKE). The wheel-coiled set of vessels was supplemented with four wheel-thrown pots meant to serve as a comparative control group.

Since we were not trying to replicate the whole *chaîne opératoire* of PG pottery production, we used only commercial clays available in the laboratory, and we did not consider the type of clay used to have had a significant effect on shaping techniques. Similarly, we did not aspire to imitate the PG shape repertoire closely: apart from the first two attempts that consisted of the simplest shape (cylinder), small jugs, larger cups, and bowls were produced. The roughouts were built from seven to nine coils, each approximately 1 cm in diameter, and the height varied from 10 to 12 cm. At the last stage of the experiment, we decided to make five vessels with different colored coils (white and red) and to alternate them while building the roughout. Because of the two colors of clay used in alternation, it was hoped that the coils would be visible on breaks even if well joined, so that coil modification due to the use of RKE could be studied closely. After firing, all vessels were intentionally broken and the fragments were examined and photographed.

RESULTS

Although the data set is rather small (especially in terms of the wheel-thrown vessels), the experiment was successful in confirming a clear association of distinct features with the wheel-coiling technique. While coil seams (Fig. 15), preferential horizontal breakage (Figs. 16, 17), compression undulations (Fig. 18), and small irregular cracks (Fig. 19:a, b) are well represented on wheel-coiled vessels, they are completely absent on the wheel-thrown pottery. Interestingly enough, the compression undulations appeared on all wheel-coiled vessels, except for those made using Method 3.

43. Roux and Courty 1998.

44. Roux and Courty 1998, p. 748.

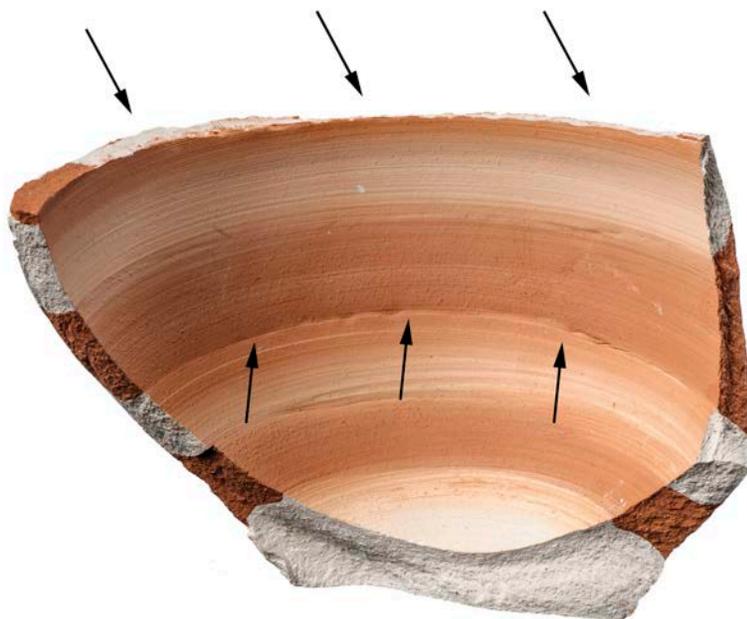


Figure 15 (*above, left*). Coil seam on interior of experimental pot 21 (Method 3). Scale 3:4. Photo A. Dekker

Figure 16 (*above, right*). Preferential horizontal breakage and undulated coil seam on interior of experimental pot 1 (Method 2). Scale 3:4. Photo A. Dekker

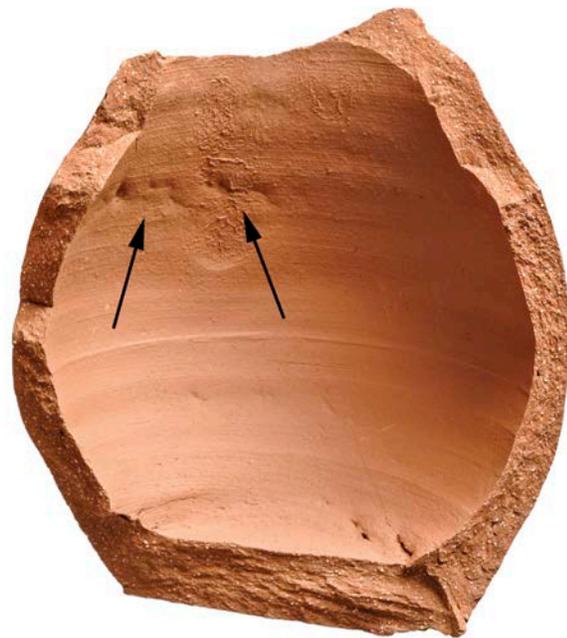
Figure 17. Preferential horizontal breakage and coil seam on interior of experimental pot 21 (Method 3). Scale 3:4. Photo A. Dekker

This suggests that the feature may be related to the way the coils were joined before the use of RKE. It is therefore possible that the necks of the PG large closed shapes displaying such traces were made with Method 2, while the rest of the body of such vessels was manufactured using Method 3. Small irregular cracks were present mostly on the exterior walls of our experimental pots, although a few occurred on the interiors as well. During the manufacturing process, we noticed that such cracks resulted from the coils being too dry, so that when they were bent to make the stacked rings, the coils tore on the outer surface, where they had been stretched the most. The cracks on the inner walls appeared to be caused by the stress applied on the coils through the use of RKE. Because this type of crack on the PG pottery, in contrast to the experimental material, is mostly visible on the *interior* walls, such features cannot be considered as a certain indication of wheel-coiling.

Figure 18. Compression undulation on interior of experimental pot 19 (Method 2). Scale 3:4. Photo A. Dekker



a



b

Figure 19. Small irregular cracks on (a) exterior of experimental pot 1; (b) interior of pot 3 (both Method 2). Scale 3:4. Photos A. Dekker

Differential thickness of walls in the same horizontal plane, on the other hand, turned out to be highly indicative of wheel-coiling. Wall thickness was measured at three parts of all pots: rim, mid-body, and close to the base. The experimental pottery shows that wall-thickness differences in the same horizontal plane tend to be quite substantial on wheel-coiled vessels, while absent or minimal on the wheel-thrown pottery (Table 3). It is true that gathering such data is time-consuming, which is a significant issue in ceramic analysis. Moreover, a wheel-thrown reference collection would be needed for all size categories registered in the ancient material for the results to be reliable. Nevertheless, since this feature is especially indicative of the wheel-coiling technique (or rather of non-wheel-thrown vessels), we have good reason to collect such data during the processing of pottery in the field.

TABLE 3. EXPERIMENTAL POTTERY: DIFFERENTIAL THICKNESS OF WALLS IN THE SAME HORIZONTAL PLANE (IN MILLIMETERS)

	<i>Wheel-Coiled</i>	<i>Wheel-Thrown</i>
Rim (average)	1.3	0.5
Mid-body (average)	0.8	0.2
Close to base (average)	1.3	0.4
Maximum difference	3.4	0.9
Minimum difference	0.0	0.1
Mode	0.8	0.4
Average	1.2	0.4

The coil joins or coil overlaps on breaks seem to be extremely problematic, and their relationship to the forming technique remains somewhat ambiguous. Type 1 overlaps (with long narrow voids running obliquely from the external surface toward the interior) are present on both wheel-coiled and wheel-thrown pottery and therefore cannot be used to discriminate between the two techniques (Fig. 20). This specific type of break probably has more to do with differential water saturation in the clay body than with a particular building method. Based on the sections of the two-colored vessels, we saw that the use of RKE can create substantial overlaps of two superimposed coils, but exclusively in the compression zones (Fig. 21).⁴⁵ Large coil overlaps have also recently been identified on pithoi from Geometric Zagora on Andros.⁴⁶ In this case, however, the overlaps are entirely the result of a handmade technique without any use of RKE. This feature clearly needs to be investigated further.

Type 2 overlaps (with large voids and smoothed, but uneven, surfaces) seems to be a different matter. Although present on one wheel-thrown vessel, in this case the voids are invariably very small, which is in contrast to the wheel-coiled pots that exhibit larger and more elongated voids (1 cm long or more; see Fig. 22). Based on the evidence of the two-colored vessels, these voids seem to be contained within a single coil in all instances and, therefore, the hypothesis that this feature results from coil overlaps appears to be refuted. The voids are probably related to imperfect kneading or wedging, which seems to be more common in the case of wheel-coiled pottery, and may have to do with the differential use of water (or variable drying time) before the kneaded lump of clay or coiled roughout are turned on the wheel.⁴⁷

Interestingly enough, the incidence and degree of visibility of a number of traces such as coil seams, preferential horizontal breakage, and small irregular cracks diminished as we proceeded with the experiment. Since we both had to learn the wheel-coiling technique, this pattern is the result of our becoming more proficient over time. The presence of these features on ancient pottery may, therefore, be understood as a function of insufficient skill, a deliberate lack of precision on the part of potters, or even a result of hastiness. On the other hand, we were able to produce some wheel-coiled

45. Although this is exactly where most of the Type 1 overlaps appear on the PG pottery, the results are not entirely satisfactory.

46. McLoughlin 2011, p. 871.

47. This suggestion seems to be supported by the results of X-radiography experimental study focusing on, among other properties, differential density and porosity distribution in wheel-coiled and wheel-thrown pottery as indicators of the manufacturing processes of archaeological ceramics; see Pierret, Moran, and Bresson 1996, pp. 424–427.



Figure 20. Type 1 coil overlaps on break of experimental pot 4 (wheel-thrown). Scale 3:4. Photo A. Dekker

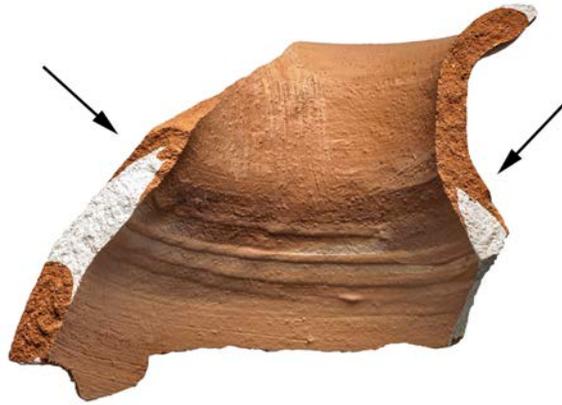


Figure 21. Coil overlaps on breaks in compression zone of experimental pot 20 (Method 2), visible due to use of two differently colored clays for alternating coils. Scale 3:4. Photo A. Dekker

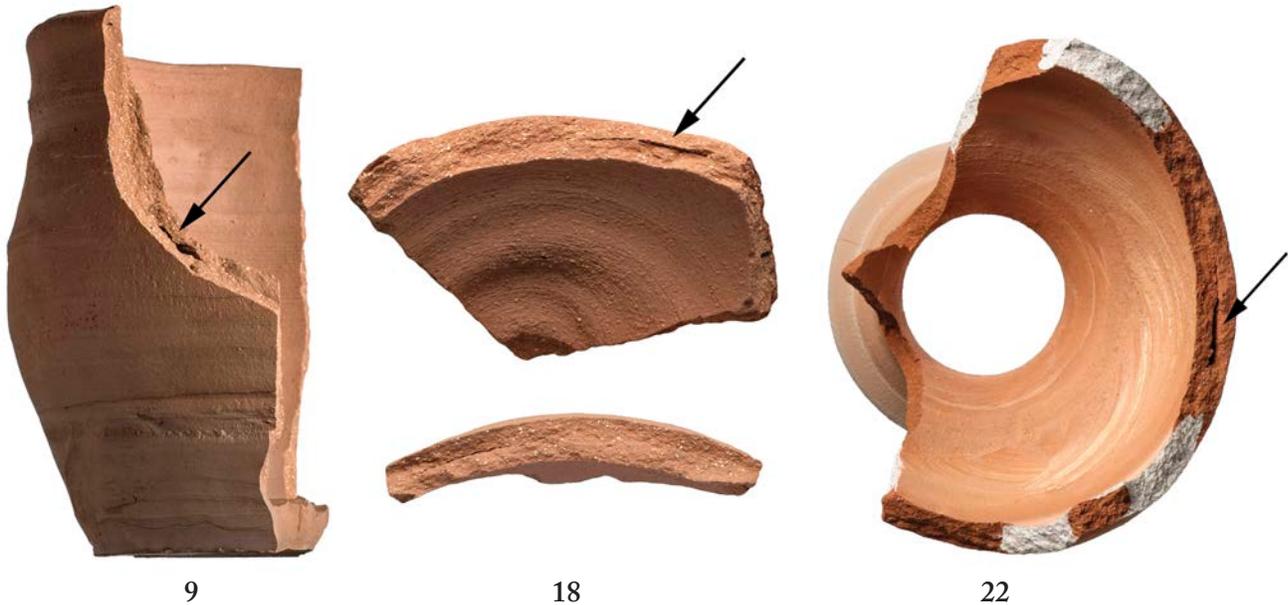


Figure 22. Type 2 coil overlaps showing large voids on breaks of experimental pots 9, 18, and 22 (all Method 2). Scale 2:3. Photos A. Dekker

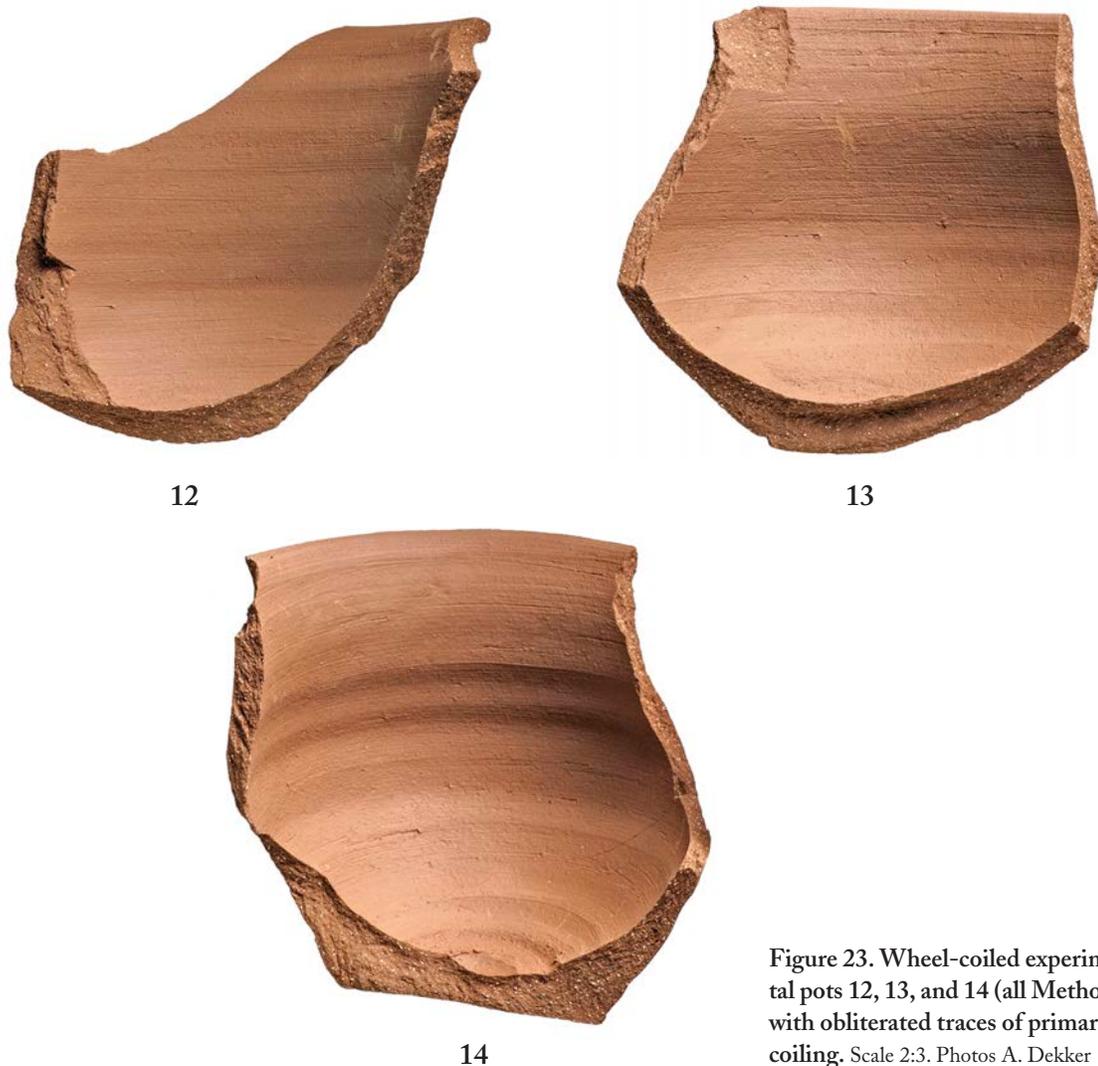


Figure 23. Wheel-coiled experimental pots 12, 13, and 14 (all Method 2), with obliterated traces of primary coiling. Scale 2:3. Photos A. Dekker

pots that exhibited almost no traces of the primary forming technique (Fig. 23). This effect was achieved by using a wooden rib to smooth the outer and/or inner walls, which resulted in highly regular surfaces with parallel striations as the only noticeable surface feature.

DISCUSSION AND INTERPRETATION OF RESULTS

The experiment has confirmed that the surface features observed on the PG pottery from Mitrou, Halos, and Lefkandi are indeed the result of the wheel-coiling technique. We have successfully replicated features such as coil seams, preferential breakage patterns, and compression undulations that resemble the features on ancient pottery very closely and are, at the same time, absent from the wheel-thrown vessels. It is also clear from our work that significant variation in wall thickness within the same horizontal plane is a good indicator of wheel-coiling (or at least of a handmade primary forming technique), although the use of this variable to identify wheel-coiled pots on a large scale is somewhat limited due to the lengthy

recording process entailed and the need for wheel-thrown reference materials for various size categories. For the most problematic features (small irregular cracks and the two types of coil overlaps), the experimental data are not conclusive and more research is needed.

The evidence suggests that the majority of PG wheel-coiled vessels were manufactured using Method 3, according to the classification of Roux and Courty.⁴⁸ The most evident feature that identifies this method on the PG material is a straight coil seam, which is only rarely parallel to the rilling. This conclusion is supported both by the scholarly literature⁴⁹ and by our experimental material (see Fig. 15 [Method 3] as opposed to Fig. 16 [Method 2]). It must be acknowledged, however, that the use of different methods to produce different parts of the same pot is not ruled out. As we have already seen in the case of large closed shapes, there is a noticeable difference in the surface features visible on the body (reflective of Method 3) and the neck (reflective of Method 2?). Despite the fact that we were able to reproduce compression undulations (often appearing on the necks of large closed shapes) only with Method 2, a clear association of the feature with this method is hampered by the small sample size of experimental Method 3 vessels.

Method 4 has only tentatively been identified on two ceramic containers from Mitrou (a skyphos and a belly-handled amphora or hydria). We suspect the use of this method based on our observation of widely spaced grooves (coil seams?) with a panelled effect, which may have been created by working each coil separately.⁵⁰ Since we did not include this method in our experimental study, this identification remains tentative. No evidence of Method 1 has been found on material from any of the three sites included in our study. Research on a larger and more comprehensive scale is planned for the future, since detailed study of the distribution of different methods and of the combination of methods for individual pots represents, in our opinion, a fruitful avenue of research worthy of additional study (see pp. 316–317, below).

The bulk of the PG vessels identified as wheel-coiled consists of medium to large closed shapes. Skyphoi and kraters may also bear traces of primary coiling, but the frequency of such instances is significantly lower (see Table 1). This is perhaps not so surprising when we consider the general morphology of the shapes. Skyphoi, cups, and kraters are open vessels, providing easy access to their interior surfaces. Therefore, there is a differential possibility for potters to obliterate the traces of coiling according to the general shape (closed vs. open vessels). Moreover, the interiors of closed shapes were not visible to potential consumers, and this may have played a role in decisions about whether to create smooth and “nice” interior surfaces or to leave them rough and “ugly.”

Most of the PG cups, skyphoi, and kraters found at Mitrou, Halos, and Lefkandi (and basically anywhere in Greece) exhibit regular surfaces with parallel striations and rilling that do not permit us to determine the particular manufacturing technique (wheel-throwing vs. wheel-coiling) used in their production. As stated above, we have been able to produce wheel-coiled pots with virtually no signs of primary coiling, which, therefore, could be mistaken for wheel-thrown vessels. The implications

48. Roux and Courty 1998, p. 748.

49. Roux and Courty 1998, p. 751, table 3; Jeffra 2013, p. 7, table 2.

50. Jeffra 2013, p. 7, table 2.

of this exercise, at least in the context of EIA pottery studies, which have historically assumed that wheel-throwing was virtually the only technique for fine-ware production, are quite unexpected: the question that emerges is not whether there was any PG *wheel-coiled* pottery in Greece, but rather how we can identify PG *wheel-thrown* pots with any certainty in the first place.⁵¹

GENERAL DISCUSSION AND CONCLUSIONS

However interesting our findings may be, one may justifiably question the importance of such a discovery for Greek EIA ceramic studies. For example, the basic distinction between wheelmade⁵² and wheel-coiled pottery is still valid and, in this sense, the results of our analysis do not change the general way in which pottery is classified. Yet we would like to suggest that the provable existence of the wheel-coiling technique in PG Greece has significant consequences for our understanding of PG ceramic production and great potential for expanding our knowledge of EIA Greek society in general.

Although our analysis was limited to three sites, the evidence does suggest that the wheel-coiling technique was not locally restricted but, on the contrary, fairly widespread. The three settlements discussed cover a large part of central Greece and, together, they can be taken as representative for this part of the mainland (together with the island of Euboeia), at least for coastal sites. Moreover, the technique was not limited to a small number of shapes but seems to have been used for almost all ceramic categories, ranging from small to large, and including both open and closed shapes. As such, wheel-coiling must be considered quite a common practice among the PG communities of central Greek potters.

Interestingly, there are several different methods of wheel-coiling distinguishable in the PG material (Methods 2, 3, and 4). This variety of techniques, and their likely (though not certain) coexistence with wheel-throwing,⁵³ has wide-ranging significance. Due to the social and cultural embeddedness of technology,⁵⁴ similarities or differences of ceramic technological styles should be studied in the context of pottery production, with special attention paid to the process of crafts learning. This process usually takes the form of lengthy training, during which technological knowledge is transferred from the master to the apprentice.⁵⁵ The novice

51. Roux and Courty have convincingly shown the potential of petrography to distinguish between the two techniques (Courty and Roux 1995, pp. 30–42; Roux and Courty 1998, pp. 753–755). For various reasons (cost, permit issues, time), however, it may not always be feasible to thin-section pottery under study on a large scale.

52. The term “wheelmade” is here used in its general meaning—referring to pottery that has been manufactured

with the help of RKE, irrespective of the actual way the wheel has been used. Therefore, the wheelmade category encompasses both wheel-thrown and wheel-coiled vessels.

53. For a modern ethnographic example of the two techniques being practiced side by side in the context of a single region, see Gelbert 1994, 1997.

54. See, e.g., Lemonnier 1993, pp. 1–35; Dietler and Herbich 1998;

Gosselain 1998, 2000.

55. See Roux and Corbetta 1989, pp. 10–40; Gosselain 2010, pp. 207–210. Beside the actual manufacturing technique, the learning process usually includes all the other activities necessary for pottery production (such as clay extraction, clay processing, fuel collection, post-firing treatment, etc.; see Gosselain 2008, p. 160; 2010, p. 208.

develops a master's motor habits related to the operational sequence of ceramic production (*chaîne opératoire*), which are seldom prone to change.⁵⁶ The material expressions of these motor habits, together with the similarly transmitted knowledge of what a pot should look like, constitute what we may call "pottery tradition." The mode of technological transfer based on a face-to-face interaction of individuals virtually guarantees the reproduction of the tradition. Logically, pottery traditions are the materialization of distinct learning networks and communities of practice and, therefore, of the identities of the producers. The spread of pottery traditions over smaller or wider geographical areas should be viewed as a result of this learning process and the degree of potters' mobility.

While up until now we have usually spoken about the "influences" of one region on another based on the similarities of their decorative styles, comparing the operational sequences of ceramic manufacturing techniques from several production centers will allow us to illustrate such influences in a very practical way and in unprecedented detail. Unlike decorative styles, manufacturing techniques cannot be easily imitated, since they are often "hidden" and inaccessible to the viewer.⁵⁷ Due to the necessary and lengthy personal involvement in the learning process that is built into the master-apprentice relationship, we can translate the vague concept of "influence" into the movement of potters and their apprentices (i.e., the producers) rather than of the finished objects (i.e., the products).

Therefore, by focusing not only on decoration or morphology but also on manufacturing techniques and the particular "way of doing things," we should be able to identify patterns of learning networks that would allow us to talk about the spread of ceramic styles in a more nuanced way. In this respect, one of the most promising topics of research is the appearance of locally made pottery in the Euboian koine style in central Macedonia. Since the pottery of the local production tradition(s) in this region was predominantly handmade during the LBA and the early stages of the EIA, the analysis of these locally produced, wheelmade (wheel-coiled and/or wheel-thrown) vessels of Euboian style may prove that there was a technological transfer that would presuppose a movement of people, namely the potters, from south to north.⁵⁸ On a smaller scale, we may even be able to talk about traditions *within* central Greece. Equally promising would be to include in future analyses the pottery from Athens, in order to test whether the traditional distinction of Attic and Euboian koine production relates solely to decorative details and morphological features, or if this division holds even at the level of vessel-forming technology.

56. Manufacturing techniques, as ethnographic data show, are often charged with social meaning. Under certain circumstances, however, potters can strive to learn new techniques, for example, to get rid of derogatory technical stigmas and to acquire "a powerful media for shaping/broadcasting a new identity through daily practice"

(Gosselain 2010, p. 200).

57. See Gosselain 1998, 2000; Lis, Rückl, and Choleva 2015.

58. The opposite scenario, that of the apprentices coming to the southern regions to learn the craft and then moving back, is equally possible. The presence of immigrant potters who settled at the Macedonian coastal sites during

the EIA and the Archaic period has been argued for by Tiverios (2012), even though on more generally understood technological (and aesthetic) grounds. Well-argued cases of potters' mobility can be found in Papadopoulos 1997; 2003, pp. 222–224. For a selection of prehistoric examples, see Lis, Rückl, and Choleva 2015.

The possible coexistence of wheel-coiling and wheel-throwing poses one important question: Why would anybody choose the former over the latter, knowing that wheel-coiling is significantly more time-consuming?⁵⁹ Although the choice of a particular technique is usually not a matter of practicality but often dependent on social and cultural context, such as kin relations and personal or group identities and a sense of belonging, it is worth noting that wheel-coiling has one great advantage over wheel-throwing. Despite the fact that both techniques can produce visually identical products, wheel-coiling is much easier to learn, so that the apprenticeship period can be substantially shorter. Even though both techniques use the wheel in the manufacturing process, wheel-coiling skips two operations that are very difficult to learn in throwing—centering and opening or hollowing the clay.⁶⁰ On the other hand, the slower manufacturing speed of wheel-coiling would have significant consequences for a potter's everyday life as well, as it would probably affect the overall scale of production.

A wider chronological perspective has the potential to shed light on the development of ceramic technology and the particular choices of potters. Unfortunately, in comparison to the later part of the EH period on the mainland and the Middle Minoan period on Crete, we lack any significant body of data regarding the use of the wheel-coiling technique in the later LBA in mainland Greece. Therefore, how and if the wheel-coiling technique developed from the previous period is difficult to say.⁶¹ This is not due to the absence of evidence but rather to the simple lack of scholarly attention paid to this particular topic. Similarly, the period following the PG era is equally unexplored regarding the technological norms of pottery manufacture. It may be significant, however, that during the study of the Middle–Late Geometric (largely Atticizing) pottery from Tumulus 36 in Voulokalyva/Halos (southern Thessaly), one of the authors was able to identify only one example of a wheel-coiled fine-ware vessel. It is perhaps of some importance that the vessel in question (a large pyxis) was decorated with two pendent semicircles and therefore can be considered as belonging to the central Greek or Euboian koine Subprotogeometric style. Whether or not this is because most potters at that time acquired the skill of wheel-throwing, while only a few stuck to the old tradition, remains to be investigated.

Based on the research presented above, the long-lived notion of wheel-throwing as the only manufacturing technique within the context of PG fine-ware production must be reconsidered. It is perhaps ironic that at least part of a ceramic category that once played an important role in the discussion of slow and fast wheel-throwing⁶² was not thrown on a wheel at all.⁶³ We have shown that an extensive range of the ceramic repertoire could have been wheel-coiled, despite the occurrence of a number of surface features usually considered representative of throwing. Moreover, the emerging picture seems to be very complex, since more than one method of wheel-coiling has been recognized in the material from Mitrou, Halos, and Lefkandi. This fact should not be viewed as an obstacle but rather as a vantage point that opens up new directions for future analysis.

Surprisingly enough, the most acute problem is not how to recognize wheel-coiled pottery, but rather the lack of features that unambiguously

59. Based on our experimental data, the manufacturing time for Method 2 wheel-coiled vessel was 40 minutes on average, which is in accordance with the data published by Roux and Courty (1998, p. 750, table 2). Method 3 was slightly faster (about 30 minutes), while the manufacturing time for a wheel-thrown pot was only 10 minutes.

60. Roux and Corbetta 1989, pp. 12–14.

61. LBA assemblages are present on all three sites referred to in the text. However, due to lack of time, pottery from this period has not been included in this study. A wider chronological assessment of manufacturing techniques is planned for the future analysis.

62. Desborough 1972, p. 145; Eiteljorg 1980.

63. This is not to undermine the work of past scholarship. Although some of the features presented above may in retrospect seem obvious, the evidence remains “invisible” if we do not pay specific attention to it. At least this has been the experience of the authors.

single out wheel-thrown vessels. More experimental data are obviously needed, followed by a meticulous macroscopic analysis of the two techniques. Just as obviously, in cases when the macroscopic traces are not conclusive, the use of analytical methods such as x-ray imaging⁶⁴ or microscopic thin-section analysis may prove to be useful, even though their respective suitability to distinguish between wheel-coiling and wheel-throwing needs to be verified by extensive testing. With a better understanding of the relationship between the range of surface features and specific manufacturing techniques, we believe we will be able to gain insights into a large array of social and cultural phenomena of the communities of EIA Greece, namely learning networks, potters' identities, and the degree of potters' mobility. In other words, we will be able to see the potters behind their pots.

64. Pierret, Moran, and Bresson 1996; Berg 2008, 2009, 2011a, 2011b.

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