BREAKING WITH TRADITION? THE ADOPTION OF THE WHEEL-THROWING TECHNIQUE AT PROTOPALATIAL PHAISTOS: COMBINING MACROSCOPIC ANALYSIS, EXPERIMENTAL ARCHAEOLOGY AND CONTEXTUAL INFORMATION*

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Riassunto. Negli ultimi anni sono stati condotti numerosi studi sulla tecnologia ceramica a Creta, grazie ai quali gli studiosi sono attualmente d'accordo nel datare l'introduzione del tornio da vasaio al M(edio) M(inoico) IB (circa 1900 a.C.), corrispondente all'emergere dei Primi Palazzi sull'isola. Gli studi più recenti sulle ceramiche del Medio Bronzo provenienti da siti della Creta settentrionale e orientale hanno rivelato che dall'introduzione del tornio nel MM IB, la tecnica conosciuta come *wheel-fashioning*, ossia una combinazione tra lavoro manuale e uso del tornio, fosse l'unica tecnica ceramica in uso a Creta fino al Tardo Bronzo. Al contrario, nella parte meridionale di Creta e in particolare nel sito palaziale di Festòs, recenti studi hanno dimostrato che la *wheel-fashioning technique* non era l'unica tecnica in uso perché, a partire dal MM IIA (circa 1800 a.C.), corrispondente al momento della monumentalizzazione del Palazzo, fu adottata per la prima volta la tecnica del *wheel-throwing*, la quale prevede l'uso esclusivo del tornio dall'inizio del processo di lavorazione del vaso. In questo articolo, per prima cosa presento brevemente le tecniche di lavorazione attestate a Festòs nelle prime fasi del periodo Protopalaziale (*i.e.* MM IB-MM IIA), e in seguito mi concentro sulle classi ceramiche festie del MM IIA che sembrano essere fabbricate con la *wheel-throwing technique*, confrontandole con quelle prodotte con la tecnica del *wheel-fashioning*. Più specificamente, per la classe delle *conical cups* (*i.e.* vasetti acromi senza anse), i più comuni vasi potori dell'Età del Bronzo attestati a Festòs sin dal III millennio a.C., si è proceduto al confronto fra esemplari del MM IIA e riproduzioni sperimentali eseguite da un vasaio professionista. Usando l'analisi macroscopica in combinazione con l'archeologia sperimentale e le necessarie informazioni contestuali, tenterò quindi di spiegare perché la tecnica del *wheel-throwing* è quasi esclusivamente attestata a Festòs e in siti che condividono la sua tradizione ceramica, come Kommòs e Haghia Triada. Poiché nel MM IIA il principale edificio palaziale di Festòs – l'Edificio Sud-occidentale – ha subito un importante ristrutturazione/monumentalizzazione, la mia proposta è che nuovi gruppi siano arrivati a Festòs in questa fase, introducendo una nuova tecnica ceramica in grado di "rompere" la lunga tradizione ceramica del sito e dell'isola. Inoltre, si propone che le *conical cups* del MM IIA di Festòs venissero prodotte in grandi quantità e in forma standardizzata per essere utilizzate nel corso dei *feasts* organizzati in occasione della ristrutturazione dell'edificio principale del Palazzo e della monumentalizzazione dell'intero sito.

Περίληψη. Τα τελευταία χρόνια πραγματοποιήθηκαν πολυάριθμες μελέτες για την τεχνολογία της κεραμικής στην Κρήτη, χάρη στις οποίες οι ερευνητές συμφωνούν τώρα στη χρονολόγηση του κεραμικού τροχού στη Μέση Μινωική ΙΒ (1900 π.Χ. περίπου), που αντιστοιχεί στην ανέγερση των Πρώτων Ανακτόρων στο νησί. Οι πιο πρόσφατες μελέτες για την κεραμική της Μέσης Χαλκής που προέρχεται από χώρους της βόρειας και της ανατολικής Κρήτης αποκάλυψαν ότι η εισαγωγή του τροχού τη ΜΜ ΙΒ περίοδο, η τεχνική που είναι γνωστή ως *wheel-fashioning*, δηλαδή μια σύνθεση ανάμεσα σε χειρωνακτική εργασία και χρήση του τροχού, ήταν η μόνη κεραμική τεχνική σε χρήση στην Κρήτη μέχρι την Ύστερη Χαλκή. Αντίθετα, στο νότιο τμήμα της Κρήτης και ιδιαίτερα στο ανακτορικό χώρο της Φαιστού, πρόσφατες μελέτες απέδειξαν ότι η *wheel-fashioning tecnique* δεν ήταν η μοναδική σε χρήση γιατί, ξεκινώντας από τη ΜΜ ΙΙΑ (1800 π.Χ. περίπου) που αντιστοιχεί στη στιγμή μνημειοποίησης του Ανακτόρου, υιοθετήθηκε για πρώτη φορά η τεχνική του *wheel-throwing*, η οποία κάνει αποκλειστικά χρήση του τροχού από την αρχή της διαδικασίας επεξεργασίας του αγγείου. Σε αυτό το άρθρο, θα παρουσιάσω αρχικά εν συντομία τις τεχνικές επεξεργασίας που πιστοποιούνται στη Φαιστό κατά τις πρώτες φάσεις της Πρωτοανακτορικής περιόδου (ΜΜ ΙΒ-ΜΜ ΙΙΑ), και στη συνέχεια θα επικεντρωθώ στις ΜΜ ΙΙΑ κατηγορίες της κεραμικής της Φαιστού, που φαίνεται να έχουν παραχθεί με τη χρήση της *wheel-throwing tecnique*, συγκρίνοντάς τις με εκείνες που έχουν παραχθεί με την τεχνική *wheel-fashioning*. Συγκεκριμένα, για την κατηγορία των *conical cups* (μικρά άχρωμα και άωτα αγγεία), το πιο σύνηθες κύπελλο πόσης της Εποχής του Χαλκού που πιστοποιείται στη Φαιστό ήδη από την 3η χιλιετία π.Χ., προχωρήσαμε στη σύγκριση ανάμεσα σε δείγματα της ΜΜ ΙΙΑ και πειραματικές αναπαραγωγές ενός επαγγελματία αγγειοπλάστη. Χρησιμοποιώντας τη μακροσκοπική ανάλυση μαζί με την πειραματική αρχαιολογία και τις αναγκαίες πληροφορίες για τα συγκείμενα, θα προσπαθήσω λοιπόν να εξηγήσω γιατί η τεχνική wheel-throwing πιστοποιείται σχεδόν αποκλειστικά στη Φαιστό και σε χώρους που ακολουθούν την κεραμική παράδοσή της, όπως ο Κομμός και η Αγία Τριάδα. Δεδομένου ότι κατά τη ΜΜ ΙΙΑ περίοδο το κύριο ανακτορικό κτήριο της Φαιστού – το Νοτιοδυτικό Κτήριο – υπέστη σημαντική ανακατασκευή/μνημειοποίηση, η πρότασή μου είναι ότι έφτασαν στη Φαιστό καινούριες ομάδες τότε, φέρνοντας μια νέα κεραμική τεχνική ικανή να «σπάσει» τη μακρόχρονη κεραμική παράδοση του συγκεκριμένου

* The earliest version of this paper was first presented at the *Craft and People* Conference held at the British Museum, London in 2012, and was then enriched with new data coming from recent study on Protopalatial pottery from Phaistos and new experimental archaeology conducted in 2018 and 2019. I would like to thank Filippo Carinci for the great opportunity he gave me to study the Protopalatial pottery from Phaistos. I am grateful to Simona Todaro for having discussed with me many aspects of this paper and to Sofia Antonello for helping me with pictures and figures. My paper has greatly improved because of the insightful comments of the two anonymous referees, whom I want to thank. A special thank to Don Evely for editing the paper.

χώρου και του νησιού. Προτείνεται, επίσης, η άποψη ότι τα *conical cups* της ΜΜ ΙΙΑ της Φαιστού παράγονταν σε μεγάλες ποσότητες και σε τυποποιημένη μορφή για να χρησιμοποιηθούν ως αγγεία για τις μερίδες κατά τη διάρκεια των *work-feasts* που οργανώνονταν με την ευκαιρία της ανακατασκευής του κυρίου κτηρίου του Ανακτόρου και της μνημειοποίησης του χώρου στο σύνολό του.

Abstract. In recent years, several studies have been undertaken on ceramic technology and there is now a general agreement among scholar about the introduction of the potter's wheel in Minoan Crete in (M)iddle (M)inoan IB (1900 BC ca.), corresponding to the emergence of the First Palaces on the island. Most recent studies on ceramic technology of MM pottery from sites of northern and eastern Crete have revealed that since the introduction of the potter's wheel in MM IB, the wheel-fashioning technique (a combination of hand-building and wheel) was the only forming technique used in Crete until the Late Bronze Age. On the contrary, in southern Crete and especially at the palatial site of Phaistos, recent studies have shown that the wheel-fashioning technique was not the only technique in use because in MM IIA (18th cent. BC), at the time of monumentalisation of the palatial site, the wheel-throwing technique was first adopted. In this paper, first I briefly present the forming techniques attested at Phaistos in the first phases of the Protopalatial period, then, I focus on the MM IIA Phaistian classes of vases which appear to be manufactured through the wheel-throwing technique, comparing them with contemporary wheel-fashioned vases. More specifically, for the class of plain handleless cups, the most common drinking cup at Bronze Age Phaistos since Prepalatial times, I compare the MM IIA examples with experimental reproductions carried out by a professional potter. Finally, using macroscopic analysis in combination with experimental archaeology and requisite contextual information, I attempt to explain why the wheel-throwing technique is almost exclusively attested at Phaistos and in sites sharing its ceramic tradition, like Kommos and Ayia Triada. Since in the MM IIA phase the main palatial building of Phaistos (*i.e.* the South-western Building) went through an important renovation, I argue that new groups arrived at Phaistos in MM IIA, introducing a new forming technique that was able to break with the long-lasting ceramic tradition of the site – and of the island. Moreover, it will be argued that in MM IIA plain handleless cups were mass-produced on the potter's wheel in order to be used in the context of communal feasts during the renovation of the main palatial building and the monumentalization of the entire site.

1. Introduction

In the last twenty years, several studies have been undertaken on ceramic technology: there now is a general agreement among scholars on the introduction of the potter's wheel in Minoan Crete in Middle Minoan (MM) IB, *i.e.* around 1900 BC [1]. The MM IB phase corresponds to the beginning of the Protopalatial period (19th-18th cent. BC), when occurred the emergence of the First Palaces on the island. The Protopalatial period is usually subdivided into MM IB, MM IIA and MM IIB.

The introduction of the potter's wheel in Crete did not signal a break with the ceramic tradition of the previous Prepalatial period, as most pots went on being produced through the established combination of the hand-building and the wheel. Following V. Roux and M.-A. Courty, in this combination, which they defined as the wheel-fashioning technique [2], the vase is wheel-made only in a second stage of the manufacturing process, when the roughout of the body has already been formed through hand-building, especially from coiling. This implies that rotative kinetic energy (RKE) is not used in the manufacturing process from the very start of each vessel.

Most recent studies on ceramic technology of Protopalatial pottery from sites of northern and eastern Crete (*i.e.* Knossos, Malia, Myrtos Pyrgos and Palaikastro) have argued that after the introduction of the potter's wheel in MM IB, the wheel-fashioning technique was the only forming technique employed on the island during the Protopalatial period and probably also later in the Neopalatial period [3]. A discordant voice is, however, represented by Ina Berg, whose recent work on Protopalatial pottery from Knossos has disclosed that there are some small vases dating from MM IB to MM IIB, which, on being examined by X-radiography, seem produced through the wheel-throwing technique [4]. This would mean that at Protopalatial Knossos both wheel-fashioned and wheel-thrown vases co-existed [5].

In southern Crete, recent studies have also shown that the wheel-fashioning technique was not the only technique in use in the Protopalatial period. More specifically, at Phaistos, closed ceramic deposits dating to MM IIA have provided vases that are manufactured by different forming techniques: most of them are made in a combination of hand-building and the wheel, some classes of vases are produced through the wheel-throwing technique, and a few cups, especially in crude ware, are still entirely handmade [6].

[1] Evely 2000; Knappett 1999; 2004; Speziale 1999; Caloi 2011.

[2] Roux-Courty 1998, 748. On the different methods of adopting the wheel-fashioning technique, see *ibid.*; Knappett 2004, 257-265; Choleva 2012, 364-366; Jeffra 2013.

[3] *Ibid.*; Knappett 2016.

[4] Berg 2009; 2011a.

[5] *Ead.* 2011b; see also *Ead.* 2015.

[6] See, for example, the handleless conical cups found in the MM IIA closed deposit from the filled-in platform of Room IL in the South-western Building of Phaistos in Caloi 2016a, 23-24, fig. 2a (hand-made), fig. 2b-e (finished on the wheel), fig. 3a-d (wheel-fashioned), fig. 4a-d (wheel-thrown). See also *Ead.* 2012, 48, 51, fig. 9.

This means that different forming techniques co-existed at Phaistos at least in the MM IIA phase. A similar pattern can be observed also at Kommos, where deposits dating to MM II present some vases that are wheel-thrown and other wheel-fashioned [7]. Moreover, Aleydis Van de Moortel has argued from macroscopic observations that wheel-throwing was introduced at Kommos in the MM IB phase and became more widespread in the MM IIA and MM IIB phases [8].

In the next pages, first I briefly present the forming techniques attested at Phaistos in the first phases of the Protopalatial period. Then, I focus on the MM IIA Phaistian classes of vases which appear to be manufactured through the wheel-throwing technique, comparing them with contemporary wheel-fashioned vases. More specifically, for the class of plain handleless cups, the most common drinking cup at Bronze Age Phaistos since Prepalatial times, I compare the MM IIA examples with experimental reproductions. In so doing, I used a combined approach which integrates the macroscopic examination of locally-made plain handleless cups with a detailed study of the traces identified on these vessels and the testing of their technological properties by experimental reproductions carried out by a professional potter, Vassilis Politakis [9]. The choice of reproducing plain handleless conical cups is motivated by the fact that at MM IIA Phaistos these cups are standardised and manufactured in a fast and quick way without being finished and/or smoothed. Despite the difficulties inherent in identifying surface features corresponding to a specific primary forming technique, the absence of any final treatment to smooth the surfaces of these plain handleless conical cups helps somewhat in identifying the primary manufacturing technique used to produce them. Finally, I attempt to explain why the wheel-throwing technique is almost exclusively attested at Phaistos and in sites sharing its ceramic tradition, like Kommos and Ayia Triada. Since in the MM IIA phase the main palatial building of Phaistos (*i.e.* the South-western Building) went through an important renovation [10], I hold that new groups arrived at Phaistos in MM IIA, introducing a new forming technique that was able to break with the long-lasting ceramic tradition of the site – and of the island. The new approach was in competition with those established by local potters: new wares emerged that contrasted with the well-known Kamares Ware. Moreover, it will be argued that in MM IIA plain handleless cups were produced *en masse* on the potter's wheel, to be used in the context of communal feasts during the renovation of the main palatial building and the monumentalization of the entire site [11].

2. The forming techniques attested at Phaistos in the first phases of the Protopalatial period (MM IB-MM IIA)

The Minoan site of Phaistos, first excavated in 1900 by Luigi Pernier, who brought to light the Second Palace of Phaistos [12], was later excavated from 1950 to 1966 by Doro Levi. The latter excavated the First Palace (Protopalatial) and the contemporary quarters of the town (Fig. 1) [13]. Recent studies have demonstrated that Phaistos is not only a consumption center, but also a producing one: it is the only palatial site on Crete of this date that has provided a potters' quarter (known as Artisans' Quarter) including a kiln and a dump area, the *Strada Nord*, located to the W of the Middle West Court (*Piazzale* I) of the Palace and continuously in use from the Prepalatial through the Protopalatial period [14]. Together with this potters' quarter, the Italian-Greek survey has also revealed the possible existence of a production area at only 800 m to the W of the Palace [15].

[7] Van de Moortel 2006, 266-269.

[8] *Ibid.*, 328. She states that few local vases, especially conical bowls, dating to MM IB could have been wheel-thrown.

[9] Within a new, major programme started in 2018 with Simona Todaro on technological study of Minoan pottery of Phaistos in a long-term perspective, from the Neolithic to the end of the Middle Bronze Age, I started a new project which combines macroscopic analysis of Phaistian Protopalatial pottery and experimental reproduction of Protopalatial ceramic material. This two-year project is entitled *La tecnologia ceramica a Festòs (Creta) nel Medio Minoico IIA (1800-1750 a.C.): l'introduzione della wheel-throwing technique e le sue implicazioni socio-politiche* and is financed by the Ca' Foscari University of Venice (*Fondi Primo Insediamento* 2018). On the experimental work by V. Politakis in his laboratory, see http://www.spiritofgreece.gr/.

[10] Carinci 2011; Caloi 2012.

[11] On the mass production of handleless conical cups at Phaistos, see Todaro-Caloi forthcoming. The paper entitled «Time for plain speaking: thinking through plain handleless cups in Minoan Crete» was presented at the 2019 AIA Meeting held in San Diego (California) in January 2019. On communal feasts at Protopalatial Phaistos, see also: Caloi 2012, 2017 and 2019.

[12] Pernier 1935; Pernier-Banti 1951.

[13] Levi 1976; see also Levi-Carinci 1988.

[14] Todaro 2009.

[15] *Ead.* 2015.

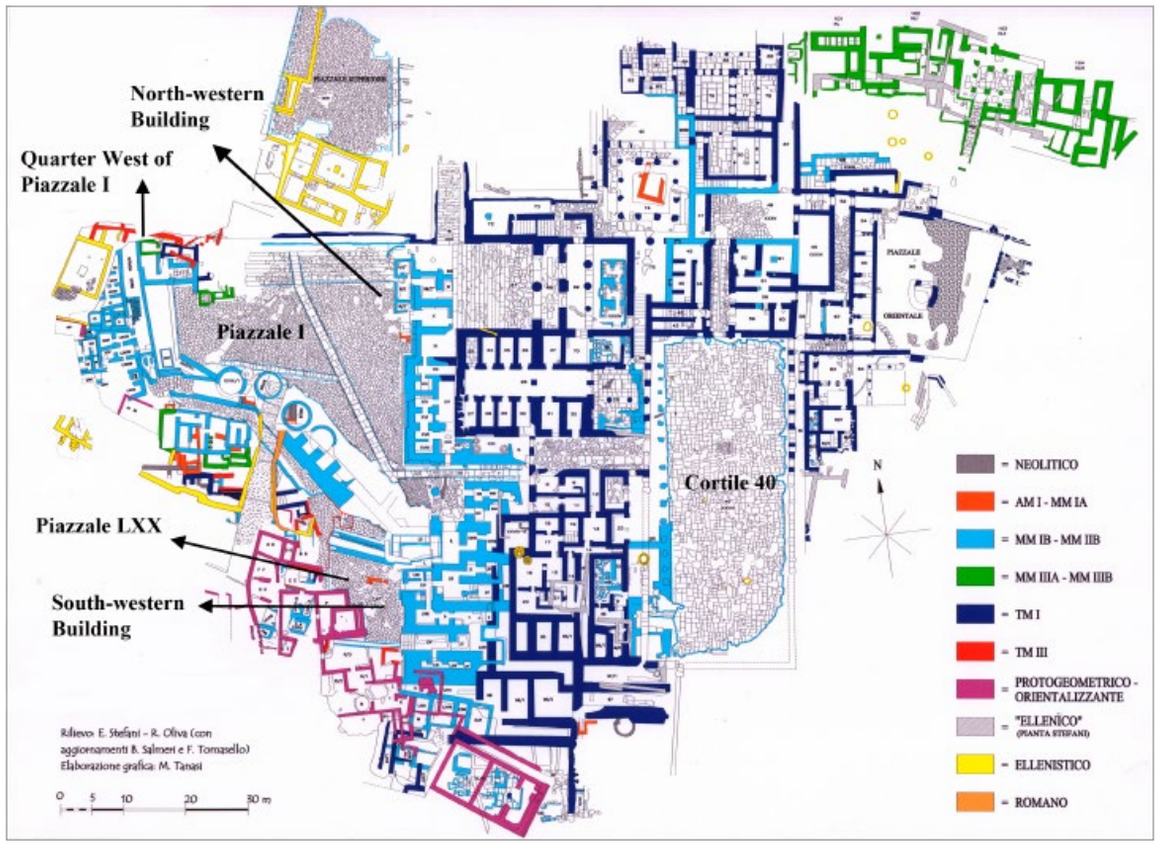

Fig. 1. Phaistos. The plan of the Palace with indications of its main courts (*piazzali*) and of its main Protopalatial buildings and quarters (revision by A., © Archivio disegni SAIA; NIG 7779.).

My recent study of the stratigraphical/contextual data and MM IB-MM II ceramics retrieved from two houses situated in the Quarter W of the Middle West Court (*Piazzale* I) of the Palace (Figs. 1-2) has been my starting point for a new definition of the ceramic sequence of Protopalatial Phaistos. This work has allowed me to identify a good sequence of three successive depositional events with homogeneous ceramic deposits, which have been dated respectively to MM IB (with an Early MM IB sub-phase), MM IIA and MM IIB[16]. The visual inspection of the finished products retrieved from each of these deposits enabled me to recognize strong changes in manufacturing techniques at Phaistos especially from MM IB to MM IIA[17]. Moreover, in the last years I have also focused on pottery from two MM IIA homogeneous deposits retrieved from the South-western Building of the Phaistos Palace (Figs. 1-2), *i.e.* the filled-in platform deposit of Room IL and the dump of the *Bastione* II wall, which marks the northern limit of the Lower West Court (*Piazzale* LXX)[18]. This study helped me in identifying specific classes of pottery which appear to be produced through the wheel-throwing technique (see *infra*, 3).

At the beginning of the Protopalatial period, in MM IB, the potter's wheel was introduced to Phaistos, as well as in the rest of the island. The traces left from these earliest wheels on the MM IB vases from Phaistos consist of irregular rillings and undulations, which are likely due to the adoption of that form that could be termed the so-called primitive wheel (*i.e.* pivoted turntable)[19].

The hallmark of the Protopalatial period is the Kamares Ware: it is decorated in polychrome on a black-slipped surface, and well represented by different kinds of drinking pots (carinated, cylindrical and straight-sided cups) and pouring vessels (mostly spouted jars and jugs). At MM IB Phaistos, most Kamares vases were produced through the use of the potter's wheel, which was however utilized in two different ways. It was used to finish handmade products, especially small vases, like drinking pots and small pouring

[16] For the first definition of a MM IB-MM IIA sequence at Phaistos, see CALOI 2009; see also *Ead.* 2013, 25-49.

[17] See *Ead.* 2011.

[18] The publication of these two deposits is in preparation: «Renovating the First Palace of Phaistos during the Middle Minoan IIA phase (18th cent. BC). Combining architectural and ceramic phases». Their preliminary presentation is in CALOI 2012 and 2016a-b.

[19] *Ead.* 2011, 90.

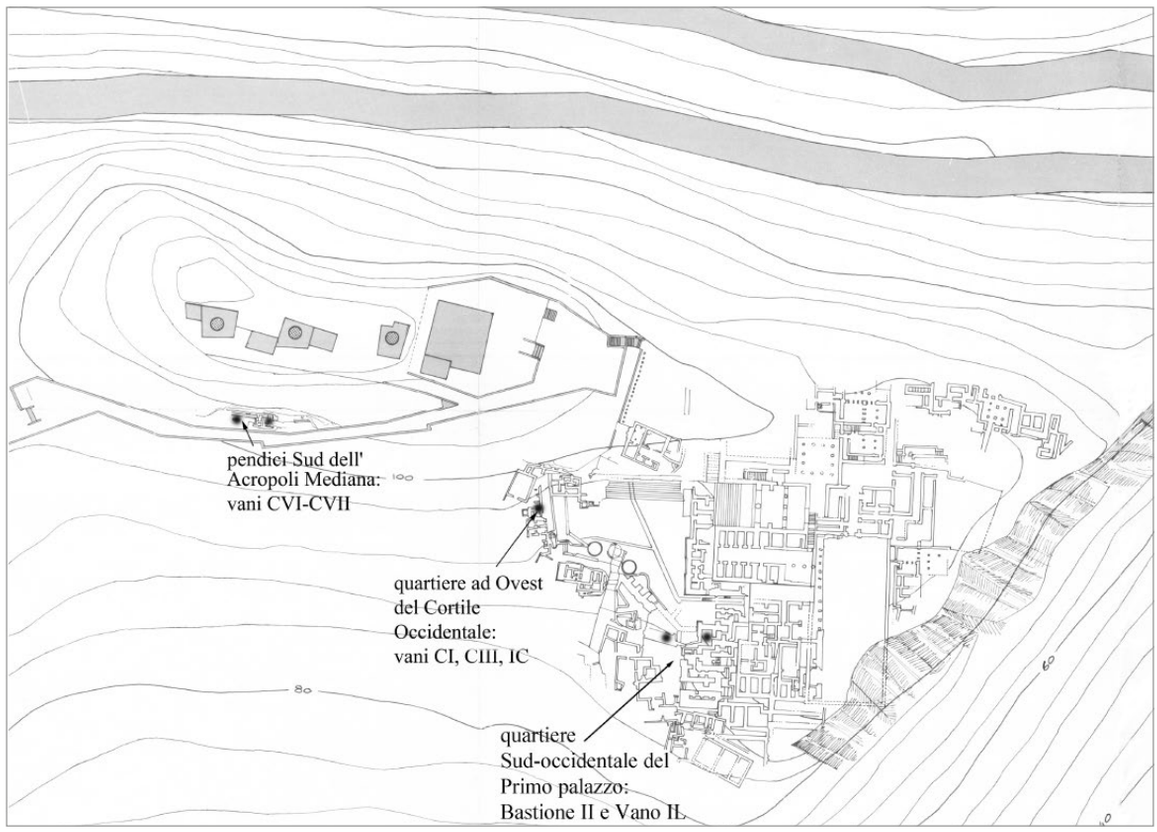

Fig. 2. Phaistos. The plan of the Palace with indications of the quarters containing MM IIA deposits (revision by A., © Archivio diapositive SAIA; 2664).

vessels (*i.e.* teapots and juglets). Otherwise, it was employed in combination with hand-building to shape bigger vessels, such as jars, jugs and containers. They were produced following the aforementioned technique known as the wheel-fashioning technique [20] or combining different parts of a vase, which have been previously manufactured through different forming techniques, in several stages [21].

As already discussed elsewhere [22], it is relevant to note that at MM IB Phaistos many vases of a crude character (especially plain handleless cups) were still produced only by hand, without using the potter's wheel. The handmade building of a vase was sometimes associated with the use of a bat, which is turned by the potter in order to produce some speed, whose employment remains anyway low and irregular [23]. This forming technique is derived from the Prepalatial tradition [24]. It is relevant to note that also the fabrics used in Prepalatial times to produce the EM IIA Fine Painted Ware are the same used in Protopalatial times to produce the Kamares Ware, thus demonstrating the strong continuity of pottery technological tradition at Phaistos and in the Mesara plain in general [25].

The study I have undertaken on Protopalatial pottery from Phaistos allowed me to affirm that a new forming technique was introduced at Phaistos in MM IIA [26], when there appeared some vases manufactured through the use of the wheel-throwing technique (see *infra,* 3). I have suggested elsewhere that this technique could be associated with the introduction of a new potter's wheel, which is different from the abovementioned primitive wheel [27], but no remains of such potter's wheels have been found in stratified MM IB and MM IIA Phaistian deposits that could support this theory.

[20] On the different methods of adopting the wheel-fashioning technique, see Roux-Courty 1998; Knappett 2004, 257-265; Choleva 2012, 364-366; Jeffra 2013.

[21] According to the study of Aurelia Speziale on the MM IIB vases from Phaistos some middle-sized vases (mainly spouted jars) were constructed in stages, combining different parts of the vase that have been previously and individually constructed by hand-building or on the wheel (see Speziale 1999). Already in MM IIA some vases (*e.g.* barbotine jugs) appear to have been manufactured in this way.

[22] Caloi 2011, 88-89; see also *Ead.* 2013, 113-115, figs. 26-27, pls. XXII-XXIII.

[23] For the use of bats see: Evely 2000, 271; Cuomo di Caprio 2007, 169-170; Todaro 2016.

[24] Similar bats were found by Peter Warren in Early Minoan II Myrtos: Warren 1972, 261-262, pl. 75.

[25] See Wilson-Day 1994; Day-Wilson 1998.

[26] Caloi 2011, 2016a.

[27] *Ibid.*, 97-98.

In the wheel-throwing technique, the rotative kinetic energy (RKE) is used from the beginning of the manufacturing process to transform a mass of clay into a vessel, thus making the production much faster [28]. Judging from a macroscopic analysis, the Phaistian wheel-thrown vases present different features compared with those produced through the hand-building and the wheel-fashioning techniques. These features, some of which have been first identified by Courty and Roux [29], seem diagnostic of the adoption of the wheel-throwing technique. They are: a) progressive thinning of the body; b) wall thicknesses gradually taper towards the rim without any discontinuities; c) regular surface, showing few asperities and microfractures; d) horizontal and parallel striations and rillings on the surface; and e) continuous configuration of the section, which does not present any discontinuities in thickness.

At MM IIA Phaistos, this new forming technique was adopted to produce only some specific, local wares and shapes (see *infra*). This means that it did not replace the older techniques (*i.e.* handmade and wheel-fashioning techniques), which instead continued to be used for the rest of the ceramic production. In particular, the wheel-fashioning technique persisted until the end of Protopalatial period and even later [30], to produce both middle-sized vases, like jugs, two-handled jars (*i.e. stamnoi*) and amphoras, and large-sized vessels, such as *pithoi* and *pitharakia* [31].

Recent studies conducted by Simona Todaro on Prepalatial pottery from Phaistos have shown that the multi-layered composition of most locally made vases was the outcome of a peculiar way of joining together slabs of clay by overlapping them and securing the junctures through the application of extra layers [32]. This technique, known as the layer-building technique, appeared in EM IIB not only at Phaistos, but also in eastern Crete, as demonstrated by the well-known Vasiliki Ware [33]. It is interesting that at Phaistos this technique went on to be used to produce some types of vessels also in the Protopalatial period (*e.g.* the large pedestalled bowls) [34], *i.e.* even after the introduction of the potter's wheel. It seems that this layer-building technique was used also in combination with the wheel during the Protopalatial period.

From what was observed before, it appears that at MM IIA Phaistos, despite the appearance of the new and faster wheel-throwing technique, wheel-fashioning and hand-building continued in use, thus showing that at least in MM IIA different forming techniques were contemporarily in use at Phaistos.

3. The appearance of wheel-thrown vases at MM IIA Phaistos

The first appearance of the wheel-throwing technique at Phaistos occurred in MM IIA. There are four MM IIA Phaistian levels/deposits that have hitherto provided some examples of wheel-thrown vases. Two are located in the main palatial building of Phaistos, the South-western Building (Fig. 2), *i.e.* the filled-in platform deposit of Room IL and the dump of *Bastione* II (see *infra*), the third one is located in the Quarter to the W of the *Piazzale* I (Figs. 1-2) (the MM IIA level on the top of the MM IB dump) [35], and the fourth one comes from Rooms CV-CVII of the *Acropoli Mediana* Building (Fig. 2) [36]. This is located on the southern slopes of the homonymous hill, which is N-W of the palace hill.

My recent technological study focused only on ceramic deposits from the platform deposit of Room IL and the dump of *Bastione* II, where not only are there attested all the three classes of pottery produced through the wheel-throwing technique that will be discussed in the next pages (see *infra*), but they also appear more plentiful than in the other deposits. The wheel-thrown vases retrieved from these two deposits are represented only by some shapes produced in three specific wares, which are the following: (1) handleless conical cups in Fine Plain Ware (see *infra*, 3.1); (2) cups in Fine Dark-on-Light Ware (see 3.2); and (3) cups and spouted jars in Polychrome on Buff-reserved Surface Ware (see *infra*, 3.3) [37].

[28] On the wheel-throwing technique, see: Cuomo di Caprio 1995, 147-149; Courty-Roux 1995.

[29] *Ibid.*, 17-20; see also Choleva 2012, 353-354.

[30] Speziale 1999, 109-114.

[31] *Ibid.*; Caloi 2011.

[32] Todaro 2013, 196-203.

[33] On the Vasiliki Ware, the hallmark of the EM IIB period in eastern Crete, see Betancourt *et alii* 1979. In this publication, Philip Betancourt discusses also the use of the layer-building technique to produce the Vasiliki Ware.

[34] See Todaro 2018.

[35] See Caloi 2009, 381-384; see also *Ead.* 2013, 68-70.

[36] The MM IIA fill retrieved from Rooms CV, CVI and CVII of the Acropoli Mediana Building has been recently published in Baldacci 2017. On the wheel-thrown handleless conical cups from this MM IIA fill, see in particular: *ibid.*, 97, pl. 121.

[37] On this specific ware see Caloi 2009, 429-430, fig. 16.

3.1 The MM IIA wheel-thrown conical cups and their reproduction through the experimental archaeology

The most frequent wheel-thrown vases are handleless conical cups in Fine Plain Ware (Fig. 3). When compared with hand-built and wheel-finished conical cups, from a macroscopic analysis, the wheel-thrown specimens present the same, following characteristics: (a) small dimensions (max h. 4.5); (b) standard measures (h. 3.7-4.5; base diam. 2.5-3.2; rim diam. 7-7.5); (c) conical profile with incurving rim on a small and raised base (base diam. 2.5-3.2); (d) deep hollow in the interior base [38]; e) clearly visible throwing marks both on the interior and exterior walls, which are likely due to poorly executed surface finish or overall lack of surface finish of the vase. In particular, the wheel-thrown specimens visible in Fig. 3 show horizontal and parallel rilling marks, as well as a regular and stretched surface that presents only few asperities and microfractures. The latter, together with many horizontal fractures, are instead visible to a higher level on other examples produced using the wheel-coiling technique and coming from the same deposits [39]. More specifically, the filled-in platform deposit of Room IL has provided hundreds of conical cups manufactured in different ways, demonstrating that in MM IIA these small vases were produced through wheel-throwing, wheel-fashioning and also hand-building techniques [40].

Experimental archaeology carried out in collaboration with the potter Vassilis Politakis has allowed him to replicate the MM IIA examples illustrated in Fig. 3, and to compare the above-mentioned macroscopic traces left on these cups with those observed on experimental reproductions formed on the wheel. The experimental handleless cups have been produced using the five following forming techniques: (1) coil-wheeling, *i.e.* a combination of coil-building using three coils of 1 cm each built on a circular base and finishing on the wheel (technique 3CW); 2) pinching with the addition of one coil on the wheel (technique PN1C); 3) pinching and finishing on the wheel (technique PNW); 4) throwing-off-the-hump (technique H; Fig. 4b); 5) wheel-throwing from a small solid clay ball (technique SB; Fig. 4c). While the results of these experimental reproductions are still being worked upon [41], I am going to present here only the vases made using the throwing-off-the-hump and the wheel-throwing techniques because the experimental handleless cups reproduced

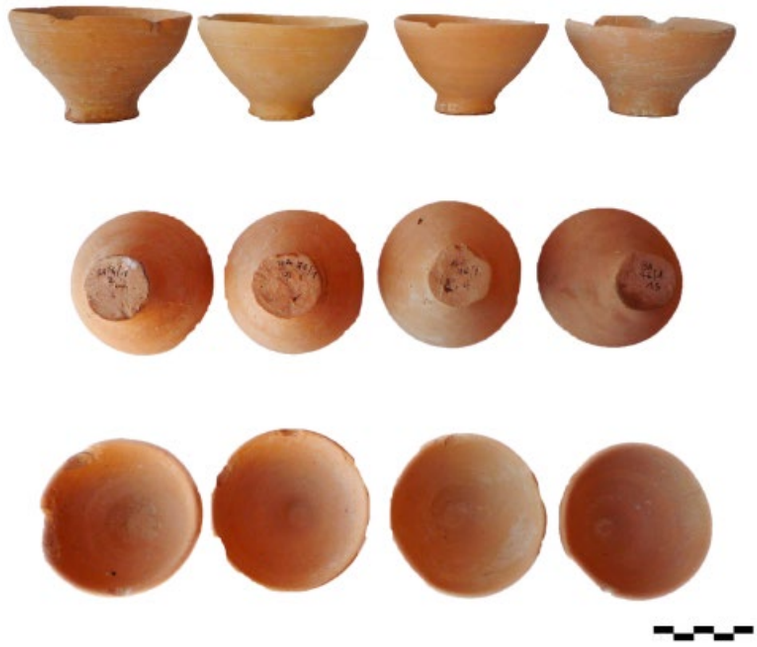

Fig. 3. Wheel-thrown plain handleless cups from the Phaistian MM IIA deposits from the *Bastione* II dump and the filled-in platform of Room IL in the South-western Building (photo A.).

[38] This feature, identified by Aleydis Van de Moortel (2006, 331) on some MM IIA wheel-thrown conical cups from Kommos, has been linked by the scholar to a specific motor habit on the part of the potter.

[39] For MM IIA wheel-coiled conical cups from Phaistos, see for example the specimen inv. MS 3/21 15 in Caloi 2016a, 28, fig. 3d, where are well visible both several horizontal fractures on the interior walls and traces of coils in section. See also the Phaistian wheel-coiled vases in Fig. 2 in the poster presented to the Barcelona EMAC 2019 (16-18 September 2019): I. Caloi, «Identifying wheel-fashioned and wheel-thrown vases in Middle Minoan Crete. Coupling macroscopic analysis and experimental archaeology».

[40] Caloi 2016a, 23-24; 2012, 51, fig. 9.

[41] Ead. in preparation.

using these two techniques show features that are analogous to those observed on the MM IIA Phaistian specimens illustrated in Fig. 3. Before describing these analogous features, it is worth noting that, following the "best practice approach" proposed by Simona Todaro for the experimental reproductions of ancient pottery [42], the experimental work was undertaken using materials and tools available in Minoan times on the basis of the archaeological evidence from Protopalatial sites of Crete. Six conditions were met:

(1) the use of natural clays collected from southern Crete, and specifically Moni Odighitria and Vori, at about 10-13 km from Phaistos. The clay sources are compatible with those used in Prepalatial and Protopalatial times to produce the well-known Mesara fine decorated pottery, and especially the EM IIA Fine Painted Ware and the MM IB-IIB Kamares Ware [43]. These clays (Figs. 4b-c), light grey in colour before firing and pink after it, are plastic and workable, making easy the work of the potter on the Minoan-type potter's wheel: such small handleless conical cups can be thrown. As already demonstrated by Jerolyn Morrison, a plastic clay is fundamental for the throwing of small vessels on the wheel, otherwise it is «not plastic enough to be formed into and hold a shape» [44].
(2) The Minoan-type potter's wheel adopted for experimental reproductions has been constructed by the potter Vassilis Politakis on the basis of the model proposed by Doniert Evely for the broad Palatial period on Crete (Fig. 4a) [45].
(3) The clay discs (wheel-heads) used for the experiments are similar to the ones found at Protopalatial Malia [46] and have a diameter of diam. 29-30 cm (Figs. 4b-c).
(4) The speed used to shape and/or throw vases on the wheel was between 85 and 140 rpm (see the speed calculator in Fig. 4a).
(5) The tool used to apply water on the experimental vases on the wheel was a natural sponge, while the strand used to cut the vases from the wheel surface was made of six hairs of a donkey tail [47].
(6) The vases were fired at 720-800 degrees in a pit-kiln reconstructed following the Minoan kilns, especially the Pre- and Protopalatial ones identified at Phaistos (Figs. 5a-b) [48].

Comparing the macroscopic features observed on Phaistian MM IIA handleless cups of Fig. 3 with those observed on their experimental reproductions, it is possible to say that, of the five different replication techniques, the wheel-thrown ones (using both the H technique and the SB technique) produced the only experimental vases showing the three following features observed on the MM IIA specimens: a short (h. max 4.5 cm) conical profile with a very small and raised base (diam. 2.5-3.2 cm), a narrow and deep hollow in the interior base (cf. Fig. 6), rilling marks on the interior and exterior walls, sometimes associated with few asperities and microfractures (Figs. 6-7). Here, it is interesting to point that some of the wheel-thrown reproductions may show microfractures on the interior walls due to bad kneading, to small inclusions or to air bubbles. This means that microfractures visible on the interior walls of MM IIA handleless cups are not necessarily due to the use of coils during the forming of the vase. Moreover, it is important to note that the experimental handleless conical cups using the wheel-coiling technique do not show up all together on the same pot the three abovementioned features – short (h. max 4.5) and conical profile with incurving rim, small and raised base (diam. 2.5-3.2) and strong rilling marks, but with few asperities on the surface – of the MM IIA specimens in Fig. 3. Instead, the experimental specimens reproduced using the coil-wheeling technique tended to an ovoid shape rather than a conical profile with incurving rim; also, on these specimens, some horizontal fractures are visible both on the interior and exterior walls, likely due to the bad junctions of the coils [49]. A significant factor here is that a coil-built vase needs to be smoothed on the potter's wheel for

[42] See the paper presented by Simona Todaro to the Barcelona EMAC 2019 (16-18 September 2019): «For a "best practice approach" to experimental reproductions of ancient pottery: on-site testing of raw clay with archaeological tools and installations. A pilot study from Bronze Age Crete».

[43] Wilson-Day 1994.

[44] Morrison 2010, 9; see also her experiments in Evely-Morrison 2010 and Morrison-Park 2007.

[45] See the potter's wheel type 3C in Evely 1988; see also 2000, 270.

[46] See Poursat 1996, 111-112, pl. 50 and the catalogue in Evely 1988; see also Poursat-Knappett 2005, 34.

[47] I want to thank A. Simandiraki who suggested to the potter V. Politakis to use donkey hair to cut vases from the wheel surface. On the basis of her experimental works, she hypothesized that this was one of the methods used by potters in Minoan times.

[48] See for example the EM III firing pit found at Phaistos in Todaro 2013, 153, fig. 76A; see also La Rosa 2002, fig. 412. It was first interpreted Vincenzo by La Rosa as a curvilinear wall (*Id.* 2002, fig. 412), but because of the finding of ceramic waste, ash and charcoal, it was interpreted as a firing pit. According to S. Todaro (2009, 337), another possible remains of an MM II kiln could be represented by the curvilinear wall found on the top of the Protopalatial house (Rooms CVIII-CXIV) located in the Quarter West of the Middle West Court, *i.e. Piazzale* I (see also La Rosa 2000, 51-54, figs. 55-56, pl. II).

[49] See the specimens reproduced using the wheel-coiling technique in Fig. 8 in the poster presented to the Barcelona EMAC 2019 (16-18 September 2019): I. Caloi, «Identifying wheel-fashioned and wheel-thrown vases in Middle Minoan Crete. Coupling macroscopic analysis and experimental archaeology».

a. b. c.

Fig. 4a-c. a. The Minoan-type potter's wheel reconstructed by V. Politakis following the model by D. Evely; b. The wheel disc and the hump of clay prepared using natural clay from southern Crete sources adopted to reproduce plain handleless cups through the throwing-off-the-hump technique; c. The wheel disc a solid clay ball prepared using natural clay from southern Crete sources adopted to reproduce plain handleless cups through the wheel-throwing technique (photos A.).

a. b.

Fig. 5a-b. The pit-kiln constructed by V. Politakis at Kyparissi following Prepalatial examples; b. The experimental plain handleless cups inside the kiln (photos A.).

Fig. 6a-b. Comparing experimental reproductions of wheel-thrown plain handleless cups with MM IIA plain handleless cups from Phaistos: left, cup reproduced using the wheel-throwing technique from a solid clay ball (a: SB6) and right, a fragmentary handleless cup from the MM IIA *Bastione* II dump (b: inv. MS 76/1 45bis).

Fig. 7a-b. Comparing experimental reproductions of wheel-thrown plain handleless cups with MM IIA plain handleless cups from Phaistos: left, cup reproduced using the throwing-off-the-hump technique (a: H19) and right, a fragmentary cup from the *Bastione* II dump (b: inv. MS 76/1 2).

long time (at least two minutes) in order to eradicate signs of the junctures of the coils, but when it is well-smoothed, the strong rilling marks that are usually attested on the MM IIA examples are no longer visible. On the contrary, if a coil-built vase is not much smoothed on the wheel, then on the interior and exterior walls you can see macroscopically the horizontal fractures due to the bad connections between the coils. Such are, however, absent on the MM IIA Phaistian specimens illustrated in Fig. 3.

Comparing the features observed on the MM IIA handleless cups illustrated in Fig. 3 with those observed on their reproductions using the five different techniques, it is possible to conclude that in MM IIA, Phaistian potters have developed wheel-throwing skills to produce a new class of wheel-thrown handleless cups in Fine Plain Ware which contrasted with the hand-built and wheel-coiled handleless cups attested at Phaistos respectively from the Prepalatial and MM IB periods, and which are still present in MM IIA deposits. The experimental reproductions have also shown that the wheel-thrown handleless cups can be produced in less than a minute, *i.e.* from 35 to 45 seconds.

3.2 The cups in Fine Dark-on-Light Ware

Cups in Fine Dark-on-Light Ware are all of small or medium dimensions, are produced in a fine and hard-fired fabric, and present a hemispherical or conical profile. The interior is often characterized by a

splatter decoration in dark paint with added red or white dots (Figs. 8a-c, 9a-c, 11). On several specimens the external rim decoration shows a series of diagonal slashes or festoons in brown or red paint (Figs. 8a, 9a-c, 11), some horizontal ridges may ornament the vase belly. Other cups do not display any painted decoration on the external surface, but only a series of horizontal ridges (Figs. 10-11)[50]. This external ridged feature seems to emphasize the new technological innovation, with the throwing marks resulting from using the wheel-throwing technique being turned into decoration. Ina Berg has also suggested that the wheel-thrown vases from MM II Knossos are often undecorated in order «to show off the new technique»[51].

The aforementioned cups in Dark-on-Light Ware show regular walls, which become gradually thinner towards the rim. They do not present any discontinuities on the surface, and the configuration of the section seems continuous, without any discontinuities in wall thickness (Figs. 8c, 10b, 11).

3.3 The Polychrome on Buff-reserved Surface Ware

The Polychrome on Buff-reserved Surface Ware usually displays polychrome decoration on a buff clay surface, which is often covered first with a thick fine creamy slip. Sometimes the polychrome decoration is replaced by the dark-on-light decoration. Wheel-thrown vases in Polychrome on Buff-reserved Surface Ware are mostly cups and bridge-spouted jars (Fig. 12). The latter are generally decorated with white-bordered brown or red vertical bands, as well exemplified by the entire specimens retrieved from the dump of *Bastione* II[52].

Fig. 8a-c. A wheel-thrown cup in Fine Dark-on-Light Ware from the MM IIA *Bastione* II dump (photo A.).

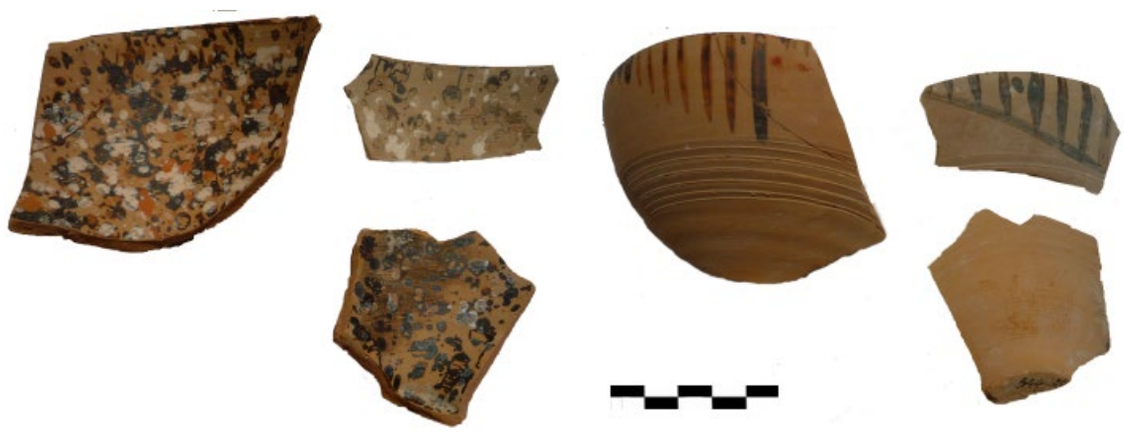

Fig. 9a-c. Wheel-thrown fragmentary cups in Fine Dark-on-Light Ware from MM IIA deposits of Phaistos (photo A.).

[50] See also Caloi 2013, fig. 41.
[51] Berg 2011b, 60-61.
[52] Levi 1976, 166, fig. 257.

Fig. 10a-b. A wheel-thrown cup in Fine Plain Ware with groove decoration from the MM IIA *Bastione* II dump (photo A.).

Fig. 11. Profiles of wheel-thrown cups in Fine Dark-on-Light Ware from MM IIA deposits at Phaistos (drawings G. Merlatti).

Fig. 12. Wheel-thrown bridge-spouted jar in Polychrome on buff-reserved surface Ware from the MM IIA *Bastione* II dump (photo A.).

4. A new forming technique and its social implications: some observations and new perspectives for the future

In the previous pages we have observed that in MM IB the handmade technique, together with the wheel-fashioning one – associating hand and wheel manufacture – are the best attested forming techniques at Protopalatial Phaistos. That means that the foundation of the Phaistos Palace in MM IB had no influence on the ceramic production, and that the Prepalatial ceramic tradition continued on in the production of the hallmark pottery of MM IB, *i.e.* the Kamares Ware [53]. Most vessels in Kamares Ware indeed continued to be produced through the combination of hand-building technique and the wheel use until MM IIB and even later [54].

Despite the introduction to/development on the island of the potter's wheel in MM IB, it appears that Phaistian potters did not acquire skills to produce wheel-thrown vases until the MM IIA phase. It seems rather that the first, real change in the Phaistian ceramic production occurred in MM IIA with the introduction of the wheel-throwing technique which, however, was used only for the production of some specific classes of vases. At MM IIA Phaistos, the wheel-thrown vases comprised but a small percentage of the total production of the site. This limited production, including cups and bridge-spouted jars, made in fine and hard-fired fabrics, and decorated in dark or in polychrome on light clay, appears in strong contrast with the production of the typical polychrome on dark-slipped surface ware, namely the Kamares Ware. Even the forms and decorative patterns differ from those of the Kamares Ware, showing a preference for handleless hemispherical and conical cups, rather than for one-handled carinated or rounded ones, and for linear motifs rather than for floral or vegetal ones. It seems to me that in MM IIA Phaistos there appeared a new drinking set, displaying a revolutionary technological change and associated with innovative decorative patterns (Figs. 8-12). Since in the aforementioned MM IIA ceramic deposits from the South-western Building there are attested various ways of manufacturing vases, it is likely that the wheel-throwing technique was a prerogative or choice of few specialist potters able to compete with other more traditional potters. Concerning the people producing and using these innovative ceramic products, some questions arise. Could the display and the consumption of this new drinking set imply the appropriation of a technological innovation from new groups present at the Phaistos palace in MM IIA?

The plain handleless cups produced through the new technique, their standard dimensions and shape (Fig. 13), as well as the absence of refinement likely due to their quick production, all point to a fast and mass production.

Since the wheel-throwing technique is one of the forming techniques particularly effective at increasing the production output and in achieving standardization, its introduction may be connected to a new need for mass production, arguably linked with the MM IIA major building projects within the palatial

Fig. 13. MM IIA standardised wheel-thrown handleless cups in Fine Plain Ware from the filled-in platform deposit of Room IL and from the *Bastione* II dump (photo A.).

[53] Day *et alii* 2006, 22-72; see also Todaro 2009, 333-334.

[54] Speziale 1999; Knappett 2004, 257-265.

site (see *infra*). Although this study on the forming technique at Protopalatial Phaistos is still ongoing, it appears to me that the new wheel-throwing technique may be associated with major architectural changes in the palatial site. In MM IIA, the main palatial building, that is the South-western Building (Fig. 1), went through architectural and functional transformations that included some alterations of the access systems and of the internal circulation patterns [55]. As discussed elsewhere [56], these operations, involving the opening of new passages, could be due to the need to exercise a stronger control of the building, connected to new persons at the palace. It is worth remarking that the two contexts of the South-western Building that contained MM IIA ceramic deposits with wheel-thrown vases, *i.e.* Room IL and *Bastione* II (Fig. 2), were both involved in the renovation of the building [57]. The ceiling of Room IL was raised and a new platform was constructed at the time of the building renovation; the filled-in platform deposit has indeed been interpreted as the remains of a feasting event, likely connected with the end of the renovation works occurred in the room and perhaps in the building as well [58]. The wall known as *Bastione* II was constructed contemporarily with the opening of a new entrance in the building (*i.e.* Corridor L), and its associated dump was indeed found full not only of pottery, but also of discarded material from cleaning and construction activities [59]. These operations may have required much labour to be provided at the palatial site. It is therefore possible that in MM IIA plain handleless conical cups were manufactured *en masse* on the potter's wheel to be used during the renovation of the main palatial building and the monumentalization of the entire site. It is important to note here that at Phaistos the first mass-production of plain handleless cups connected with major building projects occurred in EM III. As proposed by Simona Todaro [60], these EM III cups were produced *en masse* with moulds to be used as ration bowls during a major building project that substantially changed the look of the hill through the creation of the massive terraces upon which the First Palace was erected in MM IB. Building up on this recent study by Simona Todaro on the use of the Phaistian plain handleless cups as ration bowls, it is also relevant to note that the MM IIA wheel-thrown handleless cups from the two palatial deposits (illustrated in Figs. 3 and 13) seem all to contain the same quantity of solid food (Fig. 14). Without going too further into the metrology, this measurable fact corroborates the hypothesis that these handleless cups may be interpreted as mass-produced vases to be used as ration bowls (in work feasts?) during the major building activities undertaken at Phaistos in MM IIA.

Considering the contemporary occurrence in MM IIA Phaistos of the introduction of an innovative forming technique, namely the wheel-throwing one, and the remodelling of the South-western Building, there remains the possibility that the new forming technique was introduced by new groups at the

Fig. 14. MM IIA standardised wheel-thrown handleless cups in Fine Plain Ware from Phaistos containing the same quantities of lentils (photo A.).

[55] Carinci 2011, 41.
[56] Caloi 2012; see also *Ead.* 2015, 150.
[57] Carinci 2011, 42-43, 51-52.
[58] Caloi 2012; see also *Ead.* 2017 and 2019 on these commemorative deposits.
[59] *Ead.* 2016b.
[60] See Todaro 2019, 184; forthcoming; Todaro-Caloi forthcoming. On the EM III major building activities at Phaistos see Todaro 2013, 264, 294-295.

Phaistian building. There are still many questions that need to be addressed concerning the introduction and use of different forming techniques at Phaistos. Concerning the identity of the new groups, the main question is whether they were new potters or new pottery consumers; the second and related question is whether they were living nearby, or had they came from other regions of Crete. Before answering, it is important to note that we are dealing with new potters producing new wares with an innovative forming technique, but also ones likely to be adopting the same clay sources in use from Prepalatial to Protopalatial times (see *supra*), and producing some shapes, like the plain handleless conical cups, which vary in dimension, profile and manufacture technique, but belong to a well-known Phaistian category of drinking pot that goes back to Prepalatial times [61]. Given these considerations, I think that these new potters were probably living/working in the Phaistos region and, unlike the other more traditional potters, were able to develop new skills in using the potter's wheel and become more competitive. Moreover, considering the likely presence of discrete production areas at Phaistos [62] and the attestation of different forming techniques since Prepalatial times (*e.g.* the layer-building technique), it is likely that the new potters were working together with potters sharing the same production traditions in terms of clay sources and fabrics, but using different forming techniques. These potters were seemingly able to develop new skills to tackle new demands and to provide the palace with new classes of pottery, contrasting with the more common Kamares Ware. In particular they were responsible for making the numerous, standardised plain handleless conical cups to be probably used as ration bowls during the renovation works of the palace.

In order to provide more precise answers to these still-open questions, I have recently started a new, multi-disciplinary project, involving not only the macroscopic analysis of the MM IIA pottery from Phaistos, but also experimental archaeology and Computed Tomography scanning (henceforth CT scanning) of MM IIA vases [63]. This study should help in identifying how many forming techniques existed at Protopalatial Phaistos, how they were combined in the production of specific shapes, and if there was any development in the adoption and/or combination of these techniques, as well as identifying preferences in the use of one or another during the discrete phases of the Protopalatial period. Moreover, it could provide new approaches in interpreting the differences recognised between the ceramic forming techniques adopted in the S and those in the N and E of Crete. In particular, it would be interesting to verify whether the wheel-fashioning technique adopted at Protopalatial Phaistos was employed in the same way as in the northern and eastern regions of the island. Finally, since Phaistos is the only Minoan palace of this date yielding a potter's quarter, namely the Artisans' Quarter located to the W of the *Piazzale* I [64], this study could help in understanding whether there existed different potters or potting groups using discrete ceramic traditions and whether they used the same potters' quarter or preferred diverse production areas, as recently has been proposed by Simona Todaro on the basis of the possible existence of other potters' quarters identified during the Greek-Italian survey of the Phaistos hills [65].

Only such a new and multi-disciplinary technological study of the MM IIA deposits of Phaistos, associated with a deeper understanding of the socio-political structures of the Phaistian palace and town in MM IIA, will offer better insights into the social processes that led to the introduction at Phaistos of a new forming technique. Further technological studies elsewhere, using CT scanning, would also facilitate both the identification of the forming techniques adopted across Protopalatial Crete and the definition of the historical development in the use of the wheel-throwing technique during the Middle Bronze Age not only at Phaistos, but in the island as a whole.

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[61] On the topic see Todaro-Caloi forthcoming.

[62] Besides the Artisans' Quarter to the W of the Middle West Court of the Palace and the possible production area found during the Greek-Italian survey, also the trenches opened by Enrica Fiandra in the 1960s in the area to the S of the Palace (Fiandra 2000) seem to hint at the presence of another production area in close proximity to the Palace, as several kiln wasters were reported together with MM II pottery, ochre remains and pure clay within broken vases (Todaro 2015).

[63] See *supra*, fn. 9.

[64] See Todaro 2009.

[65] *Ead.* 2015.

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