MEANINGFUL PRACTICES

NON-SCRIBAL COMMUNICATION IN THE AEGEAN AND THE NEAR EAST DURING THE BRONZE AGE

edited by
Maria Emanuela Alberti, Giulia Dionisio, Anna Margherita Jasink
with additional contributions from
Judith Weingarten



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Non-scribal Communication in the Aegean and the Near East during the Bronze Age

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Table of contents

VII INTRODUCTION
Anna Margherita Jasink, Judith Weingarten, Maria Emanuela Alberti, Giulia Dionisio

EARLY BRONZE AGE

3 DECODING MATERIAL COMMUNICATION TOOLS IN PRE-LITERATE MESOPOTAMIAN AND PERI-MESOPOTAMIAN WORLD
Marcella Frangipane

31 CONNECTIVITY AT EARLY BRONZE AGE ÇUKURIÇI HÖYÜK
Barbara Horejs, Christoph Schwall

55 DISCS AND OTHER POSSIBLE TOKENS FROM 3RD MILLENNIUM NORTHERN MESOPOTAMIA: A PRELIMINARY SURVEY
Candida Felli

MIDDLE BRONZE AGE

69 MANAGING RESOURCES, SHARING KNOWLEDGE: EXPLORING THEORETICAL MODELS FOR CONTEXTUALISING POTMARKS, MASONS' MARKS AND OTHER NON-SCRIBAL COMMUNICATION PRACTICES
Sarah Finlayson

91 THE FUNCTION AND THE USERS OF PROTOPALATIAL SEALS: SEAL GROUPS OF EAST CENTRAL AND EAST CRETE
Maria Anastasiadou

109 «WRITTEN» SEALS AS SYMBOLIC MEANS OF COMMUNICATION
Anna Margherita Jasink

123 POTTER'S MARKS FROM TWO PROTOPALATIAL HOUSE TOMBS IN THE PETRAS NECROPOLIS
Metaxia Tsipopoulou

175 WHAT IS MINE IS NOT YOURS: POTTERS' MARKS AS INDICATORS OF LOCAL POTTERY PRODUCTION AND TERRITORIALITY IN THE PROTOPALATIAL PERIOD
Georgios Doudalis

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LATE BRONZE AGE

199 SOME REFLECTIONS ON SEAL USE AND SEAL USERS IN LATE MINOAN I CRETE (CA. 1600-1450 BC)
Ilse Schoep

221 COMMUNICATION BREAKDOWN: MARKS ON WEIGHTS AND THEIR ROLE IN METROLOGICAL IDENTIFICATION
Enrico De Benedictis

245 MANUFACTURING LATE BRONZE AGE PICTORIAL KRATERS ACCORDING TO SHAPE PROPORTIONS AND CAPACITIES? THE CASE OF RUDE STYLE BELL KRATERS
Laetitia Phialon

DIACHRONIC AND CROSS-CULTURAL

289 STAMPED, INCISED, INSCRIBED - SOME REMARKS ON NOTATION PRACTICES ON TEXTILE TOOLS FROM BRONZE AGE GREECE
Agata Ulanowska

311 LETTING THE CRETAN-HIEROGLYPHIC CAT OUT OF THE BAG
Judith Weingarten

327 LES MARQUES DE POTIER: QUESTIONS DE MÉTHODE
Anna Sacconi

337 PRECISION WEIGHING IN THE LATE BRONZE AGE AEGEAN BETWEEN EASTERN AND WESTERN MEDITERRANEAN
Maria Emanuela Alberti

367 PRE-COLUMBIAN NON SCRIBAL WRITING SYSTEM: THE KHIPUS AND THEIR PRESENCE IN THE ANTHROPOLOGY AND ETHNOLOGY MUSEUM OF FLORENCE
Giulia Dionisio

379 SUMMARY TABLES

383 LIST OF CONTRIBUTORS

Introduction

Anna Margherita Jasink, Judith Weingarten, Maria Emanuela Alberti, Giulia Dionisio

This volume aims to develop lines of research that were first addressed in *Periploi 9*: «Non-Scribal Communication Media in the Bronze Age Aegean and Surrounding Areas» (editors: Anna Margherita Jasink, Judith Weingarten, Silvia Ferrara, 2017). In *Periploi 12*, we are also casting a wider net both by expanding our geographical range and by bringing into the discussion additional forms of a-literate and proto-literate communication systems. Whereas, in *Periploi 9*, papers were divided by geographical regions (Aegean, Anatolia and Cyprus, Near East and Egypt), in *Periploi 12*, the perspective shifts by grouping them chronologically in order to facilitate diachronic and comparative studies: Early, Middle, and Late Bronze Age, with a final section that already takes a diachronic and/or cross-cultural viewpoint.

Periploi 9 was a response to the growing interest in connections between writing systems and «alternative» modes of interaction and communication, including those which do not obviously connect scribal with non-scribal practices. Scholarly interest seems to have increased in the intervening years, as witnessed by substantially more involvement among epigraphers and archaeologists as well as further semiological and anthropological analyses, providing evidence for new points of view. The fundamental purpose of this volume is to advance the current scientific debate, promoting more interaction among specialists. The key words recurring in the papers are: tokens, mason's marks, potmarks, seals and sealings, weights, textile tools and so on, but the discussion is much wider, with implications concerning cultural, economic and political networks. The chronological span goes from the 4th millennium to the entire 2nd millennium BC, through the presentation of several case studies and methodological considerations.

The volume begins with three papers on the Early Bronze Age that offer a significant overview for the pre- and proto-historical phases in the Near East. The first paper concerns signs and symbols that possibly transmitted ideological and practical messages across the Mesopotamian and Syro-Anatolian world (7th to 3rd millennium BC) before the spread of writing. Marcella Frangipane examines three marking systems: first, decorated pottery motifs as expressions of group identity and/or social roles; second, *cretulae* (sealings) as residual evidence for completed economic transactions in which seal impressions indicate the responsible individuals; and third, ways that potmarks could have been a practical tool for potters/workshops in tandem with the development of ceramic mass production. She explores such systems as parts of the «momentous transformation from egalitarian to hierarchical and politically centralised societies...».

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The authors of the second paper, Barbara Horejs and Christoph Schwal, bring us to western Anatolia, focusing on Çukuriçi Höyük, a coastal site in the vicinity of Ephesus occupied from Neolithic to Early Bronze Age 1 (ca. 7000-2750 BC). Çukuriçi Höyük represents a significant case study in Early Bronze I for use of a standardized weight system, metal and textile production, pottery technologies, and strategies for raw material procurement. The site's location at the central Aegean coast of western Anatolia is an ideal environment for terrestrial and maritime communication routes and offers an additional perspective into the highly dynamic Early Bronze Age period.

Candida Felli with the third paper focuses on tokens, simple geometric shapes usually made of clay (cone, sphere, disk, ovoid and so on) which played an important role in counting and recording commodities in the pre- and proto-scribal economy. The tokens discussed come from the Lower and Middle Khabur (Northern Syria) and date to the 3rd millennium BC. This makes it an unusually interesting follow-up to the paper in *Periploi 9*, «Making tokens talk» (Schmandt-Besserat and Moghimi), on Neolithic and Chalcolithic tokens excavated at Tepe Zagheh, Iran (ca. 5300-4300 BC). At this relatively late date, tokens are associated with sealings, ritual vessels, clay figurines and numeric tablets which suggests that they convey specific information in contexts of resource management within the communities and very likely function within a formative administrative system.

In the Middle Bronze Age section, Sarah Finlayson leads off with a discussion that draws together potmarks, masons' marks, incised signs or stamped seals on loom-weights and other production-related objects, including tools, as evidence of relatively widespread use of writing, marking and measuring practices, within the world of the craftspeople as part of their cognitive and practical toolkit for managing craft production. Using theoretical models and comparative evidence, she explores marking practices in a period, as she describes it, of «productive experimentation: what a sign can look like, how it can be used and by whom», and relates them, in part, to parallel signs in Cretan Hieroglyphics and Linear A (and Linear B). She draws an interesting parallel with the non-scribal marking systems in Egypt, especially the identity marks used by the workmen at Deir el-Medina ca. 1450-1350 BCE (described by Ben Haring (*Periploi 9*, 203-246), a hybrid system using forms of Egyptian Hieroglyphic signs as well as non-textual marks derived from older marking system(s), and pictorial and abstract signs. Perhaps, as at Deir el-Medina, there seems to have been potential for craftsmen to create their own signs, derived from a system of their choosing but linked by their communicative nature through the use of signs.

How such signs were put to use is still to be discovered but two case studies are laying the foundations for a deeper study of potter's marks. Metaxia Tsipopoulou takes the first steps towards creating an Aegean-wide database of potter's marks, first, by giving a thorough report on all Middle Minoan and Late Minoan IA potter's marks from the unlooted tombs HT4 and 10 in the cemetery and Sector I in the settlement at Petras, cataloguing all simple and composite marks, pot shapes, positions of the marks on the vases, and context dates; and second, adding (Tab. 3) all published marks from Malia-Quartier Mu, Syme, Vrysinas, and Kea. She signals and discusses appropriately those signs present at more than one site and/or appearing in more than one chronological period. We may now add to this initial database the recently excavated MM IIB potter's marks from Mochlos discussed in detail in the second paper on the subject by Giorgios Doudalis.

Doudalis analyses what appears to be a complex system with pottery workshops actively competing to control resources and their local markets. He argues that, while potters' marks were likely used by the potters to distinguish their vessels in the kiln, there was a perhaps more significant purpose in that they could identify ceramic workshops and distinguish the one's production from another. In support of this proposal, Doudalis pinpoints three MM IIA-MM IIB ceramic workshops using local clay but tempered with different minerals. Vases with potter's marks are then differentiated by workshops, contexts, vessel shapes, and marks: in MM IIA, when the first potter's marks appear (Tab. 3) and MM IIB, when vessel shapes are standardized following regional variations (Tab. 4). As the author justly concludes, «territoriality and workshop practices are open fields, ripe for study, and this research provides just a glimpse into how workshops were operating at the local and regional levels».

The Middle Bronze Age section also includes two papers (Anastasiadou, Jasink) which focus on Minoan Protopalatial seals. Maria Anastasiadou describes three clearly-differentiated groups of seals. Firstly, the Malia/Eastern Crete Steatite Group: with more than 700 examples it is the largest group of Minoan Protopalatial seals; as its name suggests, all are made of soft-stones of which 80% are three-sided prisms with uncomplicated and summarily rendered motifs, and likely produced in a Malia workshop. Quite different is the Hieroglyphic Deposit Group, named after the major location of sealings in the palace of Knossos. The group comprises ca 120 hard-stone seals (or impressions of hard-stone seals), overwhelmingly (91%) 3- or 4-sided prisms, of which ± 65% are engraved with signs in the Cretan Hieroglyphic script. As their primary location in a palatial sealing deposit implies, these seals were often used in administrative contexts. The small (≤ 30 seals) Malia Workshop Subgroup falls between: ca. 65% are three-sided prisms of medium-hard or hard-stone but with imagery resembling that of the soft-stone Group. Anastasiadou describes each group's seal shapes, materials and imagery which leads to insights into their different functions, users and, in particular, their links (or not) with palatial administration.

Anna Margherita Jasink concentrates on two unique Hieroglyphic seals: one an 8-sided veined-agate prism, the other an exceptionally long 4-sided steatite prism, both dated on stylistic grounds to MM II. The author proposes that neither the seals themselves nor their engraved «written» symbols reflect any function within the administrative organization of the time but rather that, despite their different materials, shapes, and symbols, both objects were meant to be worn as ornaments, perhaps indicating authority but more certainly social distinction, that is, not necessarily to be read but to be admired.

Moving on the Late Bronze Age, Ilse Schoep follows up her in-depth study of the Ayia Triada sealings (*Periploi 9*, 81-97), now to consider two complex and long-debated questions: was the main purpose of seals in Late Minoan I sphragistic or «magical/amuletic», and did they identify primarily individuals or rather group such as families or other collective entities? This new paper offers a well-structured discussion on links between the iconography of seals and the pervasive Minoan visual communication system (including wall-paintings, reliefs, figurines, pictorial textiles, and jewellery) as well as likely indications of collective group(s) when based on the phenomenon of «look-alikes» (Weingarten 1983, 1986, 1992), to which Schoep adds a more common category, simply of «alikes», i.e., seal-types displaying the same iconographic theme or motif; although easily distinguished and not necessarily used in the same way, «alike-ness» could refer

to aspects of the seal-owner's identity (gender, age, occupation, social role). As with the high number of seal-types used at MM IIB Phaistos (Relaki, 2012), Schoep argues that even the top 57 seal-users would not have been resident in the villa but likely to external suppliers or providers of commodities or participating in rituals and feasting at the Villa.

Enrico De Benedictis begins with a sharp critique of how incisions, grooves, marks, and other features have been used in the context of metrological identification of weights in the eastern Mediterranean. In the majority of cases, these features have been straightforwardly interpreted as representing units of account of a given standard. Rather, one should start by performing a metrological analysis of the weight and, if found together with other weights, of the entire set. In the absence of convincing parallels, the metrological interpretation of the mark is only one possible conclusion. De Benedictis then applies these strictures to two case-studies. The first examines the seven iron-stone weights found in Tomb 21 at Ayira Irini, Cyprus. He tests this set against both Mesopotamian and Syrian standards and judges that two marked weights appear to represent values in the Mesopotamian system. Following the same methodology, the second example studies four iron-stone weights from a hoard in Enkomi Area III, a group that remains problematic because these weights may represent two different systems. Thus, the metrological analysis can lead to different results in each case. However, De Benedictis notes that the X mark on the weights at both sites could represent one shekel of the Mesopotamia standard at least in the Cypriot environment.

Laetitia Phialon contributes a thorough study of Late Bronze Age pictorial kraters, focusing on the case of the Rude Style bell kraters found in Cyprus. She poses the question: Were the height and width (and thus the capacity) of a krater measured by the potter? Did they follow standard measurements even in different workshops, and could these measures have been part of a communication system between potters? The subject is complicated by there being a large number of imports from the Argolid as well as those produced on the island itself. After an exhaustive discussion and analysis of previous efforts to integrate quantitative data such as dimensions and proportions into the study of LBA pictorial kraters and, more specifically, Rude Style kraters, the author stresses how it is actually impossible to confirm that potters referred to any standard measurements in the manufacturing process of these kraters. As regards RS bell kraters, she concludes that there is little reason to believe that such a control happened during the manufacturing process since dimensions and capacities vary too much within each group. Rather, skilled potters may have worked with a model or shape template to visually and tactilely ensure that proportions were respected. Such caution seems fully justified by data in three Appendices, providing height, diameters, dimension and capacities of Rude-Style bell kraters, compared to those of other LBA pictorial kraters.

The last section of *Periploi 12* is dedicated to papers that discuss particular subjects both synchronically and diachronically. Agata Ulanowska presents a wide-ranging review of marks on textile tools. She points out the long history of marks especially on loom-weights, in many parts of Europe from the middle Neolithic to the recent past – a history offering potential comparanda for the possible communication practices conveyed through marked textile tools. Some notations might be explained as a personalization of tools including expressions of emotional user-tool attachments or instructions to weavers. In the Bronze Age Aegean, five types of marks appear: individual impressions (e.g. a cord, fingernail or leaf), seal-impressions, incisions, writing, and combined markings.

Seal-impressed tools are the most common (or most commonly recorded) yet only occur at a limited number of sites where they are either unique examples or a minority in tool assemblages, albeit small clusters stamped with the same seal are known from Palaikastro and Malia. Incised marks are simple and repetitive: one possible batch from Ayia Irini, Kea, comprises 13 of 15 discoid weights of uniform weight/thickness, all with incised diagonal lines, which were found together, making them a possible functional weaving set or a firing lot.

Judith Weingarten concludes a four-part study that began as an attempt to understand the glyptic role of the Minoan CAT sign (restored to its place in the Cretan Hieroglyphic script in Jasink 2009). Starting with its prominent appearance on a Hieroglyphic prism from Myrtos-Pyrgos (Ferrara, Weingarten, Cadogan, 2016), the subject was considered within a new methodology that examined Cretan Hieroglyphc seals from both epigraphic and glyptic standpoints. They suggested that the CAT could already have the value /ma/ (reading back from Linear B), and that the sign was already connected with the WOOL industry, thence evolving into the Linear A monogram «ma-ru», the ideogram (and likely Minoan word) for WOOL. The study next reconsidered (Ferrara and Weingarten, 2017) the structure of the so-called «formulas» and isolated signs on Hieroglyphic seals to raise the question if not only CATS but, in some cases, the ship, goat, and bovine signs were not only syllabic signs but visually, semantically and phonologically meaningful. The third study (Weingarten, 2017 [*Periploi 9*]) brought some later Linear A marked roundels and incised nodules into the discussion which, she argued, also had a place within the WOOL industry – ideas that are further developed and pulled together in *Periploi 12*, this fourth and final part.

Anna Sacconi deals with some methodological questions about potter's marks which may be described as isolated signs, incised or painted on any type of vase and in any era. Essentially, none of the signs are integral parts of any writing system, having no phonetic value nor representing neither syllables nor letters. The marks only had significance for those who drew them, and therefore their meaning totally eludes us. The elementary nature of many potter's marks explains why they sometimes overlap with the simplest signs (e.g., cross, trident, rectangle, branch, double-axe) of the Aegean scripts, whether Cretan Hieroglyphic, Linear A, Linear B or Cypro-Minoan. Sacconi presents a case-study from Malia (MM I and MM IIB) to demonstrate that, if one can undertake systematic research into the typology and chronology of potter's marks at the same site in specific periods, it then becomes possible to relate the marks, especially complex marks, to known script signs (in this case, in Cretan Hieroglyphic). This study suggests that, among other points of continuity, there is evidence for literacy among potters at Malia in MM I even in the absence of extant scribal documents.

Continuing her work on the relationships between measures and craftwork in Minoan Crete (*Periploi 9*, 3-40), Maria Emanuela Alberti addresses here a much-debated topic, the relationships between weighing measures and Mediterranean trade. In the framework of recent research on the development of Bronze Age European weights, her paper explores the role played in this process by the Aegean measures, i.e. by the Aegean agency. This involves the analysis of some important weight clusters of the LM I (from Akrotiri and Mochlos), and of LM IIIA-B (from Crete and Helladic mainland), as well the investigation of the possible parallels with the counting system used in Linear A and Linear B, resulting in new insights on Aegean precision weighing of the various phases.

The comparison with the published evidence from the Aeolian Islands (LBA Early) and Thapsos (Syracuse, LBA advanced), suggests that the contact with the Aegean could have been important for the formation of the local weighing systems.

The final paper, by Giulia Dionisio, illustrates a very different case of communication without writing: the *khipu* of the Andes, a recording device fashioned from strings used by several pre-Columbian cultures, specifically, in this paper, in Peru. From a totally separate part of the world, this case study raises some methodological issues concerning meaningful non-scribal communication practices, the topic of the present volume. First, with the *khipu* we face a completely alternative system of communication in semeiotic terms: the message and its support are not separated, as happens with marks on clay, for example, but constitute a whole: the object is the message and viceversa. In this perspective, the *khipu* is more like a token, though much more developed and complex. A *khipu* could register not only numerical data but also narratives, laws, ceremonies, and possibly also indicate sacred places, offerings, and other kinds of complex and articulate information through a series of colors and knots in combinations. It is also totally organic (made from colored wool and/or cotton) and this brings to our attention all the other possible systems of non-written and practical communication we probably have lost in our Mediterranean Bronze Age (and beyond).

The variety of case-studies surveyed in this volume raises questions about the broad nature of non-scribal communications, the many possible problems designed to be addressed, and the different socio-economic levels of the action and their actors. Non-scribal communication first becomes apparent among pre-state societies, such as in Neolithic and Chalcolithic Mesopotamia; however, some systems survive into the period of the Early States, when proper writing starts to be used (e.g. 4 th mill. Arslantepe), but also into the subsequent, more complex phases of state consolidation and organization. It is probably not surprising that many of the papers deal with Protopalatial Crete, a time and place known for its diverse political and cultural characteristics and peculiarities that arise from its often local, almost experimental approach to parallel communication codes. In a sense, Minoan-Crete becomes a kind of a touchstone for non-scribal communication practices.

It is increasingly apparent that, in the Bronze Age, formal writing systems could neither absorb nor entirely substitute for other forms of communication. While, in state societies, writing dominates official and administrative documentation, it nevertheless coexists with a wide range of other, parallel communication codes. The papers gathered in this volume explore and explicate the semantic and social space occupied by these «other» codes, stressing their important role even within an otherwise scribal framework. Such a-literate or semi-literate records have rarely been analysed in their own right, nor studied comparatively or diachronically: such an approach is precisely the strength of the volume.

Early Bronze Age

Decoding material communication tools in pre-literate Mesopotamian and peri-Mesopotamian world

Marcella Frangipane

Dedicated to Enrica Fiandra

Abstract: The paper analyses the changes occurred over time in some important tools of communication and transmission of social meanings, both ideological and practical, in the wide Mesopotamian world, in connection with the deep transformation of societies from egalitarian and cooperative, in the 6th millennium BCE, to hierarchical and centralised in the 4th millennium. The analysis covers a long time span from the Neolithic to early urban and State societies and a wide geographical region, including Southern and Northern Mesopotamia and the hilly and mountainous flanks surrounding it, the so-called «Greater Mesopotamia». After reviewing a variety of signs and symbols capable of conveying ideological and practical messages before writing – such as images on various materials, circulating in a variety of social environments with different purposes, and addressed to various subjects –, the author focuses on four main categories of objects: *Decorated pottery* as a «conventional» means of communicating and expressing group identity; *seal images*, which convey both identity and ideological messages aimed at expressing or reinforcing individual, family or group identities and/or social roles; cretulae, documenting and attesting economic transactions and their responsible; potmarks, as another type of sign with a practical value, likely aimed at identifying potters or their workshops at a time (4th millennium BCE) when ceramic mass production developed and the organisation of work for its manufacture changed substantially.

Introduction

I should like to begin by thanking the organisers of this volume for inviting me to make a contribution, and the opportunity to pull together a number of reflections I have made over many years regarding different types of pre- and proto-historic Near Eastern materials conveying messages of various kinds, as component parts of coded communication systems.

Some such systems (such as the three-dimensional messages conveyed by *tokens* and their containers – the so-called hollow spherical *bullae*) were replaced between the end of the 4th and the beginning of the 3rd millennium BCE by the first forms of writing, consisting initially of pictographic and then cuneiform signs; others types of material transmission of information coexisted with writing, complementing and enlightening each other. I am referring in particular to seals and sealings (*cretulae*) which continued to perform their practical administrative function as well as their symbolic and communicative function, side-by-side with writing as tools for performing and endorsing transactions, providing

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material evidence of their performance, and for communicating an ideological message to everyone involved, both actively and as onlookers.

Addressing this particular matter, I am duty-bound to pay tribute to Enrica Fiandra, whom we recently lost, for her extraordinary scientific contribution to this field, and for providing a scientifically faultless account of the intrinsic documentary function of the *cretulae* from their earliest origins, and above all for teaching us a rigorous method for analysing and decoding this material[1].

The Fiandra method, which is now internationally acknowledged and appreciated, explicitly demonstrates the close proximity of archaeology to history, not only in its purposes – since archaeological analysis must obviously examine the material evidence of human behaviour to reconstruct and understand the cultural, political and social history of past societies – but also in terms of methods.

For the archaeologist has to analyse material objects conveying messages and meanings by applying an analytical methodology similar to the historian's when analysing a text, as Mario Liverani has clearly pointed out in his brilliant book «From Text to History in the Ancient Near East»[2]. In his conclusions, Liverani points out that every text (to which I would add every form of encoded material medium of communication) contains (a) an intentional message, (b) an implicit message, linked to conventions and traditions, (c) things «unsaid» or removed from the message that may sometimes be as important as what is actually said, and, lastly (d) a selective and biased message, when the communication tool is in the hands of those who held power[3].

Another important aspect for a semiological analysis of the message, whether recorded in the form of text, or conveyed implicitly through symbols and physical objects, is to ask with Liverani «who is the sender and who is the principal behind it, who is the (direct or indirect) target, why and to what end was the message transmitted and in what context, what channel or medium of communication was used and, above all, what code was used»[4].

I consider that these Liverani's methodological reflections on the analysis of a text apply equally to the analysis of all other objects that communicate information, ideologies and identities, both as media bearing images and symbols, and in themselves just by being present as meaningful objects in the context of a given material culture. Decoding them requires seeking to identify repetitive signs or images that were traditionally established conventions, as opposed to innovating representations intended to convey narrative and ideological contents. Equally important is the type of medium used to channel the messages (everyday objects, objects intended for an elite, public, or sacred sphere), and their wide or targeted contexts of use, which may also indirectly suggest senders and recipients.

The Near East has yielded abundant materials of all these classes of objects, in some instances as early as the Neolithic. For this short presentation, I have deliberately chosen classes of objects with different chronologies, some belonging to periods prior to the Bronze Age, because I consider it useful to compare different forms of non-scribal

[1] Fiandra 1975;1981.
[2] Liverani 2014.
[3] Liverani 2014: 297-298.
[4] Liverani 2014: 297.

communication in order to better appreciate their links to different types of societies and social needs and systems, and above all to highlight the radically changing purposes of the communication as the social, economic and political structures changed. The radical difference between the pre-hierarchical and pre-state phases in the 6th and 5th millennia BCE, and the phases in which hierarchies and political powers emerged in the 4th and early 3rd millennia (the so-called Early-State societies, at the end of which writing was invented) is powerfully reflected in the type and the purpose of the messages conveyed as well as in the senders and recipients. Bottom-up views of the social and natural world and symbols referring to group identity were prevalent in the earliest phases, while in the early-state phases the messages were predominantly top-down, addressed to the population, and especially to the subordinate social categories, by the people in power. Economic transactions managed by this central power, and no longer by the community or individual families, with ever more activities involving a variety of different categories of people and officials, demanded an increasingly complex system of administrative communications conveyed through new classes of objects in addition to the traditional seal impressions. Some such objects were the so-called complex *tokens*, the hollow spherical *bullae* that contained them, numerical tablets, and, at the end of the process, pictographic tablets as well[5].

As far as the geographical area is concerned, I want to talk about a wide-ranging, but closely interconnected region that shared similar developments and was the theatre of intensive relations over millennia: the so-called Greater Mesopotamia, which includes the whole of southern and northern Mesopotamia and their related neighbouring areas to the north/northeast (south-eastern Anatolia and the southern Caucasus), and to the southeast (Susiana and Elam).

Objects bearing coded messages before writing

The pre-scribal messages make up a network of communication channels on several levels, from the *representations of world views* shared by one or more communities, to expressions of *group identity*, to *ideological messages* designed to consolidate a certain social order, to specific *practical messages*. Each of these levels uses different forms of expression and media:

a. Figurative images (human and animal) and symbols recognisable by the whole group on commonly-used media, such as ceramics or figurines, were aimed at representing a shared universe;

b. Symbolic and conventional images (shared codes) also on commonly-used media, such as pottery, expressed cultural identities;

c. Figurative and narrative images with powerful ideological significance, depicted on media mainly circulating in public environments (economic, political, or cultic/religious) – such as seals, paintings, or reliefs –, conveyed the representation of the world desired and imposed by the elites;

d. Objects resulting from specific actions of which they were the evidence, such as clay sealings (*cretulae*), conveyed information of a practical administrative nature;

e. Coded, incised (potmarks) or three-dimensional signs, such as *potmarks* and *tokens*

[5] Le Brun, Vallat 1978; Nissen, Damerow, Englund 1990; Fiandra, Frangipane 2007.

respectively, also conveyed messages of a practical order, but referred to the identification of the producers or the quality and/or quantity of certain items.

I shall try to outline the features, functions and communicative potential of four main categories among those described above: decorated pottery, seal images, *cretulae*, and potmarks. I will not take into consideration *tokens*, which are certainly materials of great interest, because I have nothing to add to what has already been masterfully written by Denise Schmandt-Besserat[6]. For each of these categories, there were substantial differences in the nature of the messages, the purposes with which they were transmitted, the senders and recipients.

«Conventional» communication: Painted pottery as an expression of group identity in the Neolithic and early Chalcolithic

The quintessential object conveying conventional messages[7] shared by a community, and generally also «understood» by other communities interacting with it, is decorated *pottery*, especially painted pottery, which spread widely in the Near East and Mediterranean, and characterised the Neolithic societies of Greater Mesopotamia and Anatolia in the 7th and 6th millennia BCE. As I have already said, I shall be considering this type of communication through objects even if it refers to very early periods not covered by the subjects of this book, because I believe it is one of the best examples of unintentional «conventional communications» that can offer a useful tool for comparing and analysing different communication means and systems developed in the course of pre-literate periods. The expression of a common identity was a function that was probably also conveyed by other aesthetic expressions, such as hair-style and clothing, of which however no trace remains to us.

The various pottery assemblages of Greater Mesopotamia were marked by «styles» that differed from region to region and changed over time, but shared the complexity and standardisation of the repertoire of motifs and decorative syntaxes. I believe that the unconscious purpose of creating such conventional codified repertoires, which today enable us to recognise defined «cultural areas», was to mark the identity of the communities that produced and used them in the interaction with other communities, making them recognisable even in those times. The senders and the recipients of the message partly coincided, in that they were mainly the communities as a whole, which were at the same time producers and users of the pottery conveying the message; but the addresses were also other communities coming into contact with them.

Decorated pottery, and painted pottery in particular, spread from when the first sedentary agricultural societies had become established, following shortly the beginning of pottery production, and characterising, with the emergence of specific repertoires and styles, communities more and more firmly established in increasingly defined territories, although their boundaries appear to have been fairly blurred, fluid, and permeable. Thus, in the 7th and early 6th millennia, the so-called proto-Hassuna and Hassuna pottery characterised the north and especially the north-east of Greater Mesopotamia, Samarra pottery was typical of central Mesopotamia, while early Ubaid pottery (phases 0-2)

[6] Schmandt-Besserat 1992.
[7] Verhoeven 2002.

became established in southern Mesopotamia (Fig. 1).

All these products, however, overlapped with continuous «trespassing» in various directions, indicating their intensive and widespread circulation over most of the territory, albeit in numerically limited quantities.

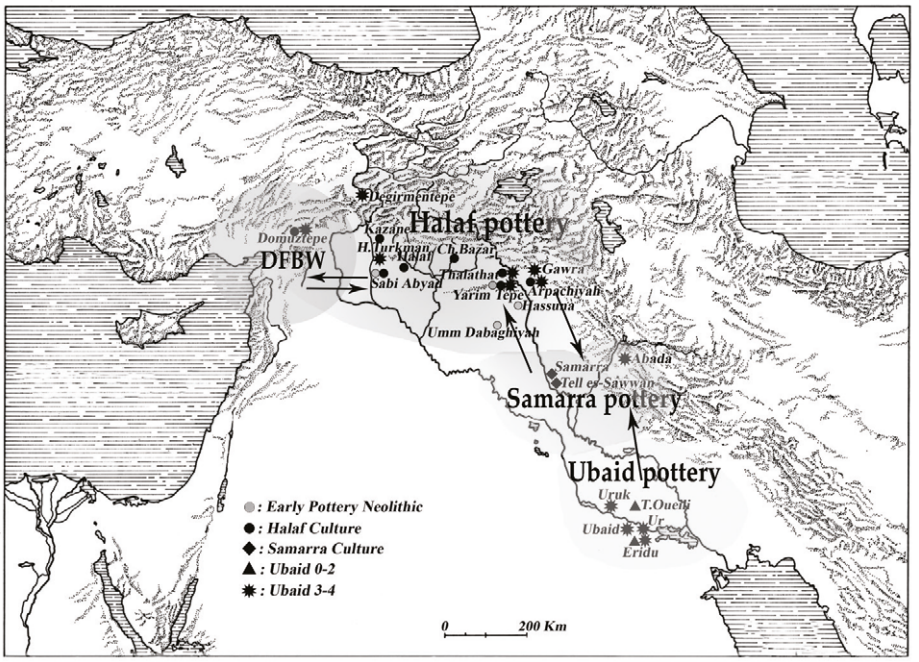


Fig. 1. Main distribution areas of the principal Late Neolithic/Early Chalcolithic pottery styles in Greater Mesopotamia

The areas where these ceramics were established and circulated were to expand and overlap during the 6th millennium BCE, when the so-called Halaf pottery spread over the whole of northern Mesopotamia and south-eastern and eastern Anatolia as a result of the multiplication and very wide spreading of small egalitarian and culturally homogeneous communities, perhaps under the pressure of a substantial and continuous increase in population[8].

Painted pottery became the vehicle of a highly codified symbolic language, which I think was an attempt to express and consolidate the identity and unity of these groups (Fig. 2). The motifs were mainly geometric, and, more rarely, narrative scenes of hunting or dancing women were depicted on some vessels which evidently portrayed common social practices with which these groups identified.

The vessels in circulation were mostly open shapes, namely serving vessels, such as bowls and plates, and archaeometric analyses conducted on materials from nearby sites in northern Mesopotamia have revealed that they were all locally made. Their widespread circulation cannot therefore have been due to ceramic exchange nor to trading in foodstuffs or other products that could certainly not have been carried in small open vessels.

[8] Nieuwenhuyse 2007; 2013; Nieuwenhuyse *et al.* 2013; Frangipane 2013.

My interpretation is therefore that there must have been the desire to reproduce and reaffirm identity symbols in each of the new community being formed, driven by demographic pressure, by splitting from mother-groups[9].

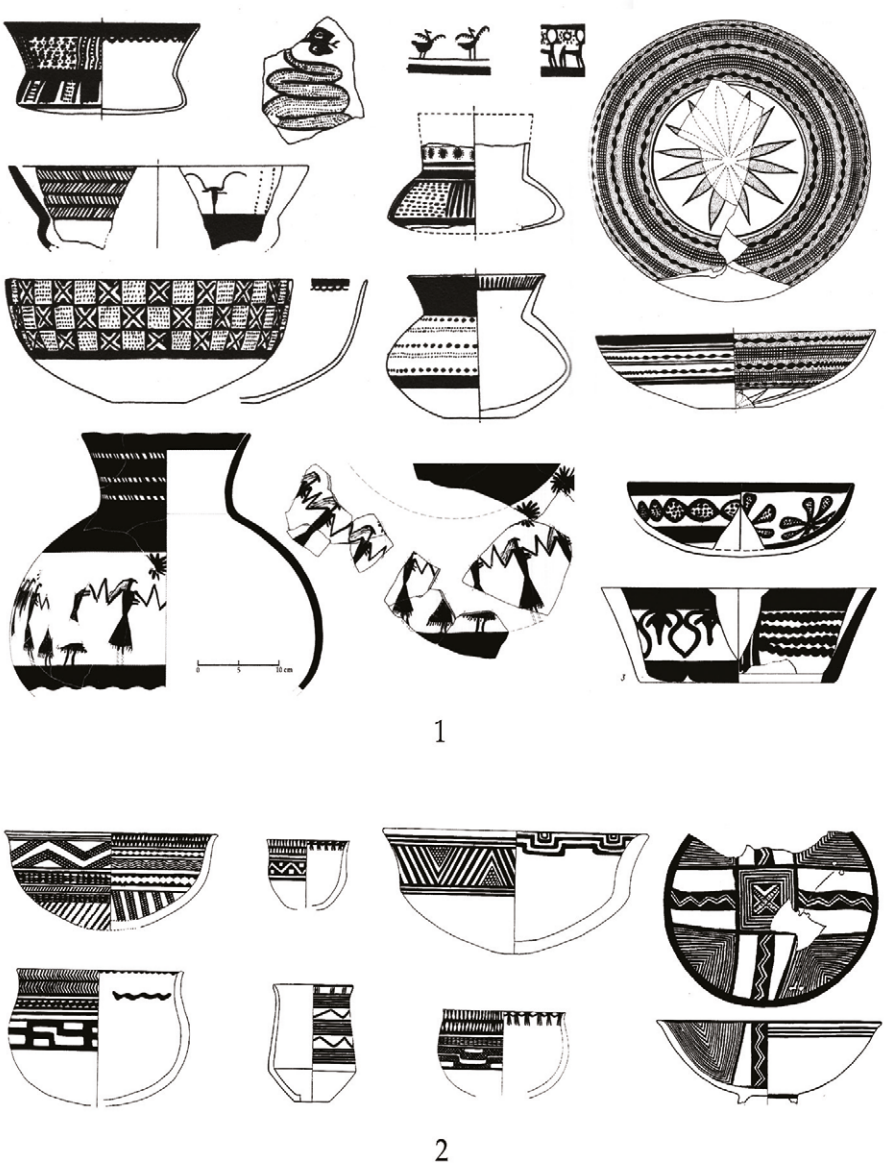


Fig. 2. The language of painted pottery in Central and Northern Mesopotamia. 1: Halaf pottery; 2: Samarra pottery. (drawings from: Forest 1996; Merpert, Munchaev 1993; Frangipane 1996)

The tradition of the production of these ceramics may well have been propagated by the physical movement from one community to the other of some of the potters themselves (perhaps women or community members who may have married in other

[9] Frangipane 2013.

villages, according to the exogamic marriage practices that were frequent in that type of society)[10]. The codification of the symbols may have become the way of strengthening and publicly recognise the ties between villages, consolidating cohesion and peaceful relations. Serving vessels were able to represent these identities and propagate their visibility on the occasion of meetings between communities or special events, in which everyone carried and displayed the icons of their identity.

These wide and frequent movements of people for a variety of reasons might also explain how some of these powerfully identifiable pottery items were found over long distances, far away from their place of origin, as is the case of typical Samarra ceramics found in northern Hassuna contexts[11], Halaf ceramics in Eastern Anatolian and Samarra contexts[12], or the so called Black Burnished Ware from Cilicia and Amuq found at Neolithic sites in eastern Anatolia (Fig. 1)[13].

An interesting evidence that may indirectly confirm this interpretation of the role played by painted pottery in the Neolithic and Early Chalcolithic periods is the fact that, starting from the 5th millennium BCE, in parallel with the emergence of more hierarchical and politically-structured societies, with central leaders and institutions governing the communities, decorated ceramics began to lose their importance and consequently their high quality and complexity. As central political entities with increasingly defined power and territorial control were formed and the communities became increasingly linked to them by obligations and mutual benefits, real or fictitious, these political institutions probably gradually became the identity benchmark of those communities. This identity was less and less manifested through symbols and aesthetic conventions previously identifying cultural and ethnic groups, and was increasingly expressed through shared ideologies and common political and civic affiliation.

In the Ubaid period of phases 3 and 4 (5th millennium BCE), while somewhat hierarchical organisations and stratified systems, in which new leaders displayed their authority and power in temples and sacred places, were established in the South and spread throughout the Mesopotamian world, the decorative repertoire showed a gradual simplification and painted pottery in general quantitatively declined[14] (Fig. 3).

This gradual loss of the social value of ceramics as means of flaunting membership and cultural identity became much more pronounced when urbanisation and the emergence of centralised and highly structured political entities developed during the 4th millennium BCE. In this period, ceramics production focused mainly on its utilitarian value and the speeding up of manufacturing, to produce large quantities of pottery rather than quality vessels, which required a great deal of work to be invested. Decoration almost disappeared, except for a particular type of decorative treatment of the surfaces on jars (the so-called *Reserved Slip*), which probably retained a symbolic and identity value referring mainly to the «high-status» world of the Mesopotamian elites, seen as a meaningful feature to be emulated by the leaders of the neighbouring communities. The ceramics widely shared by the different Greater Mesopotamian societies were either

[10] Forest 1996.
[11] Tekin 2005.
[12] Breniquet 1996; Carter *et al.* 2003.
[13] Balossi Restelli 2006; Ozdogan 2011.
[14] Carter and Philip eds. 2010.

these sophisticated elegant items, often linked to the elite spheres and to the new central storage practices – such as the aforementioned Reserved Slip jars and the spouted bottles – or they were the product of similar manufacturing procedures determined by new mass-production requirements. The most widespread examples of the latter were the so-called chaff-faced wares, containing a great deal of straw tempering required for fast-firing, often in the open air, and large quantities of roughly conical mass-produced bowls mainly used for the distribution of meals in public environments (the latter differing by period and from area to area by specific shapes, dimensions and manufacturing methods)[15].

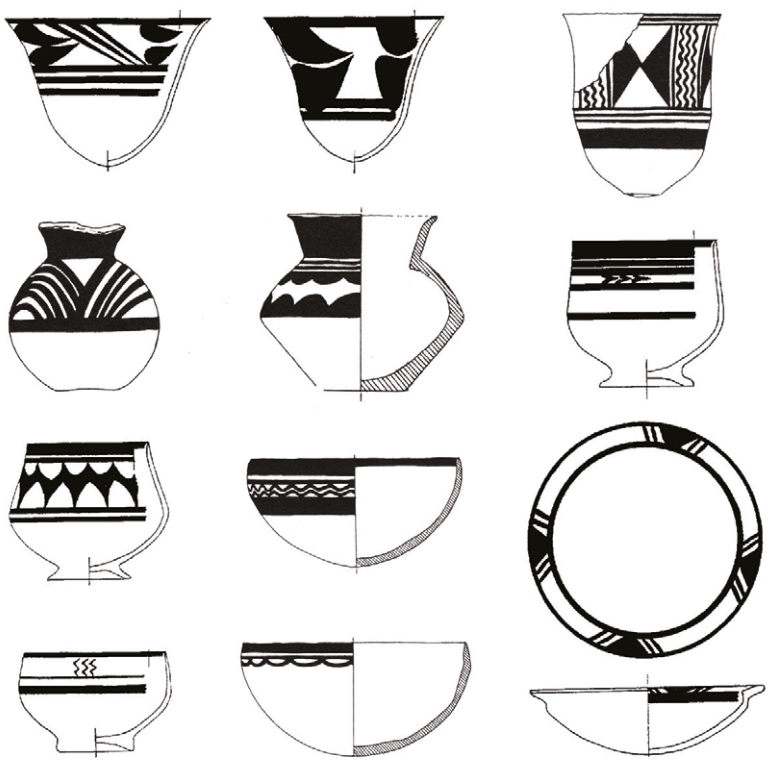


Fig. 3. The simplification of painted motifs in the Ubaid period (drawings from Forest 1996 and Frangipane 1996)

Ideological communication: The role of seal images

The second and most significant category of objects bearing and transmitting messages is, of course, the *seals*, as a medium for both conventional/iconic and evocative/narrative images. Their purpose, in the former case, was exclusively to represent group or individuals' identities (the holders of the seals); in the second case, they also served to convey messages of an ideological nature. The images therefore had a different function depending on the periods to which they belong, and the kind of social, economic, political and administrative organisation at the time (pre-state/egalitarian or Early

[15] D'Anna, Guarino 2010.

State /hierarchical). In every instance, the addressees and the senders of the imagery represented on the seals were different, because the seal owners (who were also the persons commissioning the images on the seals), besides using their impressions as a kind of «signature» to be recognised by «other» participants in the transactions, in some cases also transmitted an ideological/narrative message to other persons in the administrative environment.

The images conveyed different meanings and purposes when the operators of the administrative transactions were the people who held political (and economic) power, or their delegates, and who therefore tended to affirm the dominant ideology of power and their own idea of the social order. With the emergence of urbanisation in Mesopotamia and the birth of competitive city-states in the late 4th and early 3rd millennium BCE, some seals also identified the cities (known as «city-seals»), emphasising inter-city interactions of various kinds, such as the collection of commodities and the movement of goods from city to city, or the participation of various urban centres in cultic events[16]. These types of seals occurred in period of transition, at the beginning of the introduction of writing, and many of them were affixed to tablets as well as to *cretulae*.

Seal use and seal design in the Neolithic and Ubaid periods (7th-5th millennia BCE)

The custom of affixing seals began very early in the northern Syro-Mesopotamian region in 7th millennium BCE egalitarian Neolithic communities, characterised by a mixed agro-pastoralist economy and a collective and communal organisation of food production and distribution[17], perhaps due to the need by some groups to leave the village seasonally (for pastoralism or organised hunting), and to entrust their crops to others during their absence[18]. The most representative site is Sabi Abyad, on the Balikh River in western Jezirah, where hundreds of *cretulae* have been found in communal granaries[19]. In this context, and generally in the few Neolithic sites where seals or seal impressions have been found, the images consist of highly standardized geometric designs or plant motifs in geometric style, and more rarely of single animals, usually goats[20] (Fig. 4). In the case of Sabi Abyad, where as many as 65 different seals have been identified by their impressions, these motifs fell into iconographic groups with the same main repetitive theme and with very small differences between individual seals within each group (Fig. 4.1). Given that these were collective stores to which all or many members of the community must have had access, my interpretation is that the various standardised iconographic groups could have been the symbols of families or clans, and that the slight differences between individual images within the same iconographic group may have identified individual members of those extended social units[21]. The images were therefore a communication code through which the people responsible for the food withdrawal were identified by those responsible for the stores and perhaps by all other members of the community.

[16] Matthews and Richardson 2019.
[17] Frangipane 2016.
[18] Akkermans and Duistermaat 1996.
[19] Akkermans ed. 1996.
[20] Von Wickede 1990.
[21] Frangipane 2016.

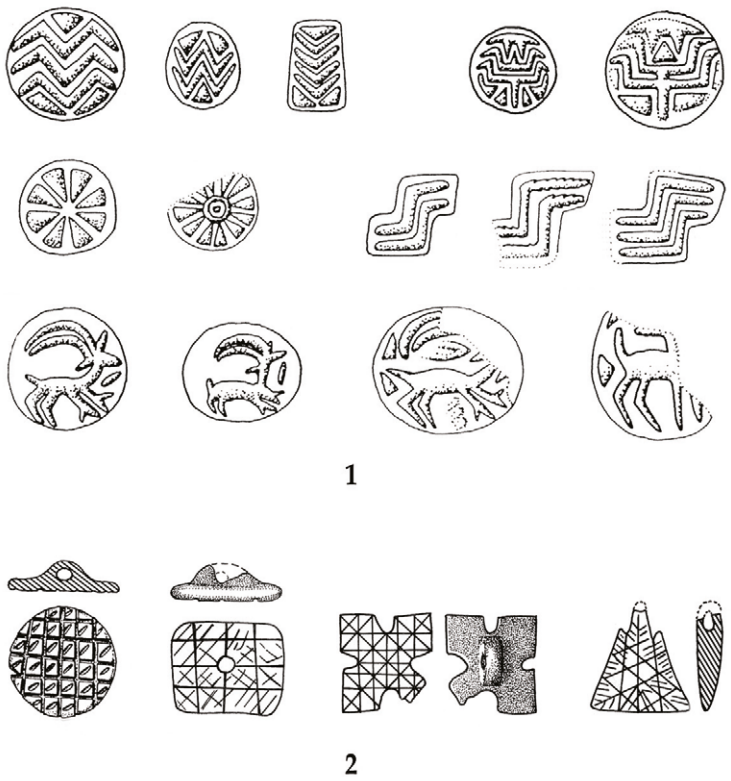


Fig. 4. Neolithic seal designs. 1: From Sabi Abyad (Duistermaat 1996); 2: Halaf seals (from von Wickede 1990)

In the Ubaid period and in Late Chalcolithic 1-2 (5th millennium BCE), the use of seals to control the circulation of goods and identify the persons responsible for the transactions spread throughout Mesopotamia and neighbouring regions. However, both the actors and the receivers differed, in relation with a radical change occurred in the economic and social organisation. When the administrative system, that had been invented and tested in the north to manage foodstuffs collectively, was adopted in the south in profoundly different societies based on the family management of subsistence economy, it became an instrument of control in the hands of socially privileged groups, who perhaps had greater resources at their disposal and whose members often also acted as the community leaders. In the Ubaid sites *cretulae* and seals were no longer found in communal stores but in the houses and, in some cases, in temple and cultic areas where food was redistributed ceremonially and under a leadership control.

It was the influence of the southern Ubaid society that had introduced substantial changes in the northern societies, in terms of their social and economic organisation, their material culture and also their symbolic spheres, in a process of multilateral interactions and mixing of cultures in which the southern socio-economic model nevertheless prevailed. Administrative control over the management of goods by means of applying seals was adopted everywhere, in both north and south, in a family-run environment, which suggests that the higher-ranking families probably possessed more resources (in land and livestock) and had begun to exploit the labour of the less privileged members

of society. This is the only way of explaining why seals and *cretulae* were widespread in many houses, with a major concentration of *cretulae* in the principal dwellings. This has been more clearly documented in the northern villages that have been more extensively excavated, and particularly in the Terminal Ubaid village of Değirmentepe in the Upper Euphrates valley in eastern Anatolia[22] and in the LC 1-2 levels (XII to IX) of Tepe Gawra, east of Upper Tigris[23]. It is also interesting to note that a large concentration of *cretulae* have also been found, in this period, in the early temple areas of Gawra XIII and VIII, as well as in the public area at Susa[24].

These radical structural changes were accompanied by substantial changes in seal imagery. There was a sharp decline in the quantities of geometric motifs, while figurative images of animals and humans became more common, sometimes in relation to each other in pastoral or hunting scenes, or in iconographies depicting either groups of animals or, more rarely, only humans, often performing some coded actions with presumably ritual or symbolic value, such as preparing food in large containers or mating acts (Fig. 5).



Fig. 5. 1-9: Seal designs from the Ubaid and early phases of Late Chalcolithic (LC1-2): 1-7 from Tepe Gawra; 8-9 from Susa (re-drawn by A. Siracusano from original drawings in Tobler 1950 and Rothman 2002, for Gawra, and from Amiet 1972 for Susa). 10: Seal impression from Arslantepe period VII (LC4) (drawn by T. D'Este)

The humans were frequently represented with stylised animal heads (elongated snouts and sometimes horns) that seem to evoke a shamanic world, also suggested by some of the animals that appeared for the first time in the repertoire, such as snakes (also used as fillers), and more rarely lions, vultures, and scorpions, all elements that were to become established and recurrent in the later 4th millennium glyptics. In these contexts the image of the «lord (or lady) of the animals» appears, consisting of a human being,

[22] Esin 1994.
[23] Tobler 1950; Rothman 2002.
[24] Amiet 1972; Le Brun 1978.

usually with an animal head, dominating animals (mostly snakes, sometimes also lions or caprids), which he/she holds in or touch with his/her hands[25] (Fig. 5, *8-10*).

These images exemplify a vision of the natural and social world that was expanding over a vast area from Susiana to Luristan, Iraqi Kurdistan and eastern Anatolia, including the entire Zagros and Taurus mountain ranges and their foothills, with local stylistic differences, but with powerfully codified images that referred to a commonly-shared sphere of ritual practices and knowledge.

Fifth millennium glyptic iconographies were therefore no longer merely visual codes identifying the operators in sealing operations, but they now conveyed a new idea of society and the world, which was probably widespread and shared, but which needed to be continuously reaffirmed. They portrayed images of everyday life, but invested with a sacred aura that consolidated ideological paradigms. It is interesting to note that it was with the emergence of temples and sacred areas used as places for the exercise of authority that «heroes» leaders began to be depicted with symbolic features of a shamanic or sacred nature, lying somewhere between the divine and the human.

Changes in the content and meaning of the seal images in the era of State formation, 4th millennium BCE

Southern Mesopotamia and Susiana

In the second half of the 4th millennium BCE (Late Chalcolithic 3-5, Middle and Late Uruk periods), while the Ubaid and Late Chalcolithic 1-2 glyptic tradition developed more or less continuously in the northern societies of Greater Mesopotamia, albeit with differences from region to region, the seal imagery changed substantially in the urbanised and highly centralised societies of the South. The visual expression of a prominent figure manifested in the earlier depiction of the «Lord of the Animals» turned into a complex ideological narrative designed to affirm the new social order and legitimise the role and authority of the new rulers. The larger surface of the cylinder seals, now clearly prevailing in southern sites, encouraged narrative representations[26] (Fig. 6). The images celebrated the duties and prerogatives of the «King/Priest» and the acts of homage and submission of their «subjects»: processions of individuals bringing goods to the temple, workers filling the stores, individuals kneeling, bound, and being lashed before the King/Priest[27] (Fig. 6, *1-3*). The latter scenes have been commonly interpreted as scenes of prisoners of war, but they may simply have been warnings of the sanctions and punishments that awaited anyone who disobeyed and deviated from the social rules established and ideologically imposed[28].

On the seals of the Late Uruk period there were also scenes depicting shepherds leading their flocks to pasture, craftsmen at work, work in the fields (Fig. 6, *4-6*), but even these images, which were at any rate more numerous in Susa than in Uruk, no longer depicted the actual daily lives of a community of equals, but exalted the image of

[25] Amiet 1972; 1980.

[26] Pittman 1994.

[27] Amiet 1961; Brandes 1979; Boehmer 1999.

[28] The reason for saying this is that I do believe that organised war against external enemies was not a central or very important factor yet in the life of these Early State societies. Nissen 2015; Bernbeck 2009.

a hierarchical society emphasising different classes of «professions» dominated by the leader/ruler who held the power to control resources and labour.

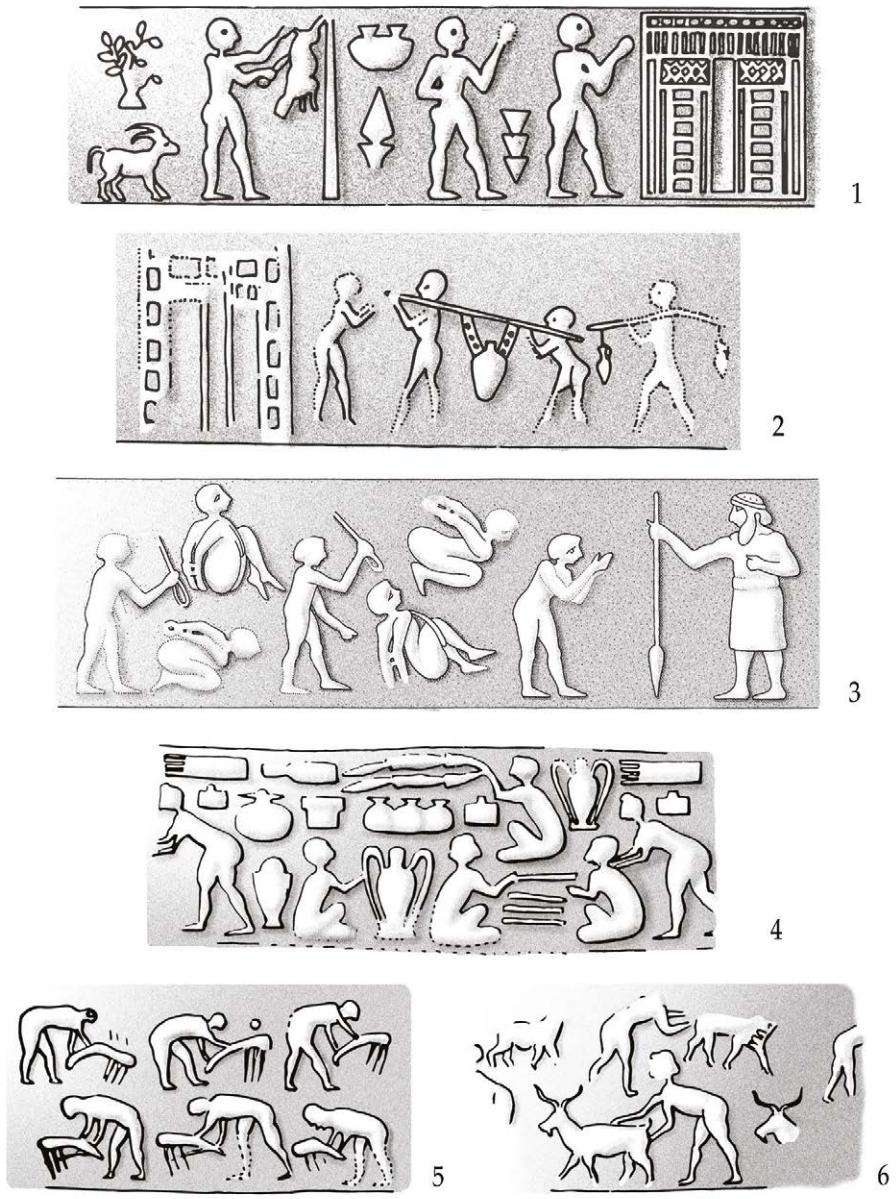


Fig. 6. Seal designs from Uruk and Susa in the Late Chalcolithic 5 period (Late Uruk). 1-3, from Uruk; 4-6 from Susa (redrawn by A. Siracusano from original drawings in Brandes 1979 and Boehmer 1999)

While this certainly reflected the actual emergence of a new economic power of the ruling elites, based on the control of the staple economy and above all the control of labour, the real hierarchical structure of Mesopotamian society may have been even more

complex and stratified than was inferable from these images[29]. The visual communication transmitted through the seals probably represented the point of view of those in power and it may have been led and oriented by those central authorities who also embodied the political and economic power and who exercised control over the transactions and the administrative management. The iconographies of this Late Uruk glyptics seem therefore to have played the role later played by the celebratory texts.

The northern regions of Greater Mesopotamia

The glyptics in the northern regions[30], having a long and established tradition since the Neolithic in both the use of the seal and the iconographic repertoire of images and symbols, changed less radically than in the south in the 4th millennium. Stamp seals continued to prevail, even though cylinder seals were also present, and the most frequent designs continued to emphasise the representation of animals, even though the scenes became more complex and the decorative syntax was more sophisticated and composite (Fig. 7)[31]. Some compositions were codified and became repetitive, such as pairs of opposite or overlapping animals, or animals rotating on the circular surface of the seal, with standardised filling motifs perhaps repeated with a symbolic value. Among the animals represented, in addition to the persistent depiction of the more common deer and caprids, there were now more lions, snakes, vultures and, less frequently, scorpions, all of which had already started to appear in Ubaid and Late Chalcolithic 1-2 glyptics[32]. These animals seem to constitute a reference to the natural world, and emphasise both the idea of nature to be dominated (dangerous wild animals) and that of nature as a provider of resources to be exploited (domestic animals and game to be hunted, such as gazelles and deer).

Humans were represented much less frequently than in the south, and when they were, they usually formed part of scenes with animals or with elements relating to work activities. At Arslantepe, for example, in the palace phase (Period VIA, 3400-3200 BCE, corresponding to LC5 or Late Uruk in Mesopotamian chronology), in the few images in which the human figure appears, it is depicted with animals or in connection with agricultural work and the transport of goods, perhaps foodstuffs, in sacks and containers[33] (Fig. 7, *7-9*). The iconography of people hand-carrying containers, which was quite frequent on the cylinder seals of Mesopotamian glyptics (Fig. 6, *2*), was interestingly emulated and re-elaborated in a local style, adapting it to the surface of the stamp (Fig. 7, *8*). There were no representations of the «Temple» or of sacred places and symbols, nor of elements clearly qualifying «seats of power», and there were no scenes depicting the subjugation of human beings, or the delivery of offerings and tributes, although these probably must have taken place.

Images explicitly referring to paramount figures and the exercise of power in general are very rare. In the previous Period VII, dated to the middle of the 4th millennium

[29] Frangipane 2007; 2018a.

[30] I am not considering here the so-called Uruk «colonies» in the Middle and Upper Euphrates valley, which are closely linked to Southern Mesopotamia.

[31] Pittman 2003; Reichel 2002; Frangipane and Pittman 2007.

[32] McMahon 2009; 2016.

[33] Frangipane and Pittman 2007.

BCE (Late Chalcolithic 3-4) and immediately preceding the palace, a large number of *cretulae* were found in two temples designed for the ceremonial redistribution of food. In this assemblage, only two images out of hundreds of seal impressions seem to refer to prominent figures, which are reminiscent of the theme of the «lord or lady of animals» with snakes, thus recalling an ancient tradition shared with the South (Fig. 5, *10*)[34].



Fig. 7. Seal designs from the northern regions of Greater Mesopotamia in the late phases of Late Chalcolithic (LC4-5). 1-10 from Arslantepe, period VIA (drawings by M. Cabua); 11-12: from tell Brak (redrawn by A. Siracusano from Pittman 2003 and McMahon 2009).

[34] Balossi Restelli 2019; Frangipane 2019b.

In the following period of the Palace (VIA, LC5, 3400-3200 BCE), characterised by an extraordinary architectural and political innovation, in which an explicitly «secular» power was established for the first time[35], the subject of the «hero» lord of animals disappeared, and the ideology of power was represented by one single clear image – out of more than 220 different seal designs – in which a leader/ruler is seated on a threshing sledge pulled by a bull and driven by a coachman, followed by a procession of people with pitchforks[36] (Fig. 7, *10*). The scene, which is depicted on one of the few cylinder seals found at Arslantepe, contains symbolic and iconographic references to a similar representation found at Uruk on a cylinder seal, now in the Metropolitan Museum of New York, and on a small plaque as well[37], but the Arslantepe depiction was in a totally local style. Although in this image the role is quite clearly defined iconographically as that of a chief/leader, he is nevertheless depicted not in a ritual/religious act or context, nor in images expressing the exercise of force, but in the act of performing an activity connected with agriculture, albeit in what is presumably a ceremonial form. The image was perhaps intended to highlight the attributes of the chief as a propitiator of the harvest (he leads the threshing), rather than of an authority exercising and imposing force on the population.

In the glyptic imagery of other sites in the north, there were even less clear references to power. At Tell Brak the most explicit reference to an outstanding figure was the image of a man fighting and killing a lion (Fig. 7, *12*). Perhaps in northern Mesopotamia the desire to communicate the image of the ruler as a «strong man» defeating the adverse forces of nature still prevailed ideologically, although at Tell Brak the political role of the central authority must have certainly been very well structured and developed. Perhaps the desire to maintain the traditional idea of the ruler as a «protector» prevailed as a means to maintain consensus. In any case, the sacred and religious aspects, so powerful in southern Uruk sites, are almost completely absent from the northern seal imagery.

North and South: A comparison

There was therefore a substantial difference between north and south in the ideological message conveyed to the people frequenting the places of power, even if the organisational structure and the degree of political and economic centralisation were very similar. I believe that this difference in the visual communication, on the one hand, may have been due to the enduring strength of a very old iconographic tradition in northern glyptics that influenced the production of new images and limited the capacity for innovation; on the other hand, deeper and more structural factors must certainly have had a great influence on the whole concept of power and its representation in southern and northern societies. The latter, although differing from each other, were probably based on a less complex stratified and hierarchical social structure, with weaker religious and sacred legitimacy of the authority compared to southern societies.

The diversity in the visual language of ideological communication found in the main Early State sites of Greater Mesopotamia, despite the strong structural and organisational affinities in the political and economic spheres, seems to clearly reflect different worldviews

[35] Frangipane 2018b; 2019a.
[36] Frangipane and Pittman 2007.
[37] Littauer and Crowel 1990; Sürenhagen 1985.

and a different ability of the central power to manifest itself explicitly and to legitimize the imposition of its authority by using coercive means. In Uruk and Susa, the images conveyed by the seals show the political leaders (the King/Priest) and the hierarchical organisation of society, made up of different social categories, professions and workmen, although there was a different emphasis between the images at Uruk, more focused on the exaltation of political and religious power (Fig. 6, *1-3*), and those at Susa, more designed to represent different activities and categories of workers (probably those under central control) (Fig. 6, *4-6*). At Brak, conversely, even in these phases, the role of the person in authority displayed in the seals appears to have been still that of a beneficial «hero» (Fig. 7, *12*), while at Arslantepe the leader bestows benefits by promoting and coordinating agricultural production (Fig. 7, *10*). It is not clear how far this leading role in agriculture of the Arslantepe ruler was conceived as part of its ceremonial or religious prerogatives, but the absence of any explicitly sacred symbols and images in seal designs was well in keeping with the overall prevailing secular character of the Arslantepe Palace and its activities, and would seem to indicate a tendency towards a more «secular» vision.

How much these differences expressed in the top-down communication systems reflected or resulted in a different ability of northern and southern societies to maintain political control and population consensus towards the new emerging ruling classes is a matter for investigation. But the different outcomes these 4th millennium early state organisation experiments had in the subsequent 3rd millennium developments in various regions of Greater Mesopotamia require further reflections on this point.

An immediate connection can be made between the solidity and development potential of a socio-political system such as the Late Uruk one in Lower Mesopotamia and the deeply rooted hierarchical organization of its society, which was not only the basis for legitimising a strong central power[38] but also for the development of a complex urban economy. The substantial inequalities in the Southern Mesopotamian societies may have needed to be strongly legitimated by a solid religious ideology, fostering a powerful visual communication capable of reflecting and imposing the new social order. The 4th millennium southern Late Uruk societies indeed transitioned without shocks into the 3rd millennium more mature and highly urbanised State, and this complex visual communication expressed through images and material objects were soon transformed into a codified system of signs, leading to the early emergence of writing[39].

Early State societies in northern Mesopotamia, conversely, only experienced a transition to more mature State forms in the heavily urbanised Khabour basin at the beginning of the 3rd millennium, while the other regions underwent a profound crisis and transformation. In the Khabour and nearby cities, glyptic art, which had previously maintained a fundamentally traditional repertoire, was radically innovated in the 3rd millennium, developing more ideologically explicit, differentiated and complex visual communications. The marked urbanisation of sites such as Tell Brak and Tell Leilan, and the consequent complexity of activities and increasing number of interacting people, led to the appearance of the first numerical tablets already at the end of the 4th millennium, but actual writing had not yet emerged there.

[38] Frangipane 2007; 2018b.

[39] Schmandt-Besserat 1992; 1996; 2007; Nissen 1986; 2015; Nissen, Damerow, Englund 1990.

At Arslantepe, the persistence of a social structure that was probably still essentially rural and poorly stratified, as well as the lack of urbanization, must have affected the shape of the political authority that was trying to forcefully impose itself in the new palatial system. This perhaps favoured the retention of the traditional visual and iconographic system and the lack of a visual communication explicitly oriented at imposing the new political and social order. The large number of non-urban groups interacting with the palace (shepherds, farmers, other cultural groups) was mostly evidenced in the glyptics by the establishment of different styles, presumably distinctive of the different groups or communities[40]. The push towards an early «secularisation» of political relations, together with the scarcity of visual references to the sphere of the sacred, in my opinion also signifies that power and consensus were weakly embedded in the religious sphere. The fact that the powerful 4th millennium central authorities at Arslantepe did not create any new images conveying a new concept of power in the glyptics imagery – with the exception of the scene of the leader on the threshing sledge taken from a Mesopotamian motif – may have been both a consequence and a cause of the weakness of the system and its early collapse around 3200 BC.

Pragmatic communication: Cretulae and Potmarks

The third group of objects I shall be considering here comprises two quite distinct categories, which are however both conveying practical messages: *cretulae* (clay sealings) and *potmarks*.

As Enrica Fiandra[41] has clearly pointed out and as has been documented in great detail at Arslantepe[42], *cretulae* convey information of an economic-administrative nature regarding the transactions performed (each object-*cretula*) and the individuals responsible for them (the impressed seals).

The meaning and purpose of the *potmarks* are conversely still debated, but they certainly also communicate a practical message relating either to the use of pottery or, more likely, to the identification of craftsmen or workshops in the manufacture process.

Cretulae as «documents»

Enrica Fiandra's long-term passionate, creative and rigorous research have shown beyond any doubt that the clay-sealings bearing seal impressions (*cretulae*) were not only a means of guaranteeing the integrity of the goods contained in the sealed containers, but above all constituted a kind of unwritten «document», certifying, like a receipt, that a transaction had taken place[43]. The sealing practice, indeed, was not so much aimed at preventing stealing (breaking a *cretula*, made of dry clay, would not have deterred a thief), but at testifying that no one had illegally opened and taken goods from the container. After breaking and removing the *cretula*, this was not dumped immediately, but a fragment of it (probably the largest one) was retained for a time as a record containing information about the transaction performed and the identity of the operator. This hypothesis is

[40] Pittman 2007; Frangipane 2016.
[41] Fiandra 1968; 1975; 1981; Ferioli *et al.* 1994.
[42] Frangipane *et al* 2007.
[43] Fiandra 1981; Ferioli *et al.* 1994; 1996.

supported by the fact that, where large quantities of *cretulae* have been found *in situ*, in many instances some of them had been piled up in a corner or in small spaces, where they had presumably been set aside temporarily.

This practice has been already documented in the Neolithic storehouses at Sabi Abyad[44] and has been fully confirmed by the in-depth research conducted by Enrica Fiandra, Piera Ferioli and myself on the thousands of *cretulae* found in *situ* in the fourth millennium palace at Arslantepe. The study of this material took more than twenty years and its results have offered new insights into the economic and administrative organisation of Early State societies before writing[45]. The extensive excavation of the various functionally diversified rooms in the palace has brought to light a wealth of *in situ* materials, which have enabled us to reconstruct three main phases in the administrative procedures (Fig. 8): (1) the phase in which the *cretulae* were affixed to the containers, represented at Arslantepe by the items found on the floor of the «distribution storeroom» A340 near the mouth of large vessels; (2) the phase when the removed *cretulae* were temporarily set aside, attested by a large number of them found in a corner of the same room (Fig. 8, *1-2*) and in the collapse layers filling it (Fig. 8, *4*), probably fallen from an upper storey where they might have been stored for a while (Fig. 8, *2*); (3) the phase in which they were finally discarded in a protected place inside the building complex, after being checked and perhaps accounted, as is suggested by the material stratification in the narrow space A206, where more than 5000 *cretulae* fragments had been thrown in succession in homogeneous groups, each bearing the repeated impressions of the same container types and seal designs (Fig. 8, *3*, *5*) This very peculiar stratification suggests that the *cretulae* must have been grouped together for checking and accounting purposes before being finally dumped[46]. It is no coincidence that the *cretulae* were usually dumped in «secure» places inside the buildings, or even buried under the floors when these were re-plastered[47], thus taking them out of circulation as a kind of «discarded archives».

The *cretula* was therefore a kind of «receipt», containing information on the persons performing the transactions and on how many of them each individual had performed. The validation function of the *cretula* and its ability to provide a tangible proof of the operations carried out perhaps still remained in force even in literate periods, but, before writing, it was the main means of transmitting administrative information. It was in fact in pre-literate contexts that we have so far clear evidence that *cretulae* were systematically retained temporarily for a given period, which may have corresponded to a sort of «administrative period». At the end of this time, in the absence of writing, they had to be discarded to avoid confusion with the *cretulae* of the following period. We have no clear archaeological evidence that these procedures also continued in scribal phases, but they were certainly an essential means of controlling economic transactions and conveying information in pre-scribal periods.

The system was perfectly functional and rational from the very beginning (the same practices have been evidenced at the Early Neolithic site of Sabi Abyad – 7th millennium

[44] Akkermans 1996; Frangipane 2016.

[45] Frangipane *et al.* 2007.

[46] Frangipane *et al.* 2007: 415-477.

[47] Fiandra 1968; 1975. The same practice of burying *cretulae* under the re-plastered floor is also attested at Arslantepe in a large room close to the pre-palace temples of Period VII (3500-3400 BCE) (Frangipane, 2019b).

BCE)[48] and continued in use for millennia, although of course the complexity of the administrative materials and the information conveyed increased with the growth in the number and variety of transactions, individuals acting in different economic contexts and officers in charge, who may also have included delegated persons.

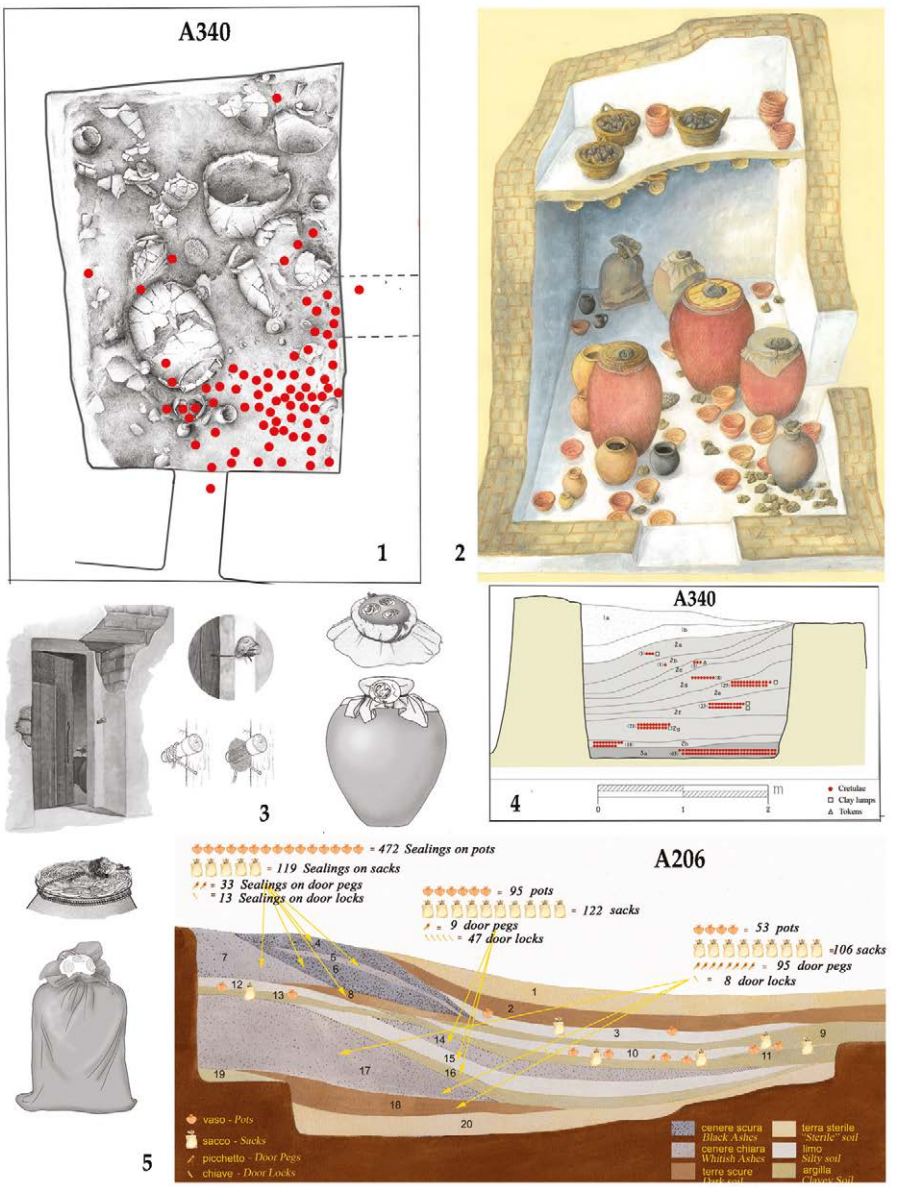
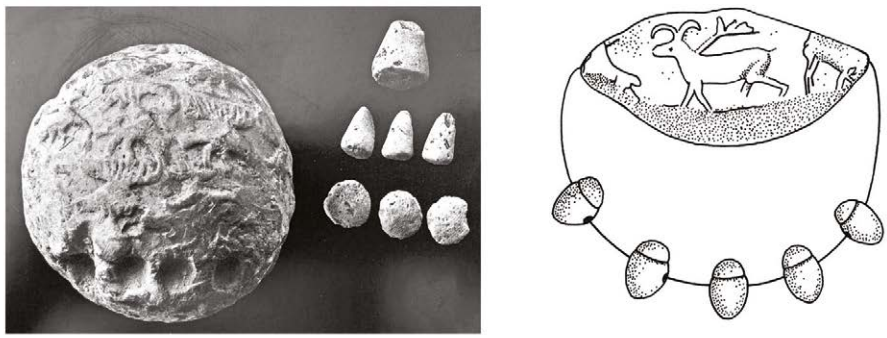


Fig. 8. Arslantepe, period VIA palace (LC5). 1: Plan of the «redistribution storeroom» A340 with materials in situ - red dots indicate *cretulae*; 2: Reconstruction of room A340 and its contents (drawing by A. Siracusano); 3: Sealed objects reconstructed by E. Fiandra and P. Ferioli on the basis of the *cretulae* back side impressions (drawing by T. D'Este); 4: Stratigraphic distribution of *cretulae* fragments in room A340; 5: The stratigraphy of the *cretulae* dump in A206 with the distribution of diversified groups of *cretulae* based on sealed objects (from Frangipane *et al.* 2007)

[48] Akkermans *et al.* 1996.

In the second half of the 4th millennium, in the southern Uruk sites and in the so-called Uruk «colonies» along the Middle Euphrates (Habuba Kabira, Jebel Aruda, Hacinebi), besides the *cretulae*, also other materials appeared: *solid ovoid cretulae*, *hollow spherical cretulae* (the so-called «*bullae*»), as well as complex *tokens* of various shapes, further diversified by means of signs engraved on their surfaces[49] (Fig. 9).



1 2

Fig. 9. Hollow and solid *cretulae* (so-called *bullae*) from Uruk sites. 1: Hollow bulla with tokens from Uruk (from Nissen *et al.* 1990, fig. 6c); 2: Solid *cretula* from Habuba Kabira (hypothetical reconstruction with tokens published by Schmandt Besserat 1996)

The tokens were often found inside the *hollow cretulae*, which appear as a forerunner of sealed envelopes bearing information. The fact that these other types of materials that had not sealed anything were also marked with seal impressions is a further demonstration that they were bearing information in their own right. The *hollow cretulae* contained information inside (probably relating to the quantity and quality of goods transported from one place to another) (Fig. 9, *1*), while the *solid ovoid cretulae*, often hanging from something by means of a string passing through them, may have been an authentication or validation tool by themselves (Fig. 9, *2*).

This increasing complexity of material communication in the administrative field led to the emergence of writing at the very end of the 4th millennium BCE. Many of these new types of administrative non-scribal materials then disappeared, but not the well-rooted *cretulae* that continued sealing containers and doors, and whose essential function of material proof of the transactions performed was not lost.

Potmarks

With the term *potmarks*, I am only referring here to a type of simple marks, usually consisting of a combination of lines and dots, incised or impressed on the surfaces of common Late Chalcolithic pottery, generally hastily fashioned and fired at low temperatures, probably in the open air[50] (Fig. 10). These ceramics were almost all straw-tempered (to be suitable for fast and hasty firing) often with coarse straw emerging on

[49] Schmandt-Besserat 1992; 1996; Nissen *et al.* 1990; Le Brun, Vallat 1978; Frangipane *et al.* 2007: 15-23.

[50] There are also other types of marks incised or engraved on different types of objects that have been interpreted as «tags» (McMahon 2020). These also constitute a transmission of practical information, but linked to administrative activities.

the surface (*chaff-faced ware*) and share similar technical and manufacturing features in different sites over a wide geographical area, from Syro-Mesopotamian regions to Eastern Anatolia and the Caucasus[51]. These ceramics were mostly mass-produced and I consider that their similarity on such a large scale was due to similar patterns of manufacture procedures, rather than to the sharing of aesthetically cultural traits.

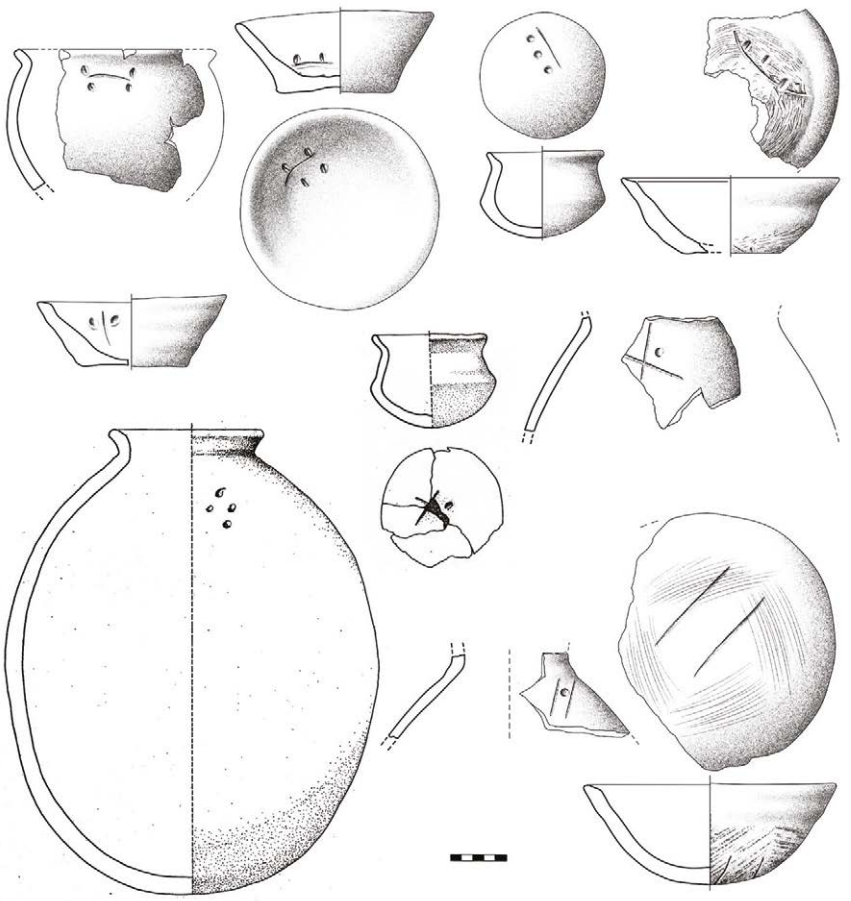


Fig. 10. Late Chalcolithic pottery with *potmarks* from Arslantepe period VII (LC3-4)

There has been much debate about the meaning of these very simple and repetitive signs. Some scholars have suggested they were a possible indication of the contents of the vessels (quality or quantity), but it must be observed that the same mark was placed on many different categories of vessels, of different sizes, ranging from bowls, to jars, to pithoi, thus making this hypothesis unconvincing. Moreover, the large amount of material found at Arslantepe in the Late Chalcolithic 3-4 levels and the thorough study conducted on them have clearly shown that, although the marks were found on many vessels of different classes, they were only applied to a small number of specimens

[51] Trufelli 1994; Frangipane 1993; Oates and Oates 1993; D'Anna, Guarino 2010; 2012; Museibli 2016; Balossi Restelli 2019.

in each class (about 10%)[52]. These considerations point to the interpretation previously advanced by Alba Palmieri[53], who saw them as marks put by the potters not so much as their «signatures» as the authors of quality products, but rather as the marking of their products in some phases of the manufacture process that would have had to be performed collectively. The technical features of the Late Chalcolithic pottery suggest that the firing was most probably done in the open air, and it is possible that the potters brought their products together for drying or firing at certain times of the year, as is still done today in communities that make ceramics in a domestic and traditional way[54]. In this case, the pots had to be stacked up, and the potter, or the workshop, would plausibly have placed their own mark, simple but recognisable, on the last pot in the pile, thus marking the belonging of all the other vessels underneath, in order to then be able to collect them when the firing was finished. This procedure, which is also practised by traditional African communities[55], would fully explain the marking of about 10% of each category of pots.

The presence of similar, albeit very elementary, marks on the ceramics of different sites over a vast geographical area that was occupied by related, but not identical cultures in the first half of the 4th millennium BCE (among them: Leilatepe in Azerbaijan, Tell Brak in northern Mesopotamia, Arslantepe on the Turkish Upper Euphrates), indicates that they were not so much a specific language with specific meanings, but a system to convey practical information related to a similar way of organising ceramic production.

A few concluding remarks

This very brief overview of the main material communication tools used in the Mesopotamian and Syro-Anatolian world throughout the pre- and protohistoric phases, shows that, as might have been expected, a radical change occurred in the type of messages, in their purposes, in the contexts of their transmission, and in the senders and receivers, in connection with the momentous transformation from egalitarian to hierarchical and politically centralised societies. This is seen in the radical change of seal imagery from the Neolithic to the Late Chalcolithic, in the disappearance of the complex but codified conventional communication expressing group identity though ceramic decorations and other aesthetic elements, and in the simultaneous emergence of a well-defined ideological message, driven and oriented in various ways and degrees by the new leaders in power.

The operation of the administrative system using *cretulae* to exercise control did not basically change, but it became more and more complex as the number of transactions and that of parties operating in the centralised economies increased. It is no coincidence that it was precisely in Southern Mesopotamia that new instruments such as the *solid ovoid cretulae* and the *hollow spherical cretulae*, together with complex *tokens*, were to

[52] Trufelli 1994; Frangipane 1993; Balossi Restelli 2019.

[53] Palmieri 1985.

[54] Angle, Dottarelli 1990-91. I have also personally observed such a procedure many years ago in the village of Uslu in the Elazig province, in Eastern Anatolia. Here the pottery was made by the women of the village on slow wheels, was left to dry at home, and then carried for communal firing to a place in the open air just outside the settlement, where a large bonfire was lit about twice a year.

[55] Gallay 1970.

emerge creating a fully-fledged administrative language, which would directly lead to the birth of writing.

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Connectivity at Early Bronze Age Çukuriçi Höyük

Barbara Horejs, Christoph Schwall

Abstract: The Early Bronze Age I Period (3000-2750 BC) in the Aegean and in Western Anatolia marks a crucial step within the gradual formation of proto-urban societies during the 3rd millennium BC. However, this development has to be seen as the result of a dynamic socio-cultural process, which had already started in the previous millennia. The integration of communities into stable communication and exchange systems affected the organisation of settlements as shown by the case study of Çukuriçi Höyük. The excavation results demonstrate a high level of craft specialization on a household basis as well as the regional and interregional connectivity of its metal-producing communities. The sites' location at the central Aegean coast of western Anatolia offers an ideal environment for terrestrial and maritime communication routes. Our contribution focuses on different layers of communication evident in objects, raw materials, practices and technologies. Several aspects will be discussed, such as the use of a standardized weight system, metal and textile production, pottery technologies, and raw material procurement strategies.

Introduction: The site

The prehistoric tell settlement of Çukuriçi Höyük (Fig. 1) is located about 7.5 km from the west Anatolian coast, near the ancient metropolis of Ephesus. Situated in a valley, the site is embedded in an intensive agricultural area, surrounded by fruit plantations[1]. Paleogeographical research has shown that in prehistoric times the site was only c. 1.5 kilometers away from the sea coast[2]. Therefore, Çukuriçi Höyük with its location on a lagoon is considered to be a coastal site[3]. Occupation of the site was attested in the Neolithic (ÇuHö XIII-VIII: c. 6680-5970 calBC), the Late Chalcolithic (ÇuHö VII-Vb: c. 3350-3050 calBC) and at the beginning of the Early Bronze Age 1 (ÇuHö Va-III: c. 3000-2750 calBC)[4].

In terms of local history, the results for the Early Bronze Age Çukuriçi Höyük probably represent a huge leap in knowledge. As explained in detail elsewhere, until our systematic excavations and geoarcheological surveys, there were virtually no solid archeological data

[1] A summary of the site, its location and the project can be found in Horejs 2017b.

[2] Compare Stock *et al.* 2013; Kayan 2014; Stock 2015; Stock *et al.* 2015.

[3] Horejs *et al.* 2010: 9; Horejs 2017b: 11-12.

[4] Horejs 2017b: 17, fig. 1.5.

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on prehistory in the vicinity of Ephesus[5]. The data obtained not only extend the history of the area around Ephesus by several millennia but also, most importantly, provide new insights into the societies of the Neolithic, Late Chalcolithic and Early Bronze Age.

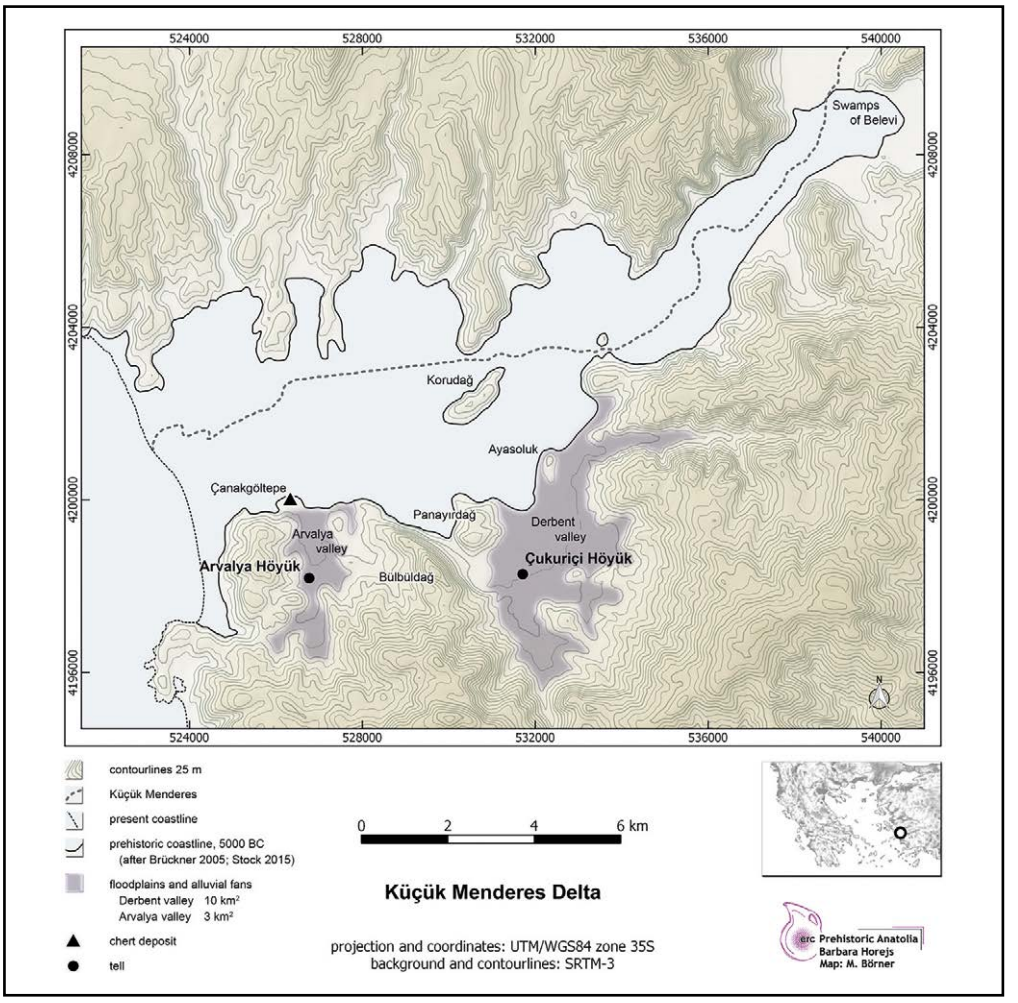


Fig. 1. Çukuriçi Höyük situated on the prehistoric lagoon based on the results of paleogeographic studies (Map: ERC Prehistoric Anatolia/M. Börner; compare Horejs *et al.* 2015: 298, fig. 1)

Evidence and data: The economic background

The tell was densely populated with residential and workshop areas during the Early Bronze Age period (Fig. 2). At that time, Çukuriçi Höyük could be described as a metallurgical production center to judge by the intensity, quantity, quality, and output of manufactured goods. Bronzes, mainly arsenical, were produced, as well as, occasionally, objects made of gold, silver, lead or tin bronze in 49 metallurgical workshops and production areas[6]. The end products included tools, weapons, jewelry, and other items

[5] Galik and Horejs 2011; Horejs 2017b: 11-16.

[6] Horejs 2009; Horejs *et al.* 2010; Horejs and Mehofer 2015; Horejs 2016; Horejs *et al.* 2017; Mehofer 2022.

of everyday and individual use; additionally, there were also ingots used for bartering, which were discovered in the settlements via casting molds. We thus gain an insight into a society semi-specialized in metallurgical production around 2950/2900-2800/2750 calBC (ÇuHö IV-III), just before tin bronze production became widely established in the region. The specialized expertise of the Çukuriçi Höyük metallurgists is reflected in their production skills, enabling them to produce such as the standardized arsenic-copper alloy, which M. Mehofer has analyzed technologically and chemically in detail[7]. The homogeneous composition of the copper ores used, whose isotopes suggest that they originate from the region, indicates a standardized production procedure. Intensive geoarcheological deposit surveys by G. Borg and D. Wolf were able to identify various ores in the wider area but could not identify the specific copper deposit used in the Early Bronze Age[8]. Thus, it remains only a hypothesis that the processed copper ores were mined in the immediate vicinity, although this, nevertheless, seems likely in our view. The extent to which the raw material was supplied by maritime connections or overland can only be conjectured. Until further evidence comes to light, both the nearby Çeşme Peninsula with its known ore deposits (maritime supply routes) and the further hinterland of Çukuriçi Höyük (terrestrial routes) with its geological conditions are potential sources[9]. The identity of the potential customers of the Çukuriçi copper produced remains an open question which will only be answered by future lead isotope analyses on arsenic bronzes from other sites. While the Çukuriçi Höyük metallurgical production center provides new insights into local production chains in this craft, the analyses of other artifact groups, their technologies and raw materials also point to other important subsistence activities of the Çukuriçi inhabitants.

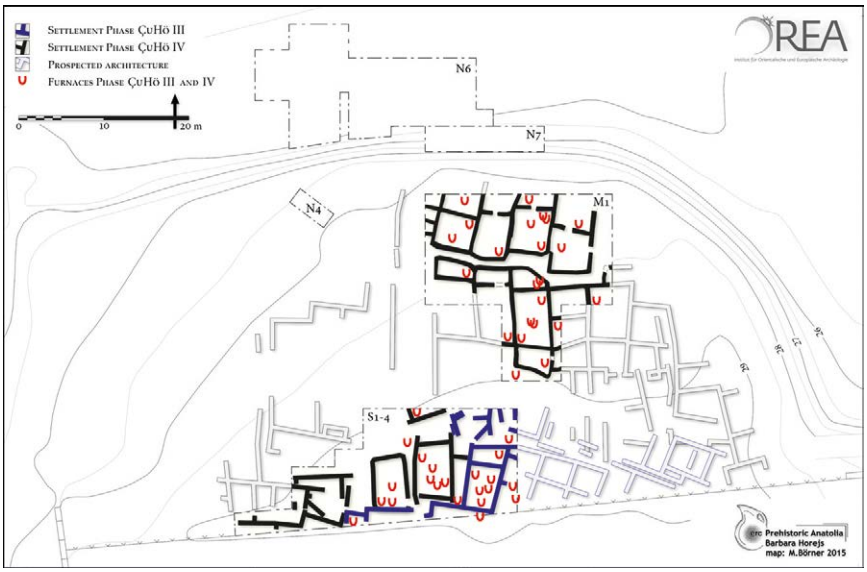


Fig. 2. Excavated Early Bronze Age settlement phases ÇuHö IV and III with furnaces and related workshop areas marked (Plan: ERC Prehistoric Anatolia/M. Börner; after Horejs 2016: 254, fig. 3)

[7] Mehofer 2014; Mehofer 2022.

[8] Borg and Wolf 2012; Wolf in preparation.

[9] Wolf in preparation.

The petrographic and geochemical analyses on pottery carried out by L. Peloschek prove the use of local clay deposits in the immediate vicinity of the tell for vessel production, tools, and technical equipment made of fired clay[10]. M. Röcklinger's investigations into Early Bronze Age pottery show the dominance of both local and customized production for the needs of the Early Bronze Age inhabitants[11]. In the context of the simultaneous production of ceramics at other sites[12], a deliberately local technology is nevertheless emerging, despite the large-scale stylistic comparability which can certainly be associated with the sociocultural aspects of traditions, practices, and identities of these societies[13]. C. Britsch's studies of textile production attest local weaving and spinning in various households of the Early Bronze Age community[14]. The weights and whorls used in these studies point to deliberately different types of textiles as end products of domestic production, which were woven using various techniques. The archeozoological investigations, in turn, suggest, due to the slaughter age of the sheep, that the wool was sourced from outside and was brought to the tell for further processing[15].

The diet of the Early Bronze Age inhabitants can be reconstructed based on the archeozoological and archeobotanical analyses, which will be summarized here for both settlements[16]. The food consisted of mollusks, fish, domestic animals, game, grains (einkorn, emmer, barley, wheat), legumes, fruit (wine, figs, olives), nuts (almond), wild plants, and herbs in different frequency and distribution. Cereals, lentil stews, sheep, and goats represent the main part of the communities' diet. From the more than 20,000 faunal remains from the Early Bronze Age settlements that were studied by A. Galik and S. Emra, more than two thirds of the mammals are caprines, with a slight dominance of goats over sheep, and considerably fewer are cattle (12.5%), fallow deer or domestic pigs. Interestingly, birds and rodents played almost no role. The detailed analyses of the experts also provide a wide range of information, for example on strategies for herd management, hunting practices, slaughter ages, waste management, landfill patterns, harvesting, cultivation practices, and food preparation.

The inhabitants of Çukuriçi Höyük practiced agriculture and gardening. However, the processing of the grain did not take place within the village on the tell, as the phytolith analysis has shown. The relevance of seafood is connected with the long tradition of the Çukuriçi settlers, which began with their founding pioneers in the early Neolithic in phase ÇuHö XIII around 6700 calBC, and the practice of fishing and shellfishing continued until the abandonment of Çukuriçi Höyük[17]. Targeted and specialized fishing in different water zones and the variety of applied techniques[18] in the Early Bronze Age prove the community's knowledge of and connection to the Aegean Sea, which probably shaped their daily life in many ways and represents an important aspect of their identity. Finally, the tendency towards goat and sheep herding should be emphasized: this type

[10] Peloschek 2016a; Peloschek 2016b; Peloschek 2017.

[11] Röcklinger and Horejs 2018.

[12] Alram-Stern and Horejs 2018.

[13] This regional differentiation becomes particularly clear in the archeometric case studies discussed by various authors in Alram-Stern and Horejs 2018.

[14] Britsch and Horejs 2014; Britsch and Horejs 2020; Britsch in press.

[15] Emra *et al.* 2020.

[16] Horejs *et al.* 2011; Galik *et al.* 2012; Galik 2014; Horejs and Galik 2016; Galik 2019; Emra *et al.* 2020.

[17] Horejs *et al.* 2015; Horejs 2019.

[18] Britsch and Horejs 2014.

of herding increased in the early 3rd millennium BC, while that of cattle and pig became less frequent than previously. On the one hand, these changes towards small animal husbandry fit well into the overall development of livestock farming around the Aegean Sea; on the other hand, they are probably also associated with socioeconomic changes that affected the forms of social organization and their structures, at least indirectly[19].

At Çukuriçi Höyük we see a direct proof of the close economic relations within the community in the practiced division of labor and the use of different raw materials, which presuppose local, regional, and supra-regional reference systems. The proven subsistence bases of agriculture, horticulture and animal husbandry took place mainly outside of the settlement due to lack of space. Although we have no data on the layout of the grain fields and orchards, we can assume that they were in the immediate vicinity of the tell (Fig. 3).



Fig. 3. Reconstruction of the Early Bronze Age settlement of Çukuriçi Höyük (Graphic: ERC Prehistoric Anatolia/OREA, 7Reasons Media GmbH)

The investigations of the botanical micro and macro remains as well as missing phytoliths suggest that the further processing of harvested cereals also took place in the surrounding area or at least outside the densely populated area. Here a clear change to the previous Late Chalcolithic working structures, in which the further processing of food (e.g. drying of fruits) was carried out directly within the settlement, can be seen[20]. As far as the excavated and analyzed data show, the Early Bronze Age inhabitants used various installations for food storage. The structures built for food storage include floor installations and coated pits, supplemented by pithoi as storage vessels. These ground-level storage systems could certainly have been complemented by other systems in the uprising architecture that have not been handed down to us due to conservation issues. The storage of food on and under the roof is still a common practice today.

[19] On the socio-cultural interpretation of the change from cattle to small animal husbandry from a cultural-anthropological perspective, see Cveček 2022.

[20] Schwall 2018: 164-165.

Thus, dependency on individual animal or plant species and the problems of associated seasonal shortages was certainly balanced and reduced. At the same time, the increasing number of inhabitants in Early Bronze Age Çukuriçi Höyük probably also supported increasing specialization in individual skills, since, at least economically-theoretically, more persons from a group were available for it than at the beginning of the Bronze Age. However, a demographic increase over the course of several generations does not appear to have significantly altered the socio-political foundations of community organization. The underlying structure of domestic units without a clearly recognizable, prominent group or elite remains and could even be understood as a constant and stabilizing factor of society. When approaching the point, it has to be noted that there is a significant gap in the sources regarding the social structure of Çukuriçi Höyük, which could only be closed if necropolises were to be investigated. Even the detailed evaluation of the excavated settlement by all currently possible analytical methods does not allow any conclusions to be drawn about individuals, which is why many questions about social and demographic developments remain open. The mighty alluvial deposits in the immediate vicinity of the settlement hill prevent a targeted search and excavation of the areas, assumed to be probable cemeteries. Their evidence in the greater area of Ephesus can be assumed without doubt, although their localization remains nebulous. The Archaeological Museum of Selçuk, for example, contains numerous completely preserved ceramic vessels, copper objects and pieces of jewelry that can be dated to the older phases of the Early Bronze Age, but whose exact origin is probably unknown. So, on this subject we can hope for future discoveries and research that will correct or extend the picture presented here to the Early Bronze Age.

The Early Bronze Age communities of Çukuriçi Höyük knew how to utilize the natural resources of their lagoon, as has been shown in numerous detailed geoarcheological analyses. In addition to the exploited clay deposits, this is particularly evident in the lithic materials that D. Wolf and M. Brandl have examined in detail. A summarizing evaluation of the lithic raw material analyses illustrates that directly accessible local rocks were those mainly used[21]. Depending on the quality of raw materials for a particular use or the procurement of prestigious materials, regional or supra-regional deposits were also used, as can be seen in volcanites for grinding stones, jadeite for polished axes or obsidian for lithic stone tools. The selection of and access to special raw materials illuminate the embedding of the Çukuriçi communities in various exchange networks of the Aegean and western Anatolia[22].

Life at and abandonment of Early Bronze Age Çukuriçi Höyük

The Early Bronze Age settlements of Çukuriçi Höyük create a picture of functional and pragmatic societies. Since the buildings, rooms, open spaces, and paths of the two settlement phases ÇuHö IV and III are characterized by similarities rather than differences, the main community structures between 2950/2900 and 2800/2750 calBC represent continuity rather than discontinuity. The most important elements can be observed in both settlement phases, which is why they will be considered together.

[21] Schwall *et al.* 2020.

[22] Bergner *et al.* 2009; Sørensen *et al.* 2017; Schwall *et al.* 2020.

It seems that the inhabitants wanted or had to increase the area they could use on the tell at the beginning of phase ÇuHö IV. The further planned development indicates an organized community that initially built generously proportioned and independent core units[23]. This Early Bronze Age nucleus would be condensed into an agglutinating settlement in the following 50 to 75 years at the maximum. In a total of three phases, including extensions and annexes, a complex settlement unit with multi-spatial buildings, squares, courtyards, and paths was created. This rapid densification reflects the building activities of two to a maximum of three generations during which the expansion of communal units (families, clans) may be visible. In the context of these considerations, at least some of the (family) descendants continued to use the ancestral homes, which were expanded accordingly by extensions. On the one hand, we see in this a successive enlargement of the original building units and thus also of a potentially extended building site (Fig. 4); on the other hand, we can also see in this the spatial continuity of individual groups in parallel with the core buildings, which suggests possible traditional ties (of a family?) to the concrete site.

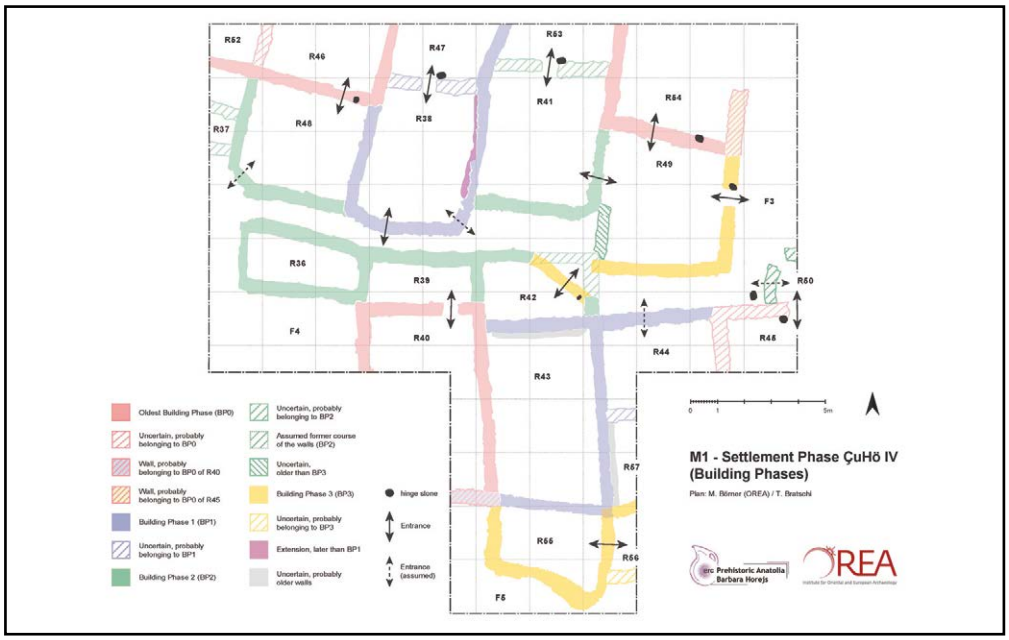


Fig. 4. Plan showing the different building phases of the Early Bronze Age architecture unearthed in trench M1 (Plan: OREA/M. Börner and Bauforschung Bratschi/T. Bratschi, after Grasböck *et al.* 2023, pl. 80)

The development of the buildings shows a strong connection of individual (relational?) groups to a building site and the original core buildings, which were subsequently extended and enlarged by a maximum of three generations. This attachment to a piece of land can certainly be interpreted as a claim and thus indirectly reflects a group-related or family property that has grown or developed differently over the decades. An interesting observation in this context is the respect of new generations of builders for older architecture: the tons of stones from underlying buildings and pavements of

[23] For a detailed study of the architecture, see Grasböck *et al.* 2023.

older settlements were not used or recycled but left in place. The extent to which the prehistoric communities of Çukuriçi Höyük dealt with the past in a special way, such as the formation of local traditions and identities, can only be speculated on but seems to be quite conclusive.

A further consequence of this strong architectural densification is the merging of detached buildings to form a series of interlinked building complexes. Initially, independent small groups now lived and worked closer together, suggesting a tight connection between the social units. These close relationships can also be indirectly developed using communal paths, squares, storage facilities or waste pits. The convergence of the architectural units into a dense and interwoven settlement structure also reflects the social and economic living conditions of the Early Bronze Age inhabitants. In this respect, the present architectural analysis provides a further important component for understanding the social structure of its inhabitants.

The abandonment of Çukuriçi Höyük

The use of the tell as a settlement hill ends around 2750 calBC. This chronological embedding is secured by a sequence of radiocarbon data that have already been presented[24]. The typochronological comparisons in combination with the radiocarbon data show a clear association of the latest Çukuriçi settlements with Troy Ib-c, which in turn is absolutely linked by dendro-dating to Troy I[25]. An earthquake that was initially suspected as a possible cause for the abandonment of the site has not been confirmed during the excavations[26]. Additionally, other monocausal explanations of singular destructive events, such as fire catastrophes, conflicts or floods, were not proven by the results of the excavations. On the contrary, the abandonment of the site seems to have been a communal and more or less rapid process. This is probably more of an organized relocation than a hasty flight by the Çukuriçi inhabitants, the truth about which can only be discovered indirectly and reconstructed on the basis of hints, as discussed in detail elsewhere[27].

We suggested a model for the abandonment, combining various reasons that had lasting effects on the inhabitants both locally and supra-regionally. The local aspect concerns the intensive metallurgical activities on the tell evident in numerous workshops.The analyses carried out by M. Mehofer demonstrably show that arsenopyrite was also prepared on site and smelted specifically for arsenic-copper alloys[28]. The spatial distribution of metal production throughout the entire settlement and the intensities and quantities suggest a constant domestic production. The toxic properties of arsenic compounds must have been released by the melting processes and this may have had a direct impact on the Çukuriçi inhabitants. Added to this is the generally unhealthy atmosphere caused by smoke, vapors and other toxic elements released as a result of the coated copper and lead processing that must have had a particularly negative effect in enclosed spaces. The population on the tell was probably characterized by chronic poisoning from metal production. These

[24] Horejs and Weninger 2016.
[25] Horejs and Weninger 2016: 136, fig. 8.
[26] Horejs 2009.
[27] Grasböck *et al.* 2023: 226-230.
[28] Mehofer 2014; Horejs and Mehofer 2015; Mehofer 2016; Mehofer 2022.

effects on the human body and the associated demographic conse-quences (low birth rate, low life expectancy, early-onset diseases, malformations, infertility, etc.) could only be verified through analyses of any necropolis related to the settlement, which have not yet been discovered. Another local aspect with an impact on the community concerns the constant exploitation of resources. The archeozoological data (indicating changes in hunting game) from the immediate region suggest that the oak forests declined in the Early Bronze Age[29]. Since there is no evidence of climatic changes at the beginning of the 3rd millennium BC, anthropogenic influences may have played a role in the slow deforestation[30].

The temporal coincidence of these local living conditions with the larger sociocultural processes can, however, be seen as an additional accelerating factor. As discussed in this paper, the Çukuriçi communities were intensively integrated into their wider environment and therefore very likely involved in the dynamic developments at the beginning of the Bronze Age. From around 2900 BC onwards, the import of tin for alloying tin bronze is proven to have taken place in the area which led to a boom in metal production and to changing economic and political conditions[31]. This dynamic progression is characterized by a political centralization, evident by the rise of new potentially powerful and strategically well-positioned centers in the wider region. The impressive fortifications of Liman Tepe, Troy and others testify that these developments have not been tension-free and harmonious but have certainly led to new security measures for these expanded centers. The culmination of people, political power and know-how probably goes hand in hand with the control of transport routes and resources. The tin imported over long distances for the production of the new and better alloy was certainly in great demand and had to be transported by routes from the interior of the country. The metallurgists of Çukuriçi Höyük apparently had only limited access, as evidenced by the very few objects made of copper-tin alloy produced locally[32]. Until the abandonment of the settlement, arsenic copper alloys dominated the spectrum of their metal production, indicating that the Çukuriçi metallurgists did not have permanent and sufficient access to tin. As a result, the inhabitants lacked a crucial raw material in a rapidly changing world. The community seemed unable or unwilling to offer alternatives to the new demands of supra-regional exchange systems at the local level. Decoupling from an essential raw material seems to have been a drastic and continual process that may have affected other aspects of life in the settlement. The breakdown of the traditional regional exchange systems based on metallurgical products probably also brought about changes in many other social and cultural aspects, such as exogamy, subsistence strategies, population structure, division of labor, etc. The combination of the local living conditions of a presumably constantly poisoned population with the supra-regional changing economic and political structures can be combined to suggest a hypothetical model for the abandonment of Çukuriçi Höyük around 2750 BC.

The settlement mound was permanently abandoned and the inhabitants probably moved away. The nearby Ayasoluk Hill may have been a potential new settlement

[29] Galik and Horejs 2011: 89-91.
[30] Stock *et al.* 2015: 575-576.
[31] Pernicka 1998: 138-141; Berger *et al.* 2014; Rahmstorf 2017.
[32] Mehofer 2016: 367; Mehofer 2022: 82.

site, but only small traces of its oldest use are known to date in the form of relocated material[33]. Scattered sherds and artifacts on Ayasoluk date back to the Early Bronze Age, suggesting at least a temporary, almost simultaneous use. The massive building development in later, mainly historical periods may have destroyed the possible evidence of an occupation at Ayasoluk in Early Bronze Age times. This hill with direct access to the sea, which would have been quite attractive for settlers, would have been a potential alternative for the Çukuriçi inhabitants without them having to give up their centuries-old local connection and the rooted knowledge associated with it. However, this hypothesis can only be substantiated by further research in the future, for example by proving the continuity of Çukuriçi technologies or the use of special raw materials on the Ayasoluk. Basically, currently we can only assume that the entire microregion was still inhabited, as has also been proven in the adjacent Arvalya Valley since the Neolithic period from around 6600 BC onwards[34]. Nevertheless, it is probably no coincidence that the most recent proven radiocarbon dates and the surface finds from Arvalya Höyük (Gül Hanım) also date to the Early Bronze Age[35]. In any case, the abandonment of Çukuriçi Höyük around 2750 calBC marks the end of its history, perhaps also related to the increase in new exclusive networks.

The context: A view on Early Bronze Age I settlements in western Anatolia and the Aegean

With the beginning of the Early Bronze Age 1 (3000-2700 BC), fundamental changes at the structural level of the settlements can be recognized in the wider region[36]. In contrast to the previous Chalcolithic period, fortified settlements appear in western Anatolia and the East Aegean at this time (Fig. 5)[37]. Besides an increased need for protection, such labor-intensive construction measures also indicate sociocultural changes. It is therefore worthwhile taking a detailed look at significant settlement features in this region[38].

A closer look at the settlements in the western Anatolian hinterland reveals a clear radial settlement structure defined by M. Korfmann as the «Anatolisches Siedlungsschema» based on the excavations in Demircihüyük[39]. This settlement pattern consists of long, rectangular or trapezoidal residential units that are built next to each other and partly form multi-room buildings with a radial orientation, resulting in a central open space[40]. Besides Demircihüyük, this type is also known from Küllüoba[41] and also from the recent excavations in Hacılar Büyük Höyük[42]. The latter is one of the largest known settlements of this period. In general, these settlements do not have separate

[33] Erdemgil and Büyükkolancı 1992: 267; Büyükkolancı 2007a: 22; Büyükkolancı 2007b: 77.

[34] Horejs *et al.* 2011; Stock *et al.* 2015.

[35] Stock *et al.* 2015.

[36] For the state of the Early Bronze Age chronology in western Anatolia and the East Aegean, see Alram-Stern 2014: 306, fig. 1; Pernicka 2014: 14, fig. 14; Weninger and Easton 2014; Blum and Riehl 2015: 185, fig. 5; Jung and Weninger 2015: 216, fig. 9a-b; Easton and Weninger 2018: 60-61, fig. 8, tab. 8.

[37] A compilation of the fortified settlements mapped here can be found in Horejs and Schwall 2018: 534.

[38] Compare also Schwall and Horejs 2020: 111-113.

[39] Korfmann 1983: 222; compare Ivanova 2008: 277.

[40] Compare Perello 2011: 126-127, 403, fig. 50.

[41] Efe 2003: 268-271; Fidan 2012; Fidan 2014: 18, 24, fig. 1-2; compare Ivanova 2008: 293.

[42] Umurtak and Duru 2017: 27-32, plan 1; Umurtak and Duru 2018: 417.

fortification walls, but the rear walls of the individual buildings are thicker towards the outside and thus reinforced to enable a closed character. In principle, the walls interpreted as defensive structures could be fortifications in the true sense or merely simple settlement enclosures. A settlement enclosure would thus suggest a social component, representing a boundary between residents and strangers or even creating a community-building character[43]. A further settlement, which is basically part of the radial settlement pattern, can be found in Karataş on the southwest Anatolian Elmalı Plain[44]. In contrast to the settlements mentioned above, this is a fortified courtyard on a hill in the middle of the settlement. The central building is also surrounded by two ring-shaped palisades on the plain, the area between them being used as living space.



Fig. 5. Fortified settlements and gold finds of the Early Bronze Age I period in western Anatolia and the East Aegean (Map: OREA/M. Börner, C. Schwall)

In the coastal region of western Anatolia and on the East Aegean islands, the settlements also consist of long, rectangular residential units, which mostly form multi-roomed buildings, but the settlement pattern varies here. The settlement Beşik-Yassıtepe[45] in the Troas seems to a certain extent to follow the orientation of the more eastern sites. Even the long, rectangular residential units from Liman Tepe[46], one of

[43] Düring 2011: 79.
[44] Mellink 1974: 352, fig. 1; Korfmann 1983: 225; Warner 1994: 169-171, pl. 8; compare Ivanova 2008: 289-290.
[45] Korfmann 1988: 392-394, fig. 1; Korfmann 1989a: 271, 276, fig. 1.
[46] Erkanal and Şahoğlu 2016: 157-162, fig. 3-5; compare Ivanova 2008: 295-296.

the largest complexes in the western coastal area of Turkey, that were built next to each other and against a fortification wall do not speak against the general concept of the «Anatolischen Siedlungsschema». Nevertheless, there are differences in terms of settlement structure between the western Anatolian hinterland and the coastal region with clear evidence of fortification walls in the western region[47]. The oldest settlement of Troy I was already enclosed by a massive wall[48]. The buildings within the citadel of Troy I consist of long, rectangular residential units, built side by side[49], but they do not follow the typical radial orientation of the settlements of the western Anatolian hinterland. However, this settlement structure is quite common in the coastal region of western Anatolia and on the East Aegean islands[50]. In Bakla Tepe, for example, Early Bronze Age 1 architecture was excavated that also consists of long, rectangular residential units surrounded by a fortification wall and a trench with a retaining wall[51]. Due to the limited excavation area, however, it must remain open as to whether the residential buildings were built directly against the fortification wall. A similar picture of Early Bronze Age 1 architecture with long, rectangular residential buildings can be seen at Yassıtepe Höyüğü in the Izmir region[52]. Recently, an associated fortification wall of this period was also discovered here[53].

The excavations on Çukuriçi Höyük have shown that the settlement mound was densely built in an agglutinating construction with rectangular residential units oriented north-south[54]. In the middle of the settlement area, however, there were always gaps in the development created by open spaces and paths. A comparable spatial organization of the settlement structure could be found in the contemporaneous settlements Thermi I-IIIA on Lesbos[55]. In both cases, however, the general settlement structure only rudimentarily follows the typical radial orientation of the «Anatolischen Siedlungsschema». At Çukuriçi Höyük the houses that are oriented north-south dominate. Only in the northern part of the area is a slightly east-west sloping orientation of the structures apparent. In the settlement Thermi IIIA especially, there is an area within the settlement that is surrounded by a fortification with bastions[56]. However, the outer area of the fortification, similar to the inner area, is densely built up with (long), rectangular residential buildings. A smilar outline can also be assumed for the Early Bronze Age 1 settlement of Poliochni azzurro on Lemnos in the northeast Aegean[57].

In the Western Aegean and on the Greek mainland a radial settlement pattern was unusual during the contemporaneous Early Helladic I period[58]. In general, the low proportion of excavated settlements on the mainland must be noted, which is why only a

[47] Compare Fidan *et al.* 2015: 67.

[48] Korfmann 1989b; Ünlüsoy 2006: 135-137, fig. 4; compare Ivanova 2008: 322-325.

[49] Ivanova 2013: 21, fig. 3; Ivanova 2016: 43, fig. 4.

[50] Compare Perello 2011: 406, fig. 55; 414, fig. 414; Ivanova 2013: 27; Ivanova 2016: 45-46.

[51] Erkanal and Özkan 1997: 273, drawing 2; 275-277, fig. 1-5; Erkanal and Özkan 1999: 120-124; Erkanal and Özkan 2000: 274, drawing 3; 277-278, fig. 7-8; Erkanal 2008: 167; compare Ivanova 2008: 275.

[52] Derin *et al.* 2017: 147-151, fig. 2; Derin 2020: 546, fig. 10; Derin *et al.* 2020: 71, fig. 1.

[53] Derin 2020: 537, 546, fig. 10; Derin *et al.* 2020: 64, 71, fig. 1.

[54] Compare Horejs 2016: 253-254, fig. 3.

[55] Lamb 1936: plan 2-3; Kouka 2002: 238-242, plan 12, 15, 18; compare Ivanova 2008: 317.

[56] Lamb 1936: plan 3; Korfmann 1983: 229-230; Kouka 2002: 240-241, plan 18.

[57] Bernabò-Brea 1964: pl. 22; Kouka 2002: 46-51, plan 3; compare Ivanova 2008: 308-309

[58] For Early Bronze Age chronology on the Greek mainland and in the Aegean, see Alram-Stern 2014: 306-307, fig. 1-2; Jung and Weninger 2015: 221, fig. 10.

development scheme of free-standing, long, rectangular or apsidal buildings integrated into a network of paths and squares can be assumed[59]. Comparisons with the East Aegean in the form of a linear settlement scheme, as found in the Early Bronze Age 2 settlement of Poliochni verde on Lemnos in the northeast Aegean[60], can only be attested in the Early Helladic II period, as it can be assumed for Lithares[61] in Boeotia. In the northwestern bordering area in Macedonia and Turkish-Thrace there are also no parallels for the radial Early Bronze Age 1-temporal settlement structures. A long, free-standing apsidal building, whose walls consist of post and clay constructions, is known from Sitagroi Va in Macedonia[62]. With Menekşe Çatağı, a contemporaneous settlement from Turkish-Thrace on the northern coast of the Marmara Sea is known with settlement structures. Here, free-standing oval buildings, which had clay or mud-brick walls, were excavated[63].

Taking the evidence into account, the settlement structure of Çukuriçi Höyük with an agglutinated order of rectangular rooms fits the pattern of Early Bronze Age western Anatolian coastal sites. The architectural alignment combines strong influences of the Anatolian as well as the Aegean model. The summarized analogies between the sites demonstrate the strong links of these contemporaneous communities and represent the underlying connectivity.

Indicators for social complexity in the Early Bronze Age 1: Fortified settlements and gold

At the beginning of the 3rd millennium BC, settlements with a reinforced outer wall in the western Anatolian hinterland or even a fortification wall in the coastal zone of western Anatolia and the eastern Aegean were detected. Such collective, fortified building constructions, which certainly reflect an increased need for the protection of the settlement community, were recorded only in the form of a ditch (width: 6 m; depth: 2.5 m) at Çukuriçi Höyük in the preceding 4th millennium BC[64]. These Late Chalcolithic features are, so far, without comparison in western Anatolia and the East Aegean. There is only a smaller Late Chalcolithic ditch (width: 2.6 m; depth: 0.4 m), which is probably more likely to be a settlement enclosure, known of from Barcın Höyük[65] on the southeastern coast of the Sea of Marmara. Although in the 4th millennium BC, there are only isolated references to settlement enclosures in western Anatolia, the ditch from Çukuriçi Höyük on the western Anatolian coastal zone indicates definite development from the Late Chalcolithic to the Early Bronze Age due to its geographical position and its proximity to the later fortifications of the early 3rd millennium BC. For the Early Bronze Age settlement phases of Çukuriçi Höyük no fortifications can be attested due to the recent destruction of the tell settlement in the outer area[66]; however, the Late Chalcolithic ditch, among other indications, indicates more continuity than discontinuity at the transition

[59] Alram-Stern 2004: 261; Ivanova 2013: 27; Ivanova 2016: 46.
[60] Bernabò-Brea 1964: pl. 23; Kouka 2002: 64-67, plan 5; compare Ivanova 2008: 309-310.
[61] Tzavella-Evjen 1984: folded plan; compare Alram-Stern 2004: 263.
[62] Renfrew 1986: fig. 8.10.
[63] Erim-Özdoğan and Işın 2002: 316, 322, map 3.
[64] Schwall 2018: 131-135; 166-167.
[65] Gerritsen *et al.* 2010: 199, 217, fig. 5B.
[66] Horejs and Schwall 2018: 534.

from the Late Chalcolithic to the Early Bronze Age period[67]. The question arises as to the motivation for the construction of numerous defensive structures at the beginning of the Early Bronze Age. Along with the emergence of such structures, there was also a general change in the settlement pattern from free-standing buildings to a radial settlement outline and agglutinating architecture. The reasons for such fundamental changes seem to be closely related to profound sociocultural changes. But how can these changes be understood based on settlement structures?[68]

Based on the excavated architecture in the Troy I settlement, M. Ivanova drew sociocultural conclusions from the shape and arrangement of residential buildings[69]. She proposes an egalitarian social structure due to the uniform appearance of the buildings. At first glance, this assumption – based only on the residential architecture – seems to point in the right direction, but the fortified area within the settlement of Thermi IIIA as well as the fortified courtyard of Karataş indicate a certain differentiation and social inequality among these communities.

To understand the social conditions of the Early Bronze Age 1 period it is, therefore, necessary to include the results of individual material studies. In this context it is worth looking at the distribution of early balance weights and gold finds of this period in western Anatolia and the Aegean. The balance weights were recently discussed by one of the authors in the context of the finds from the metallurgical center Çukuriçi Höyük, for which the author proposes a heterarchical form of society based on her excavation results[70]. Depending on the unit, it can be assumed that stone weights of only a few grams were used for fine weighing of precious substances[71]. Remarkable on this point are two beads, made of gold foil, which were found during the excavations at Çukuriçi Höyük[72]. Although these finds, apart from their material, are merely two inconspicuous adornments, the gold foil beads from Çukuriçi Höyük provide important clues about the sociocultural situation at the beginning of the Early Bronze Age in a supra-regional perspective of the known gold finds so far. The golden beads at Early Bronze Age Çukuriçi can be contextualized within the increasing number of gold finds in western Anatolia and the Aegean in the early 3rd millennium BC, which are found in settlements, graves, and caves (Fig. 5)[73]. The fact that all gold objects are jewelry objects is of particular interest as these precious, personal accessories can also be used as possible evidence of social inequality in the Early Bronze Age communities in this region. Interestingly, the distribution area of the Early Bronze Age 1 gold finds correlates with the area where most fortified settlements are attested. In addition, two gold finds, originating from fortified settlements (Thermi, Liman Tepe) were discovered, indicating a certain vertical stratification of the community.

In this context, the fortifications would not only function as a defensive structure but could also be understood as a sign of power with an onset of hierarchization within the settlement community. It is surprising, however, why these sociocultural developments are particularly tangible in the East Aegean and west Anatolia. An answer can probably

[67] Compare Schwall 2018: 273-285.
[68] Compare also Schwall and Horejs 2020: 113-114.
[69] Ivanova 2016: 46.
[70] Horejs 2016: 262-263.
[71] For the weight systems and the respective weight units, see Rahmstorf 2006; compare Rahmstorf 2011: 153.
[72] Mehofer 2022: 84, 425, pl. 30d-e; Grasböck *et al.* 2023: 225, fig. 121.
[73] Schwall and Horejs 2020: 113.

be found in the economic sector. Extensive communication and exchange systems can already be attested for this area in the Chalcolithic period[74]. Therefore, it seems possible that fortified settlements have to be seen in the context of geostrategic nodes favorable for trade, representing the emergence of a far-reaching trading system. Thus, the fortified settlements with presumably (temporarily?) hierarchically organized communities seem to indicate a precursor of the later Early Bronze Age 2 proto-urban settlements that were integrated via caravan and sea routes into an extensive supra-regional trade network[75] extending from the Aegean to the Indus region from the middle of the 3rd millennium BC[76].

Conclusions: A new picture of an Early Bronze Age society

The special geographical location of the settlement on a lagoon with direct access to the sea shaped the inhabitants in many ways starting from the first Neolithic pioneers in the 7th millennium BC, who most likely had also arrived by the maritime routes[77]. Maritime connectivity remains a cultural constant of the Çukuriçi inhabitants, which is reflected in their diet as well as in the use of maritime raw materials and networks. The use of the Aegean Sea for mobility, communication and exchange, which has been the norm since the Paleolithic, seems to have had lasting consequences for the development of regional networks with the introduction of the longboat in the Early Bronze Age at the latest[78]. The long acknowledged intensification of these networks around the middle of the 3rd millennium BC is characterized by many developments that had already started in the 4th millennium BC at the latest and also affect the Çukuriçi communities in the early phases of the Early Bronze Age[79]. This includes the oldest use of Syro-Mesopotamian weight systems outside the innovation centers as well as the very early use of tin for on-site produced tin-bronze around 2900 calBC (phase ÇuHö IV) at Çukuriçi Höyük[80].

The social impact of these dynamic developments is a long known and much discussed phenomenon in the Aegean and Anatolian Early Bronze Age. The establishment of a few large centers with massive fortifications and a new dominant role in exchange systems from around 2700 BC onwards is probably closely linked to the culmination of political and social power, as manifested architecturally in Troy II or Liman Tepe V. The Çukuriçi Höyük community certainly does not play a major role in this large-scale and continuous development in terms of supra-regional political influence. Rather, the abandonment of the settlement and the end of the former production center for arsenic copper products around 2750 BC illustrate the end of an era lasting about 500 years, which we can attest on the tell from the Late Chalcolithic period onwards. An interdisciplinary social-anthropological study by S. Cveček analyzed the social and societal structure from the perspective of a «household archaeology» that convincingly argues for a «Great Man

[74] Schwall 2018: 274-276.
[75] Efe 2002: 58-59, fig. 7; Kouka 2002: 295-302; Şahoğlu 2005; Rahmstorf 2006: 81-82, fig. 18; Efe 2007.
[76] Rahmstorf 2012; Rahmstorf 2016: 30, fig. 2.3; 34.
[77] Horejs *et al.* 2015; Stock *et al.* 2015.
[78] Strasser *et al.* 2010; Broodbank 2013; Papadatos and Tomkins 2013; Reingruber *et al.* 2017.
[79] Renfrew 1972; Rahmstorf 2011; Horejs 2014; Milić 2014; Horejs 2016; Schwall 2018.
[80] Horejs 2016.

Society» as a social structure for the Early Bronze Age inhabitants[81]. On the basis of the archeological data and the architectural results, both Early Bronze Age settlements of Çukuriçi Höyük are relatively small units which probably comprised several hundred to a maximum of one thousand people at a time. These «face-to-face» communities were organized into households from which no social or structurally particularly prominent unit is recognizable. As the archeo-anthropological analysis of S. Cveček shows, the households do not compete with each other in terms of the culmination of value, nutrition, consumption, access to knowledge or specialized production and technologies[82].

The numerous data, on the other hand, prove a system of general reciprocity within the settlement[83], i.e. an exchange between the households when necessary, as can be seen in the distribution of large wild animals or cattle[84] or metallurgical raw materials for the workshops[85]. This social structure of a «participation practice» within the Early Bronze Age society was defined in an archeological study as a possible heterarchy[86], which can be called a «Great Man Society» according to ethnological terminology[87]. However, a metal-producing community with this structure now differs significantly from previous models, as defined by C. Renfrew, O. Kouka or V. Şahoğlu for the Early Bronze Age[88].

In this respect, the results of the Çukuriçi Höyük may well be of supra-regional importance since they provide new and contrary insights into the 3rd millennium BC in the Aegean and in western Anatolia. The known narrative of Early Bronze Age societies in the East Aegean and western Anatolia can only be brought together with the results at Çukuriçi Höyük to a limited extent. It remains an open question as to what extent the intensification of metallurgy at the beginning of the Bronze Age leads directly and quasi automatically to the formation of elitist social structures. The Çukuriçi Höyük data provide significantly different results and at least indicate more diversity in the social organization structures of the wider region[89]. We hope to contribute to a fruitful discussion on the diversity of Early Bronze Age societies with the data from our ongoing Çukuriçi research, which offers an additional perspective to the highly dynamic Early Bronze Age period.

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[81] Cveček 2022: 265-268.
[82] Cveček 2022: 85.
[83] Cveček 2022: 230-237.
[84] Emra *et al.* 2020.
[85] Mehofer 2022: 86-87.
[86] Horejs 2016.
[87] Cveček 2022: 265-268. She argues in numerous details the sociocultural similarities of the Çukuriçi inhabitants with the Baruya in Papua New Guinea in contrast to other forms of society.
[88] Renfrew 1972; Kouka 2002; Şahoğlu 2005; Kouka 2016.
[89] Compare also Horejs 2016.

Age»), which made this synthesis possible. Our special thanks go to M. Börner for creating the maps and to Hazel Harrison for English editing.

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Discs and other possible tokens from 3rd millennium Northern Mesopotamia: a preliminary survey

Candida Felli

Abstract: Tokens have been neglected objects for a long period of time until the '70s of the past century when they received scholarly attention within the debate on the emergence of complex societies and beginning of writing. The subject is now experiencing a second wave of interest, especially as far as the earliest, Neolithic, attestations, in relation to their uses and functions. This article approaches the question from the perspective of 3rd millennium attestations in Northeastern Syria, concentrating especially on a specific type, clay discs, and discussing use and function in relation to contexts and associated materials.

Introduction

Accountancy is not only an important element in modern life but a task with which ancient societies came to terms very early, at least as far as the Near East is concerned. The introduction of rudimental means of counting devices and record-keeping in some of the earliest villages attested in this part of the world largely antedates the invention of writing. Best known examples are the so-called tokens, simple tridimensional objects made of different materials (stone and clay being the most common) which are attested as early as the Neolithic period in Southern Levant, Syria, northern Mesopotamia and Iran[1] and then found also more to the west[2] . Reckoned to stand for types and quantities of commodities, tokens would represent a set of evidence attesting the relevant degree of abstraction attained by the human brain in those ancient communities[3].

As to the Near East, their consistency as a corpus and their evolution through time from plain to complex tokens has been the subject of extensive research by Denise Schmandt-Besserat. Despite several criticisms to her reconstruction of a development leading to writing, there is still some general agreement that «*at least a subset consisting of many of her simple geometrical artefacts represents the precursors of writing in Mesopotamia, and therefore that cuneiform began with numerical signs*»[4]. Nonetheless, some scholars have

[1] E.g. Schmandt-Besserat 1992: 17-24.

[2] Southeastern Europe: Budja 1998; Aegean: Marangou 2001; D'Onofrio 2007a. The definition «token» is here adopted despite recent criticism (e.g. Bennison-Chapman 2018: 9, 10, «clay objects»). I leave out of consideration here reworked sherds which also have been included in the tokens discourse because they are too problematic to be dealt with here (D'Onofrio 2007a;2007b; for the Near East: Costello 2000).

[3] On this question, especially in relation to literacy, see Overmann 2016; in relation to counting, Malafouris 2013: 111-116; Valério and Ferrara 2022.

[4] Englund 2011: 33; see however Overmann 2016: 293-296.

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expressed doubts in connecting these finds to some level of accountancy only[5] and more recently, in the relevant literature, a trend towards an interpretation as «multi-functional artefacts» is actually in place especially as regards Neolithic attestations[6].

Interestingly, tokens do not disappear with the advent of urban societies and the increase in complexity of administrative practices in literate economies but continue to be used down to much later periods, especially in areas outside Southern Mesopotamia[7]. In this article I would like to take into consideration in particular clay tokens attested at mid-3rd millennium sites in Northeastern Syria (Fig. 1). Although much later than the early tokens mentioned above, such evidence represents an interesting, but somehow neglected, corpus and may offer some insights on the question of use and function of these objects at least in this period, and maybe even retrospectively.

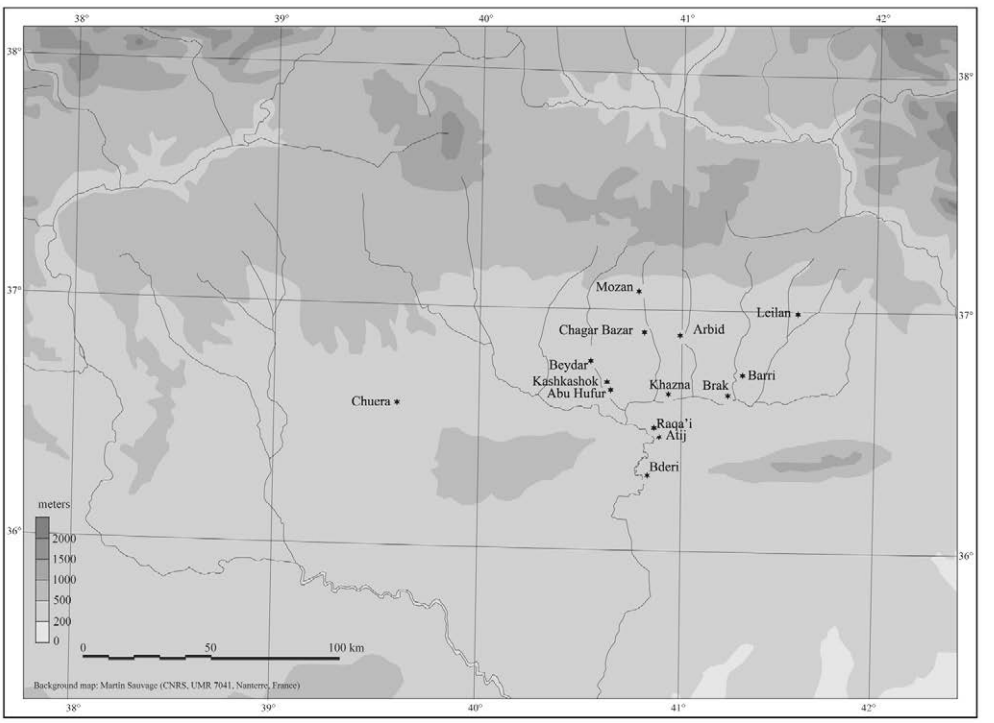


Fig. 1. Map of Northwestern Syria with indications of sites mentioned in the text (background map: Martin Sauvage, CNRS, UMR 7041, Nanterre, France)

Gathering the evidence

Northeastern Syria can be subdivided into two subregions, the upper Khabur and the middle Khabur areas, which were at the time differentiated not only from an environmental

[5] Szymczak 2013.

[6] Bennison-Chapman 2019; see also Palka 2020.

[7] For example, at Middle to Late Bronze Age Gordion: Gunter 1991: 85, pl. 29.531; see also the 27 examples from Munbaqa, Late Bronze Age context (but maybe out of place: Margret Karras apud Czichon and Werner 1998: 33) and the slightly earlier, beginning of 2nd millennium, evidence from Tell Arbid (Szymczak 2013) or Chagar Bazar (McMahon 2009: 209-211). It is impossible to say whether the five discs with linear markings coming from the early second millennium building, Palace A, at Tell Bi'a, are residual pieces or still in use at that time (Rittig, Strommenger 2010: 95, pl. 95.14.1-4, 15).

point of view, the latter more arid than the former, but also from that of settlements, since larger centers were generally found only in the upper Khabur.

This is the area where Ninevite 5 culture develops in the first half of the millennium, a phase in which a reduction in urbanism in comparison with fourth millennium is encountered: the appearance of a more dispersed settlement pattern goes along with an increase in number of smaller sites, some of which appear specialized according to different functions[8]. It is this the case of some Ninevite 5 sites found in the lower Khabur area which are dominated by large-scale grain storage facilities which appear rather disproportionate in relation to the estimated population of the time. Their relationship with larger communities in the upper Khabur area (Kashkashok, Chagar Bazar, Brak and Barri among others) or with Mari, to the south, is still matter of debate, although an overall picture of growing complexity is generally acknowledged[9].

Interestingly the findings from one of those sites, Tell Barri, have been recently evoked to support a view of tokens as objects with a religious function and therefore it appears worthy to reconsider such evidence[10].

At Tell Barri, tokens were encountered sporadically in the third millennium local sequence since the beginning of excavations at the site[11]. The most consistent corpus of these objects (and that calling for the above-mentioned attention) was however found in different clusters in a cultic context in area G. Here was discovered a religious complex surrounded by a temenos and including two temples ascribed to the EJZ2 period, i.e. first half of the third millennium[12]. The buildings belong to a specific type of single-room shrine with a bent-axis access, which is attested in several sites of that area[13] and maybe also in the neighbouring region to the east[14]. According to the very detailed plans published in the preliminary reports[15], it is possible to say that the tokens were mostly spread all over the floor of courtyard 1452 with some occurrence in the so-called «sacristy» 1409 and, outside the temple temenos, in the street 1391 and in buildings nearby (room 1441 and courtyard 1480 to the northwest and court 1390 to the southeast). In the earliest strata tokens were found also inside the shrine 1297 (stratum 44) and shrine 1548 (stratum 43). The use of similar devices seems to continue down to EJZ 3a (stratum 39), although attestations become less frequent[16].

Most of the evidence consists of rather crude, disc-shaped objects, few centimeters in diameter, which carry either none or from one to several circular impressions or incisions on one face (Fig. 2.1-7). If impressions appear generally made by the thumb, incisions are executed by means of different types of sticks, either rounded or more pointed or even star-profiled. The accuracy of execution also varies. Within this repertoire, a

[8] McMahon 2013: 464-467. For a general overview on the period see Rova 2013.

[9] Akkermans and Schwartz 2003: 216-224.

[10] See Palka 2021: 415.

[11] Area B: Pecorella 1982: 32, fig. 6:2, 3, a disc with incised cross; Biscione 1982: 47, 48; Biscione 1998: 52, fig. 12; area A, phase II: Pecorella 1998: 70, fig. 4.e, a disc with multiple dots.

[12] Strata 44-40: Pecorella and Pierobon Benoit 2008a: 23, fig. c on the right; 2008b: 11, fig. b in the centre; 15, fig. b in the centre; Valentini 2015: 111, 112, fig. 9.14. 2.

[13] Matthews 2002.

[14] Porter 2012: 178-180, figs 23. 179..

[15] Pecorella and Pierobon Benoit 2008a: 12 and 14; 2008b: 8, 12 and 17.

[16] In the Arcane DB tokens are included only in the inventory from the floor 1516 of the shrine 1297 (Unit 5, stratum 44).

number of subtypes can be singled out according to shape: regular discs, discs with one concave surface and high borders; lenticular discs, i.e. with tapering ends. In few cases, a latitudinal or longitudinal perforation is present as in later tags. Less frequently encountered types, sometimes with incisions or impressions which can vary in number, are: nodules; long nodules; quadrangles. Rarer types are the «mushroom», the cone (Fig. 2.8) and the sphere (Fig. 2.9)[17].

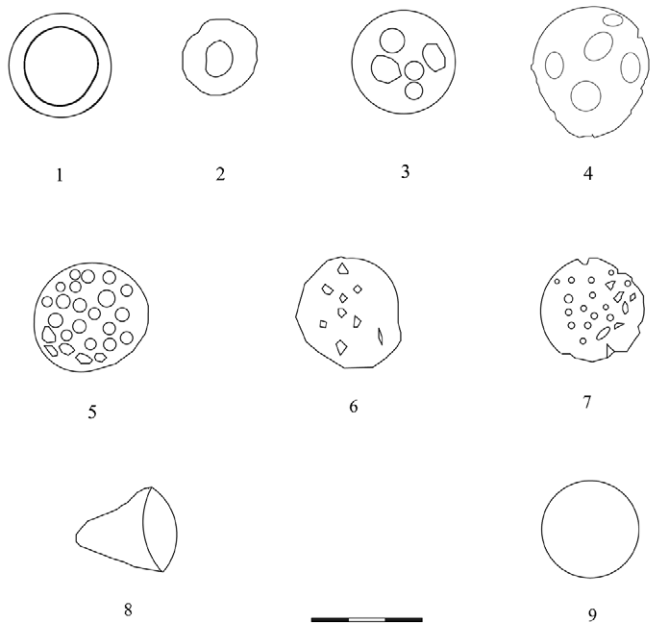


Fig. 2. Tokens from Tell Barri, area G (redrawn from Valentini 2015: fig. 9.14, except for n. 4 from Pecorella and Pierobon Benoit 2008b: 15, fig. b, in the centre above)

If we look around Tell Barri (Table 1), it is to admit that a comprehensive study of tokens from the area is still out of reach since little attention has been generally devoted to this class of objects in excavation reports, apart from the most recent ones. Within the Arcane JZ database[18], few tokens are represented since only those originating from primary inventories, i.e. securely stratified contexts, have been included while the corpus is clearly larger, as we can judge from mentions found in excavation reports.

At the site of Tell Brak tokens are attested at the site at least from the Late Uruk period[19]; numerical tablets which have been found in area TW level 12 also date to that period[20]. More relevant to our survey, Tell Brak has yielded clay pieces bearing incised and impressed marks dating to the 3rd millennium. Some, tentatively identified «as counting devices» in the preliminary report[21], were found in a pit in area HS2 along

[17] On a rough count the amount of tokens totals about 130 units. I wish to thank Stefano Valentini for providing me information on the unpublished material from the site.

[18] http://www.arcane.uni-tuebingen.de/database/.

[19] Oates and Oates 1997: fig. 15.

[20] Emberling *et al.* 1998: fig. 9.

[21] Matthews 1994: 182.

with a large collection of early Ninevite period (EJZ2) clay sealings and pottery, unsealed jar stoppers and figurines, but such identification was not maintained in the final report[22]. A trapezoidal clay object with several punctuations on one surface considered as a «possible numerical tablet or tally» has been found in a courtyard in a most likely sacred area brought to light in area HS 4:1 level 8, dated to a later phase still within the Ninevite period[23]. A disc with several punctuated markings similar to the Barri examples was found instead in a rubbish deposit in area HF2, possibly dating to the early third millennium[24]. Tokens have been uncovered also in later 3rd millennium contexts at Brak in Oates' excavations[25]: 8 discs gathering approximately around 2 types, lens-shaped (6), with several incised marks, and thicker, with one concave side (2); 2 nodules with linear incisions; 1 sling-missile like with linear incised marks[26], a tiny vessel with a calcite token inside[27]. All the specimens from Oates' excavations are apparently out of context but deemed possibly originating from earlier third millennium levels. It has been suggested that they could also have served as «counting boards»[28] as much as those at Arslantepe (see below), but according to current knowledge they are much like tallies or what we consider here more generally tokens.

Site	Discs, plain	Discs, with matkings	Nodules[29]	Quadrangles	Cones	Truncated Cones	Spheres	Other
Tell Barri	xxx[30]	xxx	xx	xx	x		x	x mushroom-shaped
Tell Brak		xx	xx	x				xx?[31]
Tell Mozan		xxx	x					
Tell Arbid	xx	xxx[32]						
Tell Abu Hufur						x		
Tell Atij		xx				xx	x	xx crescent-shaped
Tell Raqai	xxx			x?	xx		x	x tetrahedron
Tell Bderi		xx						

Similarly, at Mozan, all tokens come from secondary, though still 3rd millennium contexts, apart from a few found in later, 2nd millennium ones. Most of the specimens

[22] Matthews 2003: 102, fig. 5.75.5, 7 and 9.

[23] EJZ2/EJZ3: Matthews 1995: 88, fig. 3; Matthews 2003: 107, fig. 5.17, 5.79.3. A perforated clay disc with slightly raised edges interpreted as miniature sieve from level 4 could be another specimen of this kind: Matthews 2003: fig. 5.80.13.

[24] Matthews 1995: 118, trench HF2, level 2; Matthews 2003: 118, 119, figs. 5.45, 5.82.2, here ascribed to surface and cleaning operations, i.e. level 1.

[25] Areas FS, SS, phases M, N: Oates 2001: 138-140, figs. 174-176; McDonald 2001: 274, 275, fig. 491.132-143, table 31.

[26] Joan Oates (2001: 274) mentions the similarity of some tokens to further clay objects interpreted either as sling missiles or else (i.e lid): the question of what should drive our interpretation in favour of one or the other hypothesis remains open.

[27] McDonald 2001: 274, fig. 491.139.

[28] Oates 1996: 169, fig. 5.

[29] Here sling missile-like specimens are also counted.

[30] x = 1 specimen; xx = 2-10 specimens; xxx = more than 10 specimens.

[31] Uncertain attribution.

[32] Ascribed to 2nd millennium by excavators.

attested are of the disc type[33]; provided with just one, round shaped, impression, apart from two with several impressions[34]. One nodule type has a combination of larger and smaller round impressions joined by three lines, two longer and one shorter[35].

At Tell Arbid, one clay disc with raised edges and one lenticular in form have been found in association with the Southern Temple of Ninevite 5 date[36]. Here too the religious building, another single roomed shrine, is associated with granary rooms[37]. Although out of the chronological range of interest, it is also worth mentioning the evidence ascribed to 2nd millennium levels at the site[38]: two clusters of tokens were found on large potsherds while others were scattered around, among which 21 are of the disc type[39]. Excavators suggest that these materials were all in situ, in consideration of their very fragile state, although in my opinion the possibility that they had been thrown in there from elsewhere cannot be completely discounted; in addition, given the fact that the approximate date of the associated pottery is at the latest Akkadian, I wonder whether the actual dating of the whole context could not be earlier than suggested.

At Tell Abu Hufur, a fragment of a token of dried clay was found in room 13 of House 1, layer 4: it is of the truncated cone type with vertical incisions along the body[40].

Moving to the Middle Khabur area, 21 tokens of various forms were found in a granary at Tell Atij located to the north of the main site. A numerical tablet was also found, although not related to the same context: provided with smaller dots and two lines, the latter comes from the room of what has been interpreted as a domestic structure on top of the main mound[41]. As to the tokens, only three specimens were of the disk type, one with at least three large dots, one with seven and one with a single large band, plus two more with a sort of central pierced plug; the other types include truncated cones (8+1 uncertain), with vertical incisions along the body, much alike to the one from Tell Abu Hufur, spheres (1+1 uncertain) and crescent-shaped ones (3).

At nearby Raqai, 28 tokens have been collected: most (17) comes from level 4 (EJZ1/2), among which 11 discs, 2 cones, 1 sphere and 1 tetrahedron; 2 more discs and 2 ovoids were found in level 2 and 3[42]. Most of the tokens come from the adjacent area to a building reckoned to be a temple, to the NW, both from within and around a building, as well as some sealings and one possible tag[43]. Among significant clay objects from the site are also 140 fragmentary sealings with no seal impression, 1 small clay tablet with numerical signs and 7 «tablet blanks»[44]. The numerical tablet comes from an EJZ3 context in level 2[45].

[33] *Zählscheiben*; Wissing 2009: 298, pls. 60-63-
[34] Wissing 2009: pl. 63.1054, 1055.
[35] Wissing 2009: pl. 63.1057.
[36] Szymczak 2013: 404 and 406.
[37] Bieliński 2010; see also Valentini 2015: fig. 9.3.
[38] Szymczak 2013.
[39] Szymczak 2013, figs. 2, 3.
[40] Koliński, Lawecka 1990: 186, 212, fig. 24.18.
[41] Fortin 1990: 224-226, fig. 6; 239, fig. 20; 1991: 700, fig. 11.
[42] Dunham 2015: 307, 308, figs. 5.19-21.
[43] Dunham 2015: 307, fig. 5.154 (the caption of the plan here has level 3). Pfälzner 2011: 177 would favour an interpretation of the building as either a house with an altar for ancestor cult or a small shrine related to that cult.
[44] Dunham 2015: 298, 311.
[45] Dunham 2015: 305, fig. 5.16 and 5.17.

Further to the south, at Tell Bderi a small number of flat clay discs with incised strokes and circles, which have been interpreted as notational tablets, were retrieved in pits in level 10[46], now dated to EJZ 3 as well.

Some preliminary general considerations

As we have seen, the evidence gathered does not allow us a full understanding of the phenomenon with certainty and is also defective in terms of information on relevant details such as the original context of use of the objects. However, there are some elements which can be learned and are worth considering as part of an overall picture.

When known, provenance from open areas, either from pits or deposits on floors or dumps, appears to be the most common. No clearly in situ materials have been so far published. If we look closer to where within the settlements such open areas are located, we find a rather frequent association with collective storerooms and/or sacred buildings[47], although some attestations in houses are also found. No clear mention of location in burials is found unlike in earlier periods[48].

Some meaningful associations can be detected. In most cases, administrative devices such as sealings are encountered in the same context. At Tell Barri, for instance, tokens were found in association with clay sealings (not all with seal impressions), clay nodules, sometimes looking as if squeezed to be reused, and figurines, often partially preserved so that sometimes it proves difficult to distinguish between the two types of artefacts[49]. The same applies to some findings from Tell Brak, Arbid, Atij and presumably also Raqai, although here the connection is less obvious. This pattern is encountered also outside Jazirah proper: clay discs have been found along with clay nodules, often badly squeezed, and, significantly, sealings in the adjacent area to the west of the *Kleiner Anten-Tempel* at the site of Tell Chuera, in the steppe west of the Khabur Area[50].

The association of tokens and sealings in the same place calls for attention since it is too frequent to consider it simply chance. It has been assumed that variations both in terms of forms and markings are in some way meaningful. Reflecting upon possible functioning of this system of symbols, one could suggest that each token differently shaped represented initially a counted unit and afterwards could be substituted by a symbol standing for a sum of units: in the case of the disk, by adding a sign on its surface, one would have an increase of the number by a unit or any given quantity[51]. If one follows the idea that group of tokens, representing discrete quantities, had to be placed in «*a safe place with restricted access, since only in this way could the size of the number be retained over a long period*»[52], the need for containers expressly sealed can be understood, containers then discarded along with their content and the related sealings

[46] Pfälzner 1990: 77; Pfälzner 1992-1993: 59, fig. 59.

[47] It is to recall the presence of a single shrine temple (here on a high platform) also at Mozan in EJZ2/3 period: Pfälzner 2011: 179, 180, fig. 53.

[48] See for example at Gawra: Jasim and Oates 1986: 352.

[49] Valentini 2015.

[50] Moortgat Correns 1988: 12. It is perhaps not out of place to mention also the frequent occurrence of marks on pottery from the same level (Moortgat Correns 1988: 28, fig. 16.a. b).

[51] According to Pfälzner 1992-1993: 59 the symbol could stand for one object or the other while the markings were numerical notations. On the various numerical systems adopted in the archaic texts see Nissen *et al.* 1993: fig. 28.

[52] Nissen *et al.* 1993: 11.

once checked or when their function has ended[53]. The absence of obvious containers[54] may be explained with the use of pouches or small bags made of perishable materials. In the case of perforated specimens, it was presumably a string hole which served to keep different tokens together[55]. Finally, the evidence of lumps of clay squeezed and preserved to be ready to use could indicate the context as the manufacturing site for all such clay paraphernalia.

Another association detected within the walls of the temple at Tell Barri between tokens and miniature stemmed bowls, considered to be ritual offering vessels, as well as that with clay figurines, again an artefact which may have ritual connotations, appears instead in my view less informative on tokens actual use, i.e. it does not make tokens ritual objects themselves, as suggested by Joel Palka[56]. It certainly does not go against the interpretation of that context as a religious one, which would seem very likely. In fact, a practical use of these objects seems to be a widely shared view among scholars working in this area. According to Michel Fortin[57], for example, the clay objects at Atij are tokens which along with seals and numerical tablets can be considered as evidence for the existence of a redistributive system and for the urban character of that society. On a similar line of thought Peter Pfälzner, argues that the granaries there as much as at Raqa'i were used for community storage purposes and that tokens, numerical tablets and sealings functioned in such a system to identify individual property within them[58].

A few numerical tablets are also encountered along with tokens in this phase, corresponding to EJZ2 and 3 in Arcanian terms, at the sites of Kashkashok III, Khazna I, Raqa'i, Atij and Bderi[59]. A numerical sealed tablet is found later in EJZ 3b at Beydar[60]. Most of them are similarly characterized by the presence of impressed dots accompanied by some linear traits[61]. An earlier attestation of the practice in the area, though more to the North, in Anatolia, is represented by 14 fragments of clay tablets with impressed (some perforated) holes either isolated or in a pattern found at Arslantepe VIA: they had been tentatively interpreted by Mario Liverani as a rudimentary form of abacus or, more simply, as counting boards, in Marcella Frangipane's words[62]. At the roughly contemporary Uruk site of Habuba Kabira South, in Syria, where numerical tablets of southern type are the only type of tablets encountered, some unsealed, simpler versions too are attested showing only series of dots[63], as well as those found at Arslantepe, along with some in association with lines as at contemporary Brak[64]. Their persistence in the Khabur sites can perhaps be seen as another piece of evidence of lingering traditions in the area revolving around a visual system working with material symbols, possibly in

[53] According to Schmandt-Besserat's opinion (1992: 95) the fact that tokens are found in trash pits or deposits as much as sealings would be an indication of their use in record-keeping and not in reckoning.

[54] Unlike Abada in the Ubaid period, where tokens have been found within vessels: Jasim and Oates 1986: 355.

[55] For examples of the Uruk period see Schmandt- Besserat 1992: 109.

[56] Palka 2021.

[57] Fortin 2001: 37, figs. 9-11.

[58] Pfälzner 2002: 273, 274.

[59] Quenet 2005: 36.

[60] Sallaberger 2011: 327.

[61] Dunham 2015: 306, fig. 5.16.

[62] Liverani 1983; Frangipane in Frangipane, ed., 2007, esp. 152, 153. A possible Neolithic example from the site of Sabi Abyad has been interpreted as a gaming piece (Bennison-Chapman 2019a: fig. 14 top right).

[63] Schmandt-Besserat 2014: 313, pls. 200.2, 3, 7 and 10, 202.1.

[64] Michalowski 2003: 56, fig. 59.

connection with counting operations.

If simple, lenticular clay discs are a type already attested as early as the Neolithic, punctuated markings are mostly encountered on specimens from the Uruk period onwards (Susa), although some sparse occurrence is known also before; on the whole, however, punctuation remains less frequent than linear marks in the early periods[65], while the situation is rather the opposite in the 3rd millennium, at least as far as the area under examination. In this respect we can add that circular impressions, alone or in association with linear signs, are the basic components of the system of potter's marks encountered already on late Chalcolithic vessels both at Arslantepe and at Brak[66]. Such repertoire is significantly different from the one in use in the Euphrates region in the 3rd millennium, where linear markings, even deployed in complex designs, are attested[67]. In the Jazirah itself, where marks become less frequent in the passage to the 3rd millennium but continue to be attested especially in the EJZ 3a and b, linear markings seem to prevail in the end[68]. It could be in fact highly possible that tokens, representing a relic of a local Neolithic practice, were more conservative in respect to that tradition.

To conclude, the evidence of tokens from the Khabur area would suggest a main utilitarian use of the objects to convey specific information in the context of resource/commodity management within the local early 3rd millennium, pre-urban (?) communities. Shapes and marks most likely constituted a set of symbols of a visual language shared at least at a regional level which were adopted in different media (tablets, potter's marks as well), with different markings perhaps functioning as alternative ways for numbering distinct groups of items. It cannot be discounted that tokens could also be employed in other occasions involving counting as for example games such as modern dice, but I would maintain the embryonic administrative use as primary.

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[65] Schmandt-Besserat 1992: 17, 24.

[66] Felli 2003: 73.

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[68] Kolinski 1995; see also 2003: 90.

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Middle Bronze Age

Managing resources, sharing knowledge: exploring theoretical models for contextualising potmarks, masons' marks and other non-scribal communication practices

Sarah Finlayson

Abstract: The First Palace period on Crete was a time of relatively widespread, productive experimentation in script use and marking practices. In this chapter, I look more closely at the signs stamped and incised on pots, architectural blocks, loom-weights etc. to ask how craftspeople learnt to make and use these marks. Using both theoretical models and comparative evidence for learning and creativity to give insight into what these processes might have been, I examine how we can create a contextualised model that allows for the agency of craftspeople, their choices and experimentation, in finding new tools to help manage resources.

Introduction

Writing and marking practices in the First Palace period (roughly 1900-1750/1700 BCE) on Crete present something of a conundrum[1]. The two scripts used, Cretan Hieroglyphic and Linear A, remain undeciphered and the surviving corpora are small and fragmentary; nevertheless, the uses to which writing is put and the range of materials or objects that can bear script or other meaning-bearing signs (clay administrative documents, seals, pots, loom-weights, metals, architectural elements) all combine to give the period an air of relatively widespread and productive experimentation with marking practices, what a sign can look like, how it can be used and by whom. In this contribution, building on the papers and approaches in *Non Scribal Communication Media in the Bronze Age Aegean and Surrounding Areas* (particularly Militello's thorough review of Aegean practices), I look more closely at the signs stamped and incised on pots, architectural blocks, loom-weights etc. to ask how and why craftspeople learnt to make and use these marks.

The archaeological record, unfortunately, preserves only the material remains of learning processes and not the activities themselves[2]. Here, I review some pertinent theoretical models for learning and creativity, as well as comparative evidence, that give insights into what these activities or processes might have been. My aim is to examine the possibilities for reframing the discussion to move away from the assumption that this would necessarily have been a top-down process, and to create a contextualised model that allows for the agency of craftspeople, their active choices, initiative and experimentation

[1] I thank the editors both for their patience during the writing process and for their thoughtful comments on an earlier draft, which have contributed to a much improved paper.

[2] Minar and Crown 2001: 375.

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in finding new tools to help manage resources like time or materials. As will be seen, the material is problematic – it is sparse, unevenly distributed, in parts very much under-researched and we must always be alert to the question of whether it is heuristically valid to group all these different practices together. Nevertheless, I offer this necessarily high-level and impressionistic discussion, arranged as a series of interconnected vignettes, as a prompt to further conversations around how we can understand these marking practices on their own terms.

The First Palace period and its marking practices

The First Palace period is one of tremendous change, seeing increasing urbanisation, a visible increase in sociopolitical complexity, and an explosion in the richness of material culture. Social inequality, settlement hierarchies, even sealing administration and writing all have their roots in the prepalatial period[3], but life in the First Palace period was, nevertheless, both qualitatively and quantitively different from what came before.

By the time of the Middle Minoan IIB destruction horizon which preserves much of our evidence, the Cretan landscape was a patchwork of court-centred compounds and their surrounding territories, each containing smaller settlements linked in to these centres to varying degrees. These compounds were not necessarily palaces, in the sense of the seat of a royal family, but clearly a focus for ritual activity and elite conspicuous consumption, and also for the use of writing in the administration of agricultural produce, craft production and people's activities[4]. The political landscape was perhaps fluid, with competition between elite groups expressed through a «high culture» of architectural refinements, precious objects and their choice of script for administration[5].

The earliest writing, the Arkhanes script, appeared in the late Prepalatial on a handful of seals used as status-enhancing grave goods in the elite cemetery at Arkhanes[6]; it was presumably the parent in some way to the two scripts used in the First Palace Period, Cretan Hieroglyphic and Linear A. While both unfortunately remain undeciphered, we can nevertheless reconstruct both scripts and many details of the administrative systems in which they are used – the scripts are comprised of syllabograms and ideograms, together with symbols for numerals and weights and measures, and are used on clay sealings, tablets and those hybrid documents such as the Linear A roundel which do not fit neatly into either category[7]. Cretan Hieroglyphic script signs are also used on seals as one component of the repertoire of meaningful motifs[8].

Although the evidence for systems of weights and measurements in use during the Protopalatial is meagre, it is relatively widespread and Alberti[9] suggests that already by the end of this period balance weights, volumes for jars, and dimensions of loom-weights were standardised. There must have been considerable communication within

[3] See Tomkins and Schoep 2010 for a general overview.

[4] The exact nature of these structures is still debated, as per papers in Schoep *et al.* 2012, for example, and this noncommittal summary suffices for my discussion below.

[5] Schoep 2006.

[6] Krzyszkowska 2005: 70-72.

[7] Tomas 2010 provides a thorough introduction.

[8] Krzyszkowska 2005: 95-98.

[9] Alberti 2017: 8-11.

communities about whether, and, how, to participate in these systems, in order to get to the stage that these measures «*were actually embedded in daily lives and were used in a number of occasions, both for the production and use of the most common objects*»[10]; this process has both cognitive consequences (learning new ways to calculate with weights, for example) and practical ones (changes to equipment in workshops, new ways of measuring out goods).

Drawing these different sources of evidence together creates a picture of relatively widespread use of writing, marking and measuring practices, and this presumably was underpinned by an awareness of their intrinsic value and the value of standardisation. Within this socio-economic setting, craft workers produced objects spanning from the most exquisite to the utterly mundane, and along a spectrum of specialisation and intensity, from part-time «jacks of all trades» up to full-time highly skilled specialists. Some, at least, of these specialists were dependent in some way on elite patrons or sponsors; the seal engraver(s), potter(s) and metal worker(s) who occupied workshops within the Quartier Mu complex, Malia, for example, certainly relied on their elite patrons for a place to work, and perhaps also for subsistence support, and were in turn a source of wealth production for those elite[11].

Some of these craftspeople made use of their own marking systems; they made potmarks and masons' marks, or incised signs or stamped seals on loom-weights and other production-related objects, including tools. The practice of marking pots is extraordinarily long-lasting, with its roots in the Neolithic, and it continued beyond the fall of the Mycenaean palaces, whilst masons' marks were more closely tied to the First and Second Palace periods on Crete.

Potters' marks are «*all isolated, non-decorative marks that have been intentionally incised, impressed, applied or painted on a vessel*» – a broad definition that can cover marks made both before and after firing, all of which should be considered as «*semiotic signs, intended to convey meaning in the spheres of activity in which the vessels occurred*»[12]. They are usually found on inconspicuous parts of the vessel, such as the bottom or lower part of the side, and less commonly around the handles[13]. Analysis of the reasonably large and coherent corpus of potters' marks from Keos suggests there can be several categories, and it seems reasonable to assume that different marks had different functions depending on their chronological relationship to the firing of the vessel – although marks made before firing could always refer to processes beyond vessel manufacture[14]. Proposed functions include indicators of capacity, labels (particularly those signs that incorporate Linear A or, outside the scope of my discussion here, Linear B symbols), maker's marks, provenance or destination[15]. It should be noted, firstly, that the use of potmarks differs between sites and there are no observable global patterns, and secondly, that the system in use at a single site could incorporate a very wide range of complexity in sign forms, stretching from marks made by fingernails through to signs

[10] Alberti 2017: 10.
[11] Poursat 1996: 149-153; Poursat 2012.
[12] Lindblom 2001: 13.
[13] Bikaki 1984: 2.
[14] Bikaki 1984: 42; Bennet 1996: 314.
[15] Bikaki 1984: 42-43.

that look like Cretan Hieroglyphic or Linear A[16]. As Tsipopoulou notes, it is possible that many kinds of marks of a more rudimentary form, for example the impression of a fingernail, have been overlooked by excavators who have had their attention drawn to the script signs[17].

Masons' marks are remarkably similar to potters' in several respects. They are symbols chiselled, scratched or cut into the surface of building blocks, with the large, deeply cut marks traditionally regarded as older, the marks becoming smaller and shallower over time[18]. The later examples tend to be found on the outer faces of masonry blocks, whereas the earlier were carved on all faces regardless of whether they would be visible after construction[19].

As with potters' marks, there are recurring types of signs, the most common being double axes, tridents, stars and branches, and there are also symbols which parallel signs from Cretan Hieroglyphic, Linear A and B[20]. There has been considerable discussion as to their purpose, but with no consensus reached; scholarly opinion is divided between a magical or religious function, given some weight by the presence of masons' marks of the star and cross types on a stone altar from Malia[21], or a «practical» one. The latter category includes the use of these signs as masons' marks proper, to guide the cutting and placing of blocks during construction, to identify workmen, or even to signify the characteristic functions of that area of the building[22]. As a way beyond this impasse, Devolder, in her thoughtful contextual analysis of the Neopalatial masons' marks at Malia, underlines the potential multivalence of these marks and their purpose(s), and she points out that meanings could shift from secular to symbolic depending on context and the masons' intentions[23].

While potmarks and masons' marks have been gathered into corpora and studied as a cultural phenomenon in their own right, no such works exist for the stamped or incised marks on loom-weights or spindle whorls and other isolated craftsperson signs. Loom-weights with marks are relatively common at some sites though, notably Malia, Petras, Phaistos and Palaikastro, and appear throughout the Bronze Age; on Crete, stamping weights with seals seems to have been a particularly East Cretan practice, and they are, along with pots, one of the very few categories of objects other than sealings, and «mini-documents» like roundels or *noduli*, which carry direct seal impressions[24]. For loom-weights made of clay, the mark or seal impression would be made after the weight was shaped when the clay was leather-hard[25]. Evely[26] also records «inlay marks» on a miscellany of stone, faience and ivory/bone inlays, some of which share a resemblance

[16] Lindblom 2001: 18; Tsipopoulou 2016: 139-140.

[17] Tsipopoulou 2016: 139.

[18] Hood 1987: 205; Hood 2002: 102; Shaw 1973: 110, although Devolder 2020 challenges this assumption certainly for the material from Malia.

[19] Hood 2002: 102.

[20] Hood 1987: 208.

[21] Sakellarakis 1967: 287; Hood 2020: 88-91.

[22] Sakellarakis 1967: 286; Shaw 1973: 110.

[23] Devolder 2017: 361-363.

[24] Ulanowska 2017: 57; Ulanowska 2020: 219-220; Krzyszkowska 2005: 186; Burke 2006: 283-284 gives a good overview of the First Palace Period evidence.

[25] Ulanowska 2020: 220.

[26] Evely 1993: 203, 238; Evely 2000: Appendix 1, 641-650.

with Cretan Hierog-lyphic and Linear A signs; these were used to guide the precise joining of multi-part, often multi-material, objects and inlays.

Acknowledging the edges of our knowledge and the gaps within it

Clearly some craftspeople made marks, but beyond this how much can we actually say with certainty? Here, I briefly review some key problems or outstanding questions with the evidence or our existing approaches; as will become clear, these are not necessarily issues we can resolve, but I would suggest that it is always more productive to start from a position of awareness of, or honesty about, the material's (and our own) limitations.

The first issue is the most fundamental and also almost impossible to answer; are these marking practices emic or etic constructions? By which I mean, do all potmarks, for example, form a coherent system with an internal logic, or does it vary from site to site, even from craftsperson to craftsperson? The same signs appear within a site, and between sites, but do they always have the same significance? And what of those signs which cross media and are used by different kinds of craftspeople? While these practices belong generally to the realm of the craftsperson, our understanding of how craftspeople lived and worked, how they identified themselves and the extent to which they communicated with other craftspeople is extremely limited.

Secondly, the marks with a visual resemblance to Cretan Hieroglyphic or Linear A signs exert a gravitational affect on our attention, offering the possibility that each mark has a recognisable, readable value, but looking at these objects and practices primarily through the lens of literacy and formal writing practices only takes us so far; it is fundamentally the wrong frame of reference and our potmarks etc. end up diminished by the inevitable comparison with Cretan Hieroglyphic and Linear A writing practices. Ventris and Chadwick's[27] strongly worded statement that potters' and masons' marks should be differentiated from writing «*in the true sense of the word*», and any resemblance to the three main scripts be seen as fortuitous, has become entrenched in the literature; for many palaeographers, a single sign simply does not constitute writing, and an inscription, from which linguistic information can be derived, must consist of two or more consecutive signs aligned together[28].

Thirdly, while there is no doubt that some of the signs discussed here do share their form with Cretan Hieroglyphic or Linear A signs, a good many do not – do we place too much weight on these script-influenced or derived forms? What were the processes involved in choosing a sign, affixing its meaning and transmitting this knowledge? Did craftspeople have a completely free hand in the development of their marking systems? It is possible that some craftspeople were assigned a particular sign or mark to use, but this too must be unpicked; who would chose, and why this particular sign? The craftsperson's status, dependent/independent, full-time/part-time etc., has a bearing here and should be factored in to the discussion. Rather than assuming a downward process of influence, we should ask how craftspeople might come into contact with writing? How widely visible were examples of Cretan Hieroglyphic or Linear A, and how much did people outside of the administrative systems understand of these writing practices?

[27] Ventris and Chadwick 1973: 29.
[28] Olivier and Godart: 1996: 12; Bennet 1996: 314.

The learning, creating, innovating or resisting crafting community

The question of how craftspeople made and used marking systems encompasses the much broader issues of learning and teaching, of the internal dynamics of crafting communities, and of how meanings are fixed in signs; each of these areas has generated more literature, discussion and disagreement than can be tackled here. Instead, I will give four interrelated vignettes of particular models, or conclusions derived from comparative sociological, anthropological or archaeological research, which together provide insights into how to situate the Aegean Bronze Age materials. These are by no means intended as answers to the questions above, but rather to prompt a fresh perspective and perhaps even to add some more nuance to our thinking.

Understanding the social context of learning

The idea of the community of practice, originally formulated for examining the interconnections between learning and identity formation in the modern workplace or education system, has become quite widely used in anthropological research and more recently in archaeological discussions of learning processes and knowledge transfer in the past, although this still remains a particularly under-researched area in archaeology[29]. This model covers considerably more ground than just describing how a group of people perform a task, and it is worth expanding on it here.

A community of practice is defined by three features; firstly, a shared domain of interest, so members have a common skill or purpose, and this distinguishes them from outsiders; secondly, members interact with each other, building relationships within the group, sharing information and knowledge, and developing a collective voice; and thirdly, the group develops a single practice, which incorporates a repertoire of shared resources, including tools, ways of doing things, accumulated wisdoms and problem-solving techniques[30]. The community of practice can exist at any scale, but mostly there is a shared location, for example a workshop or building site, and although it is an essentially inward-looking group, the community develops and is shaped in response to external social, cultural or institutional contexts or constraints[31].

The shared practice prompts collaboration to learn ways to do things better and individual learning can also be the outcome of participation, but it is often incidental to other social processes, particularly those around the construction of a new identity that comes with active participation; this is learning as social participation[32]. Processes of learning are ongoing, often informal and based on sharing knowledge and experience within the group; the individual can be incorporated through peripheral learning, starting with observation or imitation and slowly moving on to picking up limited tasks[33].

The social and/or cultural context of learning is absolutely key; it defines how knowledge is transmitted between the skilled and unskilled, what tools or practices are used, and also what form the «scaffolding» takes, that is what kind of guidance is available from

[29] Wendrich 2012: 2, 5.
[30] Wenger 1998: 82-83; Wenger-Trayner and Wenger-Trayner 2015.
[31] Wendrich 2012: 5; Wenger 1998: 79.
[32] Wenger-Trayner and Wenger-Trayner 2015.
[33] Wendrich 2012: 5.

the more skilled or experienced to enable learning to a point of high competence[34]. The apprenticeship system is a good example of socially-defined scaffolding that can operate within a community of practice[35].

Because learning and the formation of a social identity are intertwined in the community of practice, knowledge becomes not just competence in the shared technical skill but also in how to be, how to behave as, a skilled person within that community, and this is a mutual development process between the community and the individual within it[36]. This point is of particular interest when considering potential communities of practice in the archaeological record, because it provides insight into other material aspects of group behaviour or identity, from shared ways of dressing to the spread of techniques.

Creativity and Innovation

Finding new ways of working, new solutions to problems requires creativity and innovation – two phenomena that have become increasingly significant in archaeological and anthropological research. While creativity and innovation are interlinked, they are not synonymous; creativity, the ability to come up with new ideas, is much wider than innovation and encompasses exploration, reconfiguration and the further development of existing practices, while innovation is the ability and will to put something new into practice, and is seen in visible changes in material culture, leaps in how things are conceptualised and made[37].

Understanding how creativity was conceptualised in the past is very challenging (not least because there is no single definition for creativity in the present); it is in many ways intangible, hence the frequent association between creativity and mystical processes like divine inspiration, but it is also a part of everyday activity and the need for problem-solving, and its articulation and outcomes are very much rooted in the material[38]. Creativity is «*an outcome as well as an intention and a process*»[39].

Creativity is often associated with the presence of a new material, but it can also spring from engagement with the old and familiar. Likewise, an individual can be a particularly creative force, but it can also be group enterprise; at the centre of any act of creativity is material entanglement, the human exploration and engagement with the latent properties of different materials[40]. This material entanglement, and the creativity it gives rise to, is guided or held by the prevailing rules, ideals, attitudes etc. of both the craftspeople and the broader sociocultural context (for example, the prevailing cultural attitude to imitation and improvisation as broadly positive or broadly negative)[41].

Significantly for our purposes here, creativity can be low-level and everyday, something that is purposefully worked at and nurtured; thinking and making are not completely separate activities, and space for creativity can be built into the craftsperson's *chaîne*

[34] Minar and Crown 2001: 372.
[35] See the papers in Wendrich 2012.
[36] Wenger 1998: 4, 263.
[37] Stig Sørensen *et al.* 2018: 3.
[38] Stig Sørensen *et al.* 2018: 3-4.
[39] Stig Sørensen *et al.* 2018: 4.
[40] Stig Sørensen *et al.* 2018: 6.
[41] Stig Sørensen *et al.* 2018: 6-8.

opératoire, which is, after all, a flow of choices and activities rather than a rigid timetable with an inevitable progression[42]. Craft activity is a particular kind of thinking through the hands, a haptic understanding of the world, with the made object as the boundary between the thoughts, intentions and physical activity of the crafter and the broader world[43].

Not all creativity results in a successful innovation; firstly, many, if not most innovations, whether functional, symbolic, practical or other, have to be inserted carefully into pre-existing social and cultural relations so as not to upset traditional lifeworlds[44]. The new is only ever partially new, and even if an innovation confronts its users with completely new ways of acting, it must have the potential to be inserted in a pre-existing horizon of experiences in order for it to be willingly taken up, often through a period of negotiation, communication and re-contextualisation of the new object or practice[45]. Secondly, innovations are only successful if they meet a pre-existing need, it is not enough simply to be novel[46] – this is a deceptively simple point, and will be picked up again below.

Two factors particularly significant when considering innovation in practices involving material culture are the principles of affordance, the qualities or properties of a material, object or environment which invite a particular response, and *Eigensinn*, «obstinacy», which is those properties that limit the variability of their use and restrict the potential to integrate them into new things; the push and pull relationship between affordances and *Eigensinn* has a powerful effect on the development and implementation of innovations[47].

Learning and creating within the crafting community

How, then, do the craftspeople within a community of practice work, learn or create? Anthropological research has highlighted how craftspeople's knowledge or skill can be divided between the declarative and the non-declarative, procedural or tacit. Declarative knowledge can be expressed verbally, and is often made up of significant orienting principles or conceptual structures for that craft, whereas non-declarative knowledge is much more specific and accrued through observation and experience; non-declarative knowledge is often impossible to verbalise, because it is made up of muscle memory from repeat movements or from sensory observations and instincts[48]. Bentz Høgseth, who is both academic researcher and craftsman, calls these two kinds of knowledge the *knowing how* and *knowing what*; the *knowing how* flows through the craftsperson's body, their movements and technical skills, while *knowing what* occurs through reflection on these movements and techniques and in describing them[49]. Both aspects are necessary – as Wynn and Coolidge dryly observe, «*no one has ever learned to be a competent artisan by reading a book*»[50].

[42] Stig Sørensen *et al.* 2018: 10.
[43] Stig Sørensen *et al.* 2018: 12.
[44] Bernbeck and Burmeister 2017: 8, 11.
[45] Bernbeck and Burmeister 2017: 12; Hahn 2017: 53, 55-56.
[46] Hahn 2017: 45.
[47] Bernbeck and Burmeister 2017: 5.
[48] Wynn and Coolidge 2014: 47.
[49] Bentz Høgseth 2012: 62, 64.
[50] Wynn and Coolidge 2014: 47.

At the same time, knowledge can be externalised into tools, materials and even the layout of the working space; tools and materials carry information about their potential use, their affordances, but also act as reminders of previous usage, and the way these objects are arranged in the workshop becomes part of the craftsperson's thinking processes[51]. The more a craftsperson can free up their higher working-memory capacity by either «storing» knowledge in their surroundings or in developing effective tacit knowledge, the better they can reflect on their crafting and make (mental) space for creativity[52].

All these forms of knowledge are closely interwoven, and, while it is certainly true that non-declarative knowledge is harder for outsiders to understand and is generally not afforded much respect in contemporary life, one should not underestimate the detail and complexity of declarative knowledge. Clear and productive communication between members of a community of practice, between teacher and apprentice, and indeed between craftsperson and «customer», all require the development of technical vocabulary to describe tools, techniques and materials, to agree standards and to plan out a piece of work – this is Bourdieu's *discourse*, the system of rules and/or conventions, which defines and shapes the *habitus*[53]. These vocabularies can be extensive (for example, the 200 or so words Norwegian fishermen apparently have to describe and classify waves), and although they are specific to communities of practice and their materials, the words and concepts can be recorded in writing or other notation systems, as part of the design or teaching process or to fix certain meanings or standards[54].

While many of these processes of communication, creating and learning occur within the community of practice and can be opaque to outsiders, the social, cultural and economic landscapes in which craftspeople are operating nevertheless continually exert an effect. Changes in craft and production processes imply social negotiations around demand, labour, resource procurement etc. which extend beyond the individual or the community of practice into the wider community[55]. Knappett and van der Leeuw[56] point to the importance of cultural brokers who can act as conduits for information about new practices, materials or requirements from the wider world, «translating» it into something understandable or meaningful to the community of practice. At the same time, the wrong kind of outside intervention can result in a new practice not being fully taken up and incorporated into pre-existing practices. The technique of wheel-fashioning pottery, for example, was adopted in a very patchy way across the Bronze Age Eastern Mediterranean, and one factor seems to be the extent of direct elite involvement in supporting potting communities; in the Levant, elite interventions, with the demand that dependent potters embrace a new mode of working and produce a new style of pottery, disrupted established processes of learning and knowledge transfer, particularly of non-declarative practical knowledge, such that the new technology never became deeply rooted and did not spread between communities[57].

[51] Wynn and Coolidge 2014: 48.
[52] Wynn and Coolidge 2014: 55-56..
[53] Bentz Høgseth 2012: 70-71.
[54] Bender Jørgensen 2012: 243-244.
[55] Sofaer *et al.* 2018: 298.
[56] Knappett and van der Leeuw 2014: 73-75.
[57] Knappett and van der Leeuw 2014: 77.

The sign has its own meaning: insights from Non-Textual Marking Systems in Ancient Egypt

The rich material culture of Ancient Egypt includes an array of marking systems made by craftspeople in the course of their activities, from craft production to large-scale building projects, as well as featuring forms of marking and writing not really represented in the Bronze Age Aegean, such as ostraka. Although these marking practices have suffered from similar problems of poor publication and lack of scholarly attention, there have more recently been notable attempts to analyse them in a more systematic and rigorous way; potmarks, masons' marks, hallmarks, seals, tags etc. have been classified as «Non-Textual Marking Systems», «Graphic Memory Aids» or «Numerical Information Storage Systems», all falling within the overarching category of «Systems of Graphic Information Processing», which also includes writing[58]. Non-textual Marking Systems (NTMS) have a wide range of possible uses, but they are linked by their communicative nature through the use of signs[59].

These NTMS can contain signs which share a form with Egyptian Hieroglyphic or Hieratic signs, others derived from older marking system(s) as well as pictorial or abstract signs; in the earliest documented phase of the system at Deir el-Medina (1450-1350 BCE), Hieroglyphic signs made up roughly 50% of the repertoire[60]. The Deir el-Medina signs refer to individuals, and were multifunctional, appearing on work rostra and other «paperwork» as well as on personal property – there seems to have been considerable potential for craftsmen to create their own signs, derived from a system of their choosing, with the context in which the signs were used setting the boundaries for how to interpret them[61].

At the earlier site of the Step Pyramid Complex at Saqqara, the marking systems are similarly complex, encompassing different ways of encoding meaning by different groups. Here, the majority of the Hieroglyphs incised on the backs of the faience tiles decorating the complex do not conform with any known toponym, word or phrase that could designate a workshop, craftsperson or product, and should rather be understood as graphic, non-textual symbols; this marking system co-existed with masons' marks using some of the same sign forms but with different technical meanings, and Hieroglyphic inscriptions on pots and architectural elements with a dedicatory function[62]. Different ways of constructing and assigning value to signs can also be observed in the systems of builders' marks used at different contemporary sites; denotative signs, such as a geometric marks with a locally agreed and specific meaning or Hieroglyphic signs which function as abbreviations, contrast with connotative signs, which refer to their meaning using various conventionalised metonymic relationships (geographic location standing for origin of a particular group of workmen, for example)[63].

Clearly the making and using of marking systems could be highly time and site specific, and each sign would need to have its meaning agreed and fixed within the user group (which might only be a very few craftspeople). van der Moezel's reminder that the

[58] Budka *et al.* 2015: 1.
[59] Budka *et al.* 2015: 1.
[60] Haring 2017: 236, 242.
[61] Haring 2017: 236-237, 241.
[62] Kuraszkiewicz 2015: 46-47.
[63] van der Moezel 2015: 25-26.

meaning signs have is not pre-existent, but created by humans who send, receive and interpret meaning according the agreed, conventional system of codes, is a crucial one here, particularly given that the signification can be agreed in a completely arbitrary way[64]. It is worth adding that the signs' impenetrability or lack of decipherment reflects a failing on our part to get to grips with the conventions for interpreting them, rather than any failing in the system itself.

I do not wish to labour this point, but the arbitrary nature of the relationship between signifier (the form the sign takes) and the signified (the concept or idea to which the signifier refers) is rarely properly acknowledged; while both Peircean and Saussurean semiotics can provide extremely useful theoretical frameworks for analyses of early writings[65], there is always the danger that these fixed schema, icon/index/symbol etc., translate into a similarly fixed impression of meaning construction as always following a particular logical pattern. As van der Moezel[66] puts it, sometimes «*this means that*» suffices.

Discussion: crafting communities/marking communities in the Aegean Bronze Age

Drawing on the four discussions above, I would suggest the following as a basic general context for craft marking practices in the Aegean; all of these marking systems were communicative, and they met specific communication needs within a community of practice. The community could be as small as a single weaving workshop or as large as all the masons working at one time on a court-centred compound.

The meaning of the marks used, how, where and when they were needed, would be negotiated and agreed within that community, and then become part of the body of knowledge taught to apprentices or new members. Participating in this marking practice could reinforce group identity and the place of each individual within that community. Here, potmarks, masons' marks etc. could be just one of the potentially many tools, working practices, problem-solving hacks or traditions that a particular community of craftspeople developed and maintained in the course of their daily work, and perhaps of no more significance than, for example, their own preferred recipe for clay or the trick they used to keep blades sharp. This only takes us so far though, and looking at some specific details of Aegean practice suggests with additional problems or productive ways to add nuance to the picture.

The craftsperson who marks

The model of the community of practice rightly focuses our attention on the people who actually made and used a set of marks; Christakis takes this even further in his analysis of potters' marks from the sanctuary site of Syme and identifies the individual potters within the group, using a palaeographical analysis of a set of marks with the same form[67].

[64] van der Moezel 2015: 9-10.
[65] For example, Robertson 2004.
[66] van der Moezel 2015: 18 n. 32.
[67] Christakis 2016: 140-143.

His starting point is the very pertinent observation that previous discussions of potmarking have focused almost exclusively on the meaning and function of the marks, with the result that the people behind them have been forgotten[68].

While Christakis concludes that the individual potter used his or her own interpretation of the standard mark as part of a statement of individual identity within the uniformity of the group, «*in the negotiation of his social coming into being*»[69], I would suggest that this too risks simplifying the potential range and complexity of meanings. Fundamentally, a sign is a hook on which to attach a piece of information, a way of freeing up the craftsperson's working memory by fixing something that needs to be remembered into an external object; as discussed above, the vocabulary used within a craft activity could be large and highly detailed, to say nothing of the range and complexity of non-declarative knowledge, and we should not assume that signs sharing the same form also shared the same meaning, or that marks could always be easily verbalised. It is possible that some marks were used alongside non-declarative information (a particular movement, for example), and in themselves stood primarily as a prompt to recall. The differences Christakis identifies in the seemingly identical potmarks suggest we should acknowledge the potential for individual craftspeople to adjust a sign to add in their own glosses and make it more personally meaningful – although this comes with the concomitant risk that the sign is less readable to others.

The potential tension between the individual and the group within a community of practice is also worth unpicking a little further – the extent to which a sign speaks of an individual to the wider group, or of one group to another, may well have varied between different groups of craftspeople. Devolder suggests that, in addition to the utilitarian function of signs in identifying the different teams of quarrymen and masons so they could be remunerated for the work they had done, masons could have made their marks as an expression of pride in their achievement, the mark of a difficult job well done[70]. Cross-culturally, stonemasons are generally more mobile than other kinds of craftspeople, and there is also considerable scope for specialisation or differentiation, between highly-skilled masons working on elite materials like ashlar through to local labour-forces who could turn their hands to everything else[71]. During the Second Palace period, it is possible that Knossos maintained a team of skilled ashlar masons who could be sent out to work, and make their marks, at sites across Crete; in such an employment landscape, masons' marks could also function as a form of advertising to anyone who might wish to commission the masons, as well as to the local, less-skilled labourers[72]. This would, of course, require at some point a statement of how different marks tied up with particular masons in a context, and using a vocabulary, that was accessible to people who were not necessarily themselves part of this marking community.

Other practices suggest a more inwardly-directed communication, not intended for an outside audience; the minute differences observable between the Syme potmarks in Christakis' study[73], all of which are incised on the same part of the pots but differ in

[68] Christakis 2016: 136.
[69] Christakis 2016: 136.
[70] Devolder 2017: 362-363, analysing the Second Palace period masons' marks at Malia but also relevant here.
[71] Bevan and Bloxham 2017: 71-72.
[72] Bevan and Bloxham 2017: 87.
[73] Christakis 2016: 140-141.

the order in which the strokes are incised and their dimensions, certainly suggest these communications were aimed at fellow potters who would spot the nuances and grasp their significance.

Likewise, the seal impressions on pot handles at Myrtos-Pyrgos, five of which were covered over with a dark wash after impressing making them all but invisible (Fig. 1), were clearly not intended to be read by anyone beyond those who could see and handle the pots before the wash was applied (and the gods who see all, as Weingarten suggests in her review of this material)[74].



Fig. 1. The seal impression, CMS II.6 no. 229, on pot handle MP 71/268, with traces of black glaze still visible within the impression (image courtesy of the *CMS*, Heidelberg)

Michailidou, discussing the range of writing and marking practices visible in Neopalatial Thera, asks what significance a householder might find in the mark on a pot in his storeroom?[75] I would suggest that the craftsperson may well have considered his or her marks to become essentially invisible, or at least to be opaque in meaning, once beyond the boundaries of the workshop, and certainly to not always be of relevance to those outside of the community of practice.

The assigned sign

There is general agreement in the literature that the use of Cretan Hieroglyphic and Linear A signs in these marking systems should be understood in the context of craft production associated with the palace or elite group.

Bikaki[76], for example, suggests that the rise of a centralised and controlled economy, coupled with the presence and use of writing, provided the impetus for craftspeople to

[74] Weingarten 2015: 71, 73, 75.
[75] Michailidou 1992-1993: 8.
[76] Bikaki 1984: 42-43.

incorporate script signs into their repertoire of potmarks (and this could also apply to other practices like masons' marks or incising loom-weights).

Other scholars see the incised and stamped marks as indicating that production was now being directly administered from above[77].

How would this work in practice though? Drawing on the discussion above, we should posit some sort of cultural broker who could introduce this new practice into the craft community, and drive the negotiation and agreement that would be needed for different signs to be incorporated into the established repertoire.

Craftspeople would need to be given a set of signs and taught both how to correctly write them and what the given meaning was, then there might be a period of time needed for adjustment, to embed this new element into the sets of knowledge held by each craftsperson. This innovation was successfully adopted across several sites in the First Palace period, suggesting it met a pre-existing need – but what exactly was that need, and was it felt by the elite administrators or by the craftspeople?

Where Cretan Hieroglyphic and Linear A signs were introduced, they did not replace other forms of marks but were used alongside them. At Petras, for example, the most common kind of mark is the impression of a fingernail, followed by various shapes made up of incised lines; Cretan Hieroglyphic and Linear A signs are much less frequently used and they do not correlate with a specific vessel shape[78].

So one must ask whether the script signs were functioning differently from the other sign forms? Was the information they provided qualitatively different? Although we can identify the signs it is impossible, with the exception of the cloth ideogram (CH 041, Fig. 2), to pull out any meaning.

And again, were these particular marks communicating information primarily for the craftspeople or to their elite supervisors?

Focusing in on loom weights, the distribution of marked weights at Malia *Quartier Mu* suggests that complete sets of weights for looms could each have contained one marked weight; the group of 145 weights in area VII 3, which would equip 4 looms, included 4 weights with the Cretan Hieroglyphic sign 061, a sort of inverted Z[79]. The Z sign is found on 6 weights in total, from different parts of the site, but all made of the same clay[80]. A comparable pattern of marking out specific weights is observed at Petras, where the cloth ideogram is incised on cuboid loom weights but never on discoid weights (Fig. 2)[81]. This certainly could suggest that weavers were producing textiles for markets beyond the elite group, which consequently felt a need to clearly demarcate the resources – tools, workspace, perhaps an implication of certain amounts of time – to be used in textile production for their own benefit.

One must also acknowledge the small but nonetheless observable accumulation of weaving-related signs or symbols on loom-weights; the cloth ideogram at Petras, seal impressions on a spool at Malia depicting two spiders (naturally-skilled weavers!), the spindle whorl from Chamelevri impressed by a seal with an iris flower motif perhaps

[77] Burke: 2006: 283.

[78] Tsipopoulou 2016: 140-141, 143.

[79] Poursat 2001: 29.

[80] Poursat 2001: 29.

[81] Tsipopoulou 2016: 144, although Weingarten (personal communication) points out that these could be functioning as labels.

signifying the dying process[82]. On the face of it, this is seems absurd – what else would a loom weight be used for? – but it could perhaps point to a somewhat clumsy attempt by the elite «managers» to find a shared vocabulary or set of reference points as part of the process of negotiating the use of new signs.

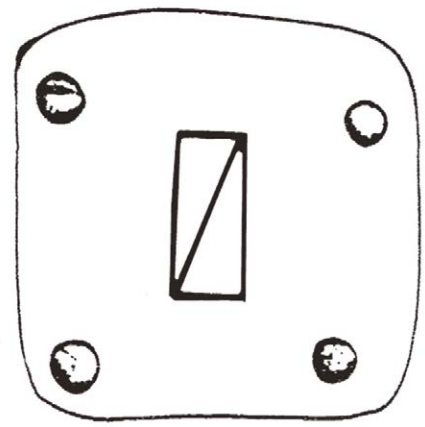


Fig. 2. A loom-weight from Petras, PM 218 LW81, with the Cretan Hieroglyphic ideogram for cloth incised on one face (image courtesy of Dr. Metaxia Tsipopoulou and the Petras excavations archive)

Whereas only potters or masons are likely to have made potmarks and masons' marks (given the likely stage in the *chaîne opératoire* when marks were made), the picture is less clear with marked loom-weights.

Ulanowska[83] observes that the manufacturing of loom-weights was not complex and it could have been carried out by the weavers themselves, their apprentices or children; if the weights were made by potters, they would need a template or a good understanding of the functional parameters of textile tools in order to produce the right size and shape weights.

However, the use of good quality clays to produce very uniform tools could suggest that potters were responsible for their manufacture[84]. If as Poursat suggests[85], some weights at Malia were in fact incised with their marks by potters, this would present an extra level of external imposition or intervention into the day to day working practices of the weavers, as well as suggesting communication or collaboration (albeit perhaps enforced) between different communities of practice at the site; the appearance of the same seal impressed on spherical weights from *Quartier Mu* (CMS II.6 no. 203, Fig. 3) and the northeast border of the Palace (CMS II.6 no. 212, Fig. 4) could also support this position.

[82] Tsipopoulou 2016: 141, 144; Ulanowska 2020: 221.
[83] Ulanowska 2020: 215.
[84] Ulanowska 2020: 216.
[85] Poursat 2001: 28.



Fig. 3. the seal impression, CMS II.6 no. 203, on a spherical weight found in *Quartier Mu* (image courtesy of the *CMS*, Heidelberg)



Fig. 4. a weight from the northeast border of the Palace impressed by the very same seal as Fig. 3; the seal impression, here CMS II.6 no. 212, is marked with an arrow (image courtesy of the CMS, Heidelberg)

«Take what you need, leave what you don't»[86]

Some craftspeople may well have been assigned «official» marks to use within the context of production organised from above; it is also possible, though, that some craftspeople themselves chose to use signs with a form derived from Cretan Hieroglyphic or Linear A for their own purposes and without outside prompting, as appears to have been the case at the Egyptian sites discussed above. At a site like Malia, the physical location of craft workshops within the *Quarter Mu* complex does suggest that the use of Cretan Hieroglyphic signs on pots and loom weights was one element of the overall strategy for administering activities there, but this still leaves open the question of whether the craftspeople opted in to this way of signifying meaning or it was imposed upon them. How could we differentiate between these two options, given that we lack readable records documenting the organisation and management of craft activities? We simply do not know how much autonomy craftspeople had, or the relationship between each specific context – sanctuary site versus court-centred compound/palace versus elite complex – and the status of the craftspeople working there.

There is perhaps an assumption here that script use is, firstly, the mark of officialdom, and, secondly, that when signs that look like Cretan Hieroglyphic or Linear A signs appear, they were being used as logograms or ideograms. As we saw, though, with the example of Egyptian masons' marks above, script signs could be used in several different ways, including simply as shapes without any linguistic significance, and these multiple uses could co-exist within a single worksite – some of the masons fixed their own meanings in signs.

While Cretan Hieroglyphic and Linear A usage was centred on court compounds and elite structures during the First Palace period, the use of writing was not hidden from those outside of these buildings; the Cretan Hieroglyphic crescent sealings which accompanied goods into the centre from the hinterland, for example, or the Linear A roundels used as a receipt of some sort, could both carry text in addition to their seal impressions[87]. The use of Cretan Hieroglyphic signs on seals, as one component of creating a meaningful motif, would also familiarise a range of people with what the signs looked look and how they could carry meaning. I would suggest that there was potentially a level of general awareness of writing practices that could encompass, at one extreme, a more detailed knowledge of script use, through to a vaguer sense that these signs were valuable and could be made meaningful.

It is certainly possible that some craftspeople observed the use of writing and chose to borrow some of the signs, either fully aware of their meaning (I come back to the use of the cloth ideogram on a loom weight, for example, see Fig. 2), or choosing to affix their own context-specific meaning which disregarded the semantic or ideographic content of the sign. This could represent a desire to partake in a practice associated with elite activities, although this need not necessarily imply any status aspiration – the very strong link between writing and administration could well suggest, to an observer, that this was a practice that promoted good organisation, productivity or success. It could also reflect the mobility or independence of a particular group and their ability to observe practices

[86] A phrase borrowed from the contemporary world of yoga instruction, but rather apt here with its built-in acknowledgement of individual agency and context-informed responses.

[87] Hallager 1996; Weingarten 1995.

outside of the confines of the workshop – the mobility of masons was discussed above, and this could contrast sharply with a dependent potter, for example, or a weaving community of practice, within which the men and women could well have different constraints on their mobility.

We cannot pull these different systems and practices, these craftspeople working on different materials in different socioeconomic settings, into a single logical system capable of encompassing both fingernail marks and readable script signs. Unsatisfactory though it is, a more productive approach would be to embrace the complexity and look at each marking system on its own terms, as a magpie-like collation of things that were useful and meaningful, that could be chosen or could be assigned, that met a particular need at a specific time and in a way that was shaped or constrained by the community of practice's setting.

Conclusions

The tone of much of the preceding analysis and discussion has been somewhat general and non-committal but deliberately so; the fragmentary and small-scale nature of the evidence, as well as the fact that the different practices discussed may have had very different prompts and meanings, demands an open and flexible approach. The tendency in the earlier literature to find a single overarching logic runs the risk of obscuring meaningful differences between craftspeople, the various materials they worked, or changes through time and space.

Instead of viewing pot or masons' marks, or the signs incised on loom weights etc., through the lens of (elite) administrative practices, a comparison that these marks will only ever be diminished by, I would propose that we position these marking practices wholly within the world of the craftsperson, part of their cognitive and practical toolkit for managing craft production. Perhaps at certain points these processes were directed from above (and it is unfortunate in this respect that the surviving Linear B tablets give us no pointers for how craftspeople working within the palatial economy were managed), but fundamentally these were practices driven and shaped by craftspeople. This approach acts as a challenge to the hierarchy of values inherent in much discussion of literacy, and allows the dignity of skill and creativity to all participants by properly recognising the value of skilfully creating a tool that answers a particular need.

It also allows for complexity, for the possibility that different people made different choices, and that what was done at one site was not necessarily the same everywhere – this is, after all, the essence of agency, that people chose to do things that work for them in their particular circumstances, according to their skills, resources and needs.

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The Function and the Users of Protopalatial Seals: Seal Groups of East Central and East Crete

Maria Anastasiadou

Abstract: The material traits of Protopalatial seal groups allow insights into their possibly different functions and users. Seals of the less exclusive Malia/Eastern Crete Steatite Group appear rather as symbolic objects meant to be worn on the body than administrative instruments. Those of the Hieroglyphic Deposit Group would have had the highest possible status and may have been used by a restricted number of high ranking individuals involved in administrative transactions with the palace. The Malia Workshop Subgroup seals may be seen as hard-stone versions of steatite seals used by individuals active in the milieu in which the steatite seals were produced but aspiring to ownership of higher ranking artefacts[1].

The most prominently represented seal groups in Protopalatial east central and east Crete are the Malia/Eastern Crete Steatite Group (Malia Steatite Group), the Hieroglyphic Deposit Group and the Malia Workshop Subgroup (Fig. 1).

The three groups share certain traits that differentiate them from the Protopalatial glyptic of central Crete, most prevalent among which is the preference for prismatic seals and the occurrence of Cretan Hieroglyphic inscriptions on their seal faces[2].

The contemporaneous presence of the three groups in the same general geographical region raises the question of whether there was a differentiation in their use and perception on behalf of the societies that produced and consumed them.

Below, it will be argued that the shapes, material, and imagery of each group may provide valuable insights into this topic.

Protopalatial seal groups of East Central and East Crete (Table 1)

With more than 700 examples, the Malia Steatite Group is the largest group of Protopalatial seals (Fig. 2)[3]. The seals are most often cut in steatite and rarer in other soft

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[2] For the Protopalatial glyptic of central Crete, see Anastasiadou 2010: 63-71; 2011: 120-137, 148-159; 2016: 167-169; 2019a.

[3] For detailed discussions of this group, see Yule 1980: 212-213; Poursat and Papatsarouha 2000: 257-261; Anastasiadou 2010: 58-63; 2011: 63-115; 2016: 162-163.

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materials and they are always hand-engraved. More than 80% of the seals in this group are three-sided prisms. Conoids (truncated or not) with Δ-, T-, or Π-shaped perforation, four-sided prisms, rectangular plates and signets follow. The intaglios are often deep and commonly display flat floors, deep outlines and undisguised tool marks.

The motifs are rendered summarily. Representational motifs such as humans, animals, and their parts, objects and constructions but also floral and ornamental motifs are common. In depictions involving representational motifs, background landscape elements that would help create the effect of images encountered in the natural world are missing. Floral and ornamental fillers that provide an ornamental quality to the image are, on the other hand, common.

Some images are put together by representational motifs that are combined with each other in manners similar to those of script signs in inscriptions[4]. In these «pictographic» images the combined motifs have no obvious thematic relationship to each other, their natural proportions are disregarded and they are often juxtaposed in paratactical or rotational manners with regard to each other.

Inscriptions of the Cretan Hieroglyphic are encountered on ca. 8% of the material and less than 4% of the image repertoire.

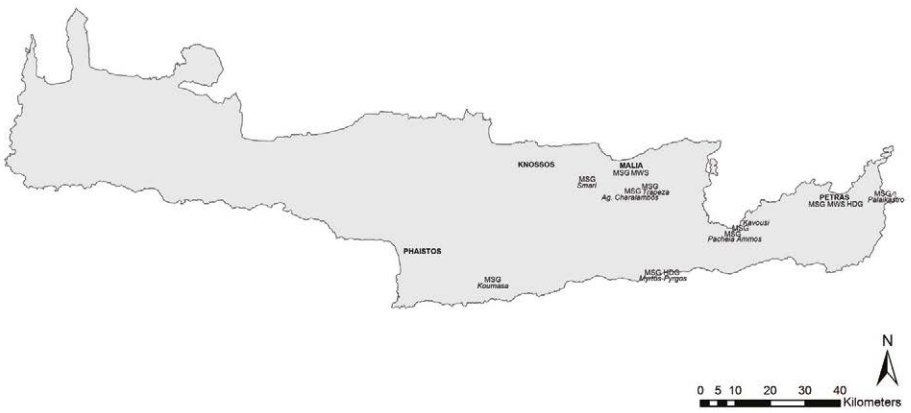


Fig. 1. Map of Crete with find-spots in which Protopalatial seals of the Malia/Eastern Crete Steatite Group (MSG), the Hieroglyphic Deposit Group (HDG), and the Malia Workshop Subgroup (MWS) have been recovered in contexts no later than MM II. Sites with palaces are written in capitals

Malia, where a large number of these objects has come to light, was certainly a, if not the, major production centre of this group and possibly also the trend-setter for their production and consumption elsewhere[5].

The objects were also popular in the Lasithi Plateau and the general region of Pediada. Single finds or clusters of such seals in the eastern part of the island, e.g., Petras, suggest a familiarity with these objects in areas as far as Kato Zakros.

[4] For the «pictographic» images, see Anastasiadou 2011: 344-345.

[5] For distribution maps of these pieces, see Anastasiadou 2011: 113, fig. 55 (only three-sided prisms); 2016: 161, fig. 2 (including the totality of the material but pieces from both secure and reported find-spots).

	Number	Materials	Engraving technique and style	Shapes	Imagery other than Cretan Hieroglyphic inscriptions	Cretan Hieroglyphic	Most notable find-spots
MSG	→ < 700	→ steatite → other soft materials rare	→ hand-engraving → deep intaglios with flat floors and commonly display flat floors → deep outlines →undisguised tool marks → summarily rendered motifs	→ three-sided prisms (< 80 %) → conoids (truncated or not) with Δ, T, or Π perforation → four-sided prisms →rectangular plates →signets	→ representational motifs → floral motifs → ornamental motifs → 'pictography'	→ ca. 8% of the seals →> 4% of the images	→ Malia → Lasithi Plateau → Pediada → Petras → East as far as Kato Zakros
HDG	→ < 120	→ hard stones, e.g., green jasper carnelian, agate chalcedony	→fast rotating tools deep but smooth intaglios → affluent use of curves → rounded intaglios	→ three- and four-sided (ca. 46%) → *Petschafte* → a few other shapes, including an eight-sided prism	→ representational motifs → ornamental motifs	→ ca. 53% of the seals → < 65% of the images → < 91 % on prismatic seals	→ Petras → Myrtos-Pyrgos → several other find-spots but not reliable information
MWS	→ > 30	→medium hard, e.g. reddish limestone → hard stones, e.g., rock crystal, carnelian, agate, breccia	→ fast rotating tools → deep smooth intaglios → drillings with undisguised tool-marks → summarily rendered motifs	→ three-sided prisms (ca. 61 %) → truncated cones → figural seals → *Petschafte*	→ representational motifs →ornamental motifs are rare → 'pictography' is uncommon	→ ca. 21 % of the seals → ca. 11 % of the images	→Malia →Petras

Tab. 1. Protopalatial Seal Groups of East Central and East Crete. The column «Most notable find-spots» only includes find-spots of seals, not of nodules with seal impressions (Malia Steatite Group: MSG; Hieroglyphic Deposit Group: HDG; Malia Workshop Subgroup: MWS)



Fig. 2. Malia/Eastern Crete Steatite Group: modern impressions of the three-sided prism CMS II,2 no. 174, a «pictographic» image on side (b) (Malia Workshop); three-sided prism CMS XI no. 81, abraded surface, the Hieroglyphic inscription CHIC 044-049 on side (b); signet CMS XII no. 90, floral representation; seal impression CMS II,6 no. 192 on a weight (Malia, Quartier Mu, Building A) (images courtesy of the CMS Heidelberg)

The Hieroglyphic Deposit Group takes its name from the so-called Hieroglyphic Deposit, which was discovered by Arthur Evans in the west wing of the Knossos palace (Fig. 3)[6]. This is an assemblage of impressed nodules and Cretan Hieroglyphic tablets that probably dates to MM III or MM IIIB/LM IA[7], although a MM II date has been recently suggested.



Fig. 3. Hieroglyphic Deposit Group: side-view and impressions of the jasper four-sided prism CMS I Suppl. no. 73, a fish on side (a), inscriptions of the Cretan Hieroglyphic on the other three sides, CHIC 044-049 on side (d) is a repeated sign-group, those on the remaining two sides are hapaxes («Siteia»); cornelian three-sided prism CMS VI no. 93, repeated inscriptions of the Cretan Hieroglyphic on all sides («Lasithi»); jasper *Petschaft* CMS IX no. 31 and impression, ornamental representation put together by three loop motifs («Praisos»); seal impression CMS II,6 no. 179 on a *nodulus*, hapax Hieroglyphic inscription CHIC 036-092 (Malia, Quartier Mu, Building B) (images courtesy of the CMS Heidelberg)

Many of the nodules in the assemblage carry impressions of MM II seals that display Cretan Hieroglyphic descriptions and stylistically belong together. For this reason, the group they make up, which also comprises of many seals (as opposed to seal impressions), was named after the Deposit.

The group comprises more than 120 hard stone seals that are cut with fast rotating tools[8]. Green jasper is the most popular material, followed by cornelian, agate and chalcedony. Approximately 46% of these pieces are three- and four-sided prisms

[6] Evans 1909: 19-22. For more lengthy discussions of the group, see Evans 1909: 138-44; Yule 1980: 215.219; Anastasiadou 2016: 165-167.

[7] For a summary of the opinions regarding the date of the documents found at the Hieroglyphic Deposit at Knossos (MM IIB, MM IIIA or MM III/LM I), see Anastasiadou 2016: 170 n. 70 with the relevant bibliography. For a recently suggested dating of the Deposit to MM II, see Godart 2024.

[8] The following 121 pieces have been counted with the group in this study: CMS I nos. 425, 428-430; II,1 no. 122; II,2 nos. 3, 217 (?), 223 (?), 227, 230, 248, 249, 251 (?), 256, 282, 286, 296, 316, 321; III nos. 19, 27, 93, 95 (?), 101, 102, 104, 110, 134 (?), 149, 227, 228-230, 236 (?), 234, 237, 238; IV nos. 29, 132, 136, 137, 156, 31D; V Suppl. 3 no. 41; VI nos. 91-97, 100-105, 107, 124, 125, 127-133, 138, 139, 141, 143-149; VII nos. 33, 34, 36 (?), 40, 41, 255; VIII nos. 34, 102, 103; IX nos. 21, 29, 31; X nos. 280, 312; XI nos. 12, 13, 331; XII nos. 89 (?), 99, 100-103, 105-107, 109-112, 113 (?), 115 (?), 117, 10D; XIII nos. 37; CHIC nos. 275 (?), 294; Krzyszkowska 2012: 146-147, no. P.TSU06/104 (chlorite); 149-155 nos. P.TSK06/145, P.TSK05/499 (?), P.TSK05/322, P.TSK05/259, P.TSK05/291, P.TSK05/291.

represented in equal quantities. The remainder are *Petschafte* and a few seals of other shapes, including an eight-sided prism. The intaglios are deep but they have a smooth surface. An affluent use of curves and rounded intaglios often create the impression of opulence[9]. More than half of the seals (ca. 53%) and more than 65% of the total number of images in the group display Hieroglyphic inscriptions. The vast majority of inscriptions (more than 91%) are encountered on prismatic seals. Non-Hieroglyphic images are made up of representational or ornamental motifs. Frontal cat or humanlike heads, whole cats, and hybrid creatures with human heads are common but other representational motifs, such as humans, goats, and birds are also encountered. Ornamental motifs consisting of spirals, veined leaves, lily flowers, and trefoils are common as are also fillers in the form of S- and J-spirals, crescents, dumbbell motifs and hatching. «Pictographic» representational images are very rare[10].

The majority of these seals have reportedly been recovered from find-spots in eastern Crete, and mainly the Siteia eparchy[11]. The discovery of a piece in Protopalatial Myrtos-Pyrgos and the recent recovery of several such seals in Protopalatial Petras confirms the supposition that these objects were popular in eastern Crete[12]. Seals of this type have also been reported from Malia and central Crete. However, their proportionately small numbers from these find-spots and the fact that none of them can be connected with a reliable context does not, at least in present evidence, allow a connection of these pieces with the central part of the island. For this reason it is noteworthy that several nodules with impressions of such seals were recovered in Knossos (Hieroglyphic Deposit).

The Malia Workshop Subgroup is the smallest of the three groups (Fig. 4)[13]. It includes fewer than 30 seals cut in medium-hard and hard stones with fast rotating tools[14]. Reddish medium-hard limestone and rock crystal are the most popular stones with cornelian, agate, and breccia following[15]. Three-sided prisms constitute ca. 61% of the seal shapes but truncated cones, figural seals and *Petschafte* are also encountered more than once. The intaglios are deep but, as inherent in the hard-stone technique, as a whole smooth with the exception of drillings in which tool-marks are often left undisguised. The motifs are, as in the steatite group, summarily rendered and the general imagery also resembles that of the steatite seals. Common are vessels (here created by dots and crescents), heads of wild goats and whole hoofed quadrupeds but dogs/lions and humans are also represented more than once. Ornamental devices are rare and, when encountered, they are created by the combination of circles. Dumbbells

[9] E.g. CMS III nos. 230, 238.

[10] The following seals that had been included in Group B of the Malia Workshop Subgroup in Anastasiadou 2016: 164, n. 27 are here considered closer to the Hieroglyphic Deposit Group: CMS II,2 no. 230; III no. 236; VI nos. 95, 96, 139; VII no. 36; XI no. 331; XII no. 115; Krzyszkowska 2021: 150, no. P.TSK05/499. «Pictographic» image on: CMS II,2 no. 230a.

[11] For a distribution map of these pieces but one including both pieces with secure and those from reported find-spots, see Anastasiadou 2016: 161, fig. 2.

[12] Myrtos-Pyrgos: Ferrara *et al.* 2016: 81-82, no. 1. Petras: Krzyszkowska 2012: 149-155, nos. P.TSK06/145, P.TSK05/322, P.TSK05/259, P.TSK05/291, P.TSK05/261.

[13] For this group see, Yule 1980: 213-214; Anastasiadou 2016: 163-165. This is a modified discussion of the group as presented in Anastasiadou 2016: 163-165 that only takes into consideration pieces that belong to Group I of Anastasiadou 2016: 164, n. 27.

[14] The following objects are counted in the group: CMS II,1 nos. 462, 468; II,2 nos. 79, 129 (?), 130, 150, 168, 412; III nos. 20 (?), 21, 22, 43, 181; IX no. 32; XII nos. 93, 94; CHIC no. 230 (?); Krzyszkowska 2017: 149-152, nos. PTSK12.877, PTSK13.1485, PTSK14.2603, PTSK14.2604, PTSK12.1249; 2018: 11, Pl. 6c; Anastasiadou 2019b: 152 no. S1.

[15] For this medium-hard limestone, see Krzyszkowska 2018: 10-14.

are the commonest fillers. «Pictographic» images are uncommon[16]. Cretan Hieroglyphic inscriptions, only attested on prisms, are present on ca. 21% of the material and make up ca. 11% of the images.

Among the seals with secure provenance, some have been recovered in Malia and a cluster comes from Petras, Siteia. Since most of the Malia pieces have been found in the Malia Seal-Cutter's Workshop there can be no doubt that at least some of these would have been manufactured there[17].

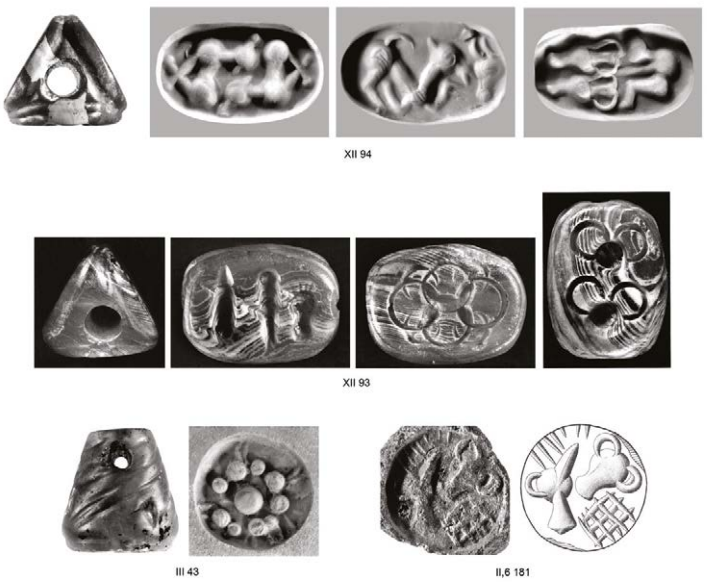


Fig. 4. Malia Workshop Subgroup: profile and impressions of breccia (?) three-sided prism CMS XII no. 94; agate three-sided prism CMS XII no. 93, the hapax sign sequence CHIC 068(?)-009-011 on side (a); rock crystal truncated cone CMS III no. 43 («Malia»); seal impression CMS II,6 no. 181 on a nodulus, hapax sign sequence CHIC 052-054-038 (?) (Malia, Quartier Mu, Building A) (images courtesy of the CMS Heidelberg)

The «character» of each group

The soft steatite of the Malia Steatite Seals was locally available[18]. The softness of the material would have made engraving easy but would also have contributed to quick abrasion of the seal's surface through use. Some objects with badly worn intaglios may well have been abraded by wear and tear[19]. The soft material in combination with the summary manner of rendering the motifs and the rather crude engraving would make the manufacturing process of these objects straightforward. Training individuals to carve the uncomplicated motifs in the soft stone would, probably, also not have been particularly

[16] Perhaps CMS XII no. 94b.

[17] For distribution maps of these pieces, see Anastasiadou 2011: 113, fig. 55 (only three-sided prisms); 2016: 161, fig. 2 (including the totality of the material but pieces from both secure and reported find-spots).

[18] For the soft stones used in seals of the group, see Anastasiadou 2011: 31-36 with further bibliography. For soft stone sources in Crete, see Becker 1976; Warren 1969: 124-156.

[19] For a discussion of the possible causes of the abrasion attested in the surface of these seals, see Anastasiadou 2011: 22-23.

time-consuming.

The representations on these seals seem to be intended more as signs/symbols of some sort rather than as descriptive media meant to «naturalistically» render images seen in the physical world. This is suggested by the summarily rendered motifs, the absence of landscape elements and the use of fillers[20]. This impression is further strengthened by the «pictographic» images in which the individual motifs may only be viewed as symbols of some kind[21].

The small number of seals with Hieroglyphic inscriptions betrays a restricted access to the technology of script[22]. This is further underlined by two observations. First, when encountered on three-sided prisms, inscriptions are most often only attested on one seal face. Secondly, seal faces with inscriptions that occur more than once in the Hieroglyphic corpus (repeated), such as the sign groups CHIC 044-049 and CHIC 057-034-056, are commoner than seal faces with hapax inscriptions[23]. Frequently repeated inscriptions could represent sign groups that referred to terms which were regularly used. This has been suggested for CHIC 044-049, the commonest sign sequence on seals of the group (29 examples) and Protopalatial seals in general and also the only sign sequence encountered on steatite seals from the Malia Workshop. The popularity of this sequence on the seals in question suggests a certain degree of standardisation in the use of the script on them. It has been proposed that this inscription could have stood for an extremely popular entity, such as the term «palace» or even have encoded a responsibility of low status in a hierarchical administrative system[24].

Its use need not always imply access to the technology of reading and writing by the engravers and users of the Malia Steatite Group. Since the sign sequence is so common, it is conceivable that illiterate individuals who would not have been able to read its signs could still have recognised their grouping as an image that symbolised a concept.

Seals of this group are rarely attested by their seal impressions. Only six out of ten impressions that can be associated with the group with certainty were stamped in the Protopalatial period[25]. Only these can, therefore, be considered indicative of their use in the time in which they were manufactured. This constitutes less than 1% of the number of seals that belong to the group. Three are impressed on administrative documents and the other three in clay objects, a loom weight, and two vessels[26].

[20] For a detailed discussion of the imagery of the group, see Anastasiadou 2011: 341-369.

[21] For a discussion of the possible meaning of the «pictographic» images, see Anastasiadou 2011: 354-356.

[22] For the Cretan Hieroglyphic inscriptions encountered on three-sided prisms of the group, see Anastasiadou 2011: 66-70.

[23] A rare case of a prism with individual inscriptions on all three sides is CMS II,2 no. 244 with the inscriptions CHIC 012-016-062-018; 060-044-056; 041-031-011.

[24] Olivier 1990: 18; Poursat 2000. For critique and a discussion of Olivier's suggestion, see Weingarten 1995: 303; Karnava 2002: 199-201.

[25] For impressions of such objects, see Anastasiadou 2011: 109-11; Sofianou and Brogan 2010: 35, 142 fig. 5; Anastasiadou: forthcoming. The following impressions are stamped on objects recovered from MM II contexts: CMS II,6 nos. 192-194, 196, 214. The pithos in Sofianou and Brogan 2010: 135, 142 fig. 5 was, according to the excavators, probably impressed in MM II-III. The seal impressions from the MM IIB Hieroglyphic Archive of Petras are not taken into consideration in this contribution because it is not possible to assess the material of the seals used. For the date of this deposit and of these seal impressions, see Tsipopoulou and Hallager 2010: 26, 195-205.

[26] Administrative documents: CMS II,6 nos. 193-194, 196. Weights, vessels: CMS II,6 no. 192; Sofianou and Brogan 2010: 35, 142 fig. 5; Anastasiadou: forthcoming.

The limited role of script on these seals and the small number of impressions made by them suggest a restricted role of these objects in the Hieroglyphic administration[27]. Their large numbers and the abraded surface of several among them could point to a primary function as some kind of amulets meant to be worn on the body. The recovery of a significant number of such objects in the Malia Workshop raises the possibility that these were, at least in part, serially produced artefacts destined for wide consumption. Common repeated inscriptions encoding non-personalised terms, such as CHIC 044-049, would not necessarily have to be individually ordered to fit the demands of a specific seal user.

The seals of the Hieroglyphic Deposit Group provide an excellent contrast to the steatite ones[28]. They are represented in much smaller numbers and are, as a rule, cut in hard stones which were, with the exception of jasper, rock crystal, and quartz, not available on the island[29]. Hard stones would have been more valuable than the local steatite not only because of their greater scarcity but also because of their more impressive colours and their resistance to wear[30]. A much more sophisticated technology was required to cut them than that needed for engraving soft stones because the tools would have to be operated in a compound appliance, the horizontal spindle[31]. The complexity of the tool as well as the technical skills required to build it and learn to effectively operate it would necessitate a larger set of skills and, consequently, significant training.

The strong connection of these objects with the Hieroglyphic script attests to great familiarity with it. Script is the most common imagery of these seals. Approximately 74% of the prisms with Hieroglyphic script display inscriptions on all sides[32]. One of the main functions of these objects would have been that of script carriers. Repeated inscriptions are popular as they are encountered in ca. 58% of the images with Hieroglyphic inscriptions but hapax sign-groups predominate with more than 80% of the total when each different inscription is only counted once[33]. There are prisms with repeated inscriptions on all their sides, others combining hapax with repeated inscriptions and also those which only display hapax sign groups[34]. The inscriptions are put together by two to six signs but exceptions with more signs, such as an elongated four-sided prism with an inscription of 15 signs on one side, are also encountered (Fig. 5 NMA 8915)[35]. The variability in which repeated and hapax inscriptions may be combined on the different sides of these seals,

[27] For this subject, see also Anastasiadou 2011: 22-23.

[28] For these seals, see Yule 1980: 215-219; Anastasiadou 2016: 165-167.

[29] For the possible sources of hard stones used in the Aegean, see Krzyszkowska 2005: 82-83; also Müller 2007: 13-17

[30] For the subject of the value of hard stones and metals in the Aegean as opposed to that of soft stones, see Müller 2012.

[31] For the technique employed in engraving hard stones, see Betts 1989: 12-14; Evely 1991: 156-160; Müller 2000: 195-198.

[32] Nineteen four-sided prisms, 20 three-sided prisms, and one eight-sided prism bear Hieroglyphic inscriptions on all sides. Apart from these, there are: one four-sided prism with Hieroglyphs on three sides (CMS XII no. 112), one with Hieroglyphs on two sides (CMS VI no. 100), and two with Hieroglyphs on one side (CMS III nos. 236, 237); also three three-sided prisms with Hieroglyphs on two sides (CMS IV no. 156; XI no. 12; XII no. 115) and three with Hieroglyphs on one side (CMS II,2 no. 230; III no. 230; VI no. 96).

[33] The sign groups CHIC 044-049 and CHIC 044-005, which are often combined in one piece, are the most popular (21 and 20 times respectively). They are followed by the sign-groups: CHIC 038-010-031 (14 times, also counted CHIC 038-010); CHIC 036-092-031 (11 times, also counted CHIC 036-092); CHIC 046-044 (7 times); CHIC 038-010 (alone or with a third sign, 5 times).

[34] Repeated inscriptions on all sides: e.g. CMS II,2 no. 296. Hapax and repeated inscriptions: e.g. CMS IV no. 29D; VI no. 102 (one hapax [CHIC 018-043] and seven repeated inscriptions). Hapax inscriptions on all sides: e.g. CMS III no. 234.

[35] CHIC no. 294b.

the longer sign-groups and the frequent use of hapax inscriptions suggest a flexibility in the use of script and, therefore, a larger connection with literacy than that attested on the steatite seals.

These seals appear to have been used for sealing more intensively than their steatite counterparts. The number of impressions from MM II contexts that can be attributed to seals of the group corresponds to ca. 13 % of the number of existing seals[36]. If the impressions recovered at the Hieroglyphic Deposit in Knossos and the *Dépôt Hiéroglyphique* in Malia, which are possibly MM III in date but are stamped within the milieu of the Cretan Hieroglyphic administration, are added to the above, the proportion of seal impressions to seals rises to ca. 38%[37].



Fig. 5. Protopalatial four-sided objects with inscriptions of the Cretan Hieroglyphic on all sides: four-sided clay bar HM 1391 (Malia palace, CHIC no. 112); hard (?)-stone elongated four-sided prism NMA 8915 (CHIC no. 294); jasper four-sided prism CMS II,2 no. 256 (Adromyloi, Siteia) (HM 1391 image courtesy of the Heraklion Archaeological Museum © Hellenic Ministry of Culture and Sports - Hellenic Organisation of Cultural Resources; NMA 8915 image courtesy of the CMS Heidelberg and the National Archaeological Museum, Athens © Hellenic Ministry of Culture and Sports - Hellenic Organization of Cultural Resources Development (H.O.C.RE.D.); CMS II,2 no. 256 courtesy of the CMS Heidelberg)

[36] MM II: CMS II,6 nos. 176-180; 183, 184 (?); 185, 186, 187, 188, 198 (?), 199 (?), 200 (?), 228 (?), 230 (?). EM III/MM IA-LM I: CMS II,6 no. 231.

[37] MM II-III: CMS II,6 nos. 168; CMS II,8 nos. 20 (?), 33, 34 (?), 37, 38, 44, 62-73, 75-80, 82, 83, 85, 88, 89 (?), 90. For the date of the *Dépôt Hiéroglyphique* in Malia, see CHIC: 28 (end of MM III); Schoep 1995: 34-36 (MM IIIB); 2001, 148; Pini in CMS II,6: 189 (LM I). For that of the Knossos Hieroglyphic Deposit, see CHIC: 28 (MM IIB); Younger: 1999: 381-382 (MM III); Schoep 2001 (MM IIIA); Pini in CMS II,8: 6-8 (MM IIIA-LM I).

The precious materials and elaborate execution of these seals in conjunction with their relatively limited numbers point to a more exclusive type of artefact than the steatite seals. The active use of script suggests that these seals, or at least those among them with elaborate sign-groups, were individually ordered with personalised inscriptions that would meet specific needs. The larger representation of their seal faces in sealing argues a more significant use in MM II and MM III administration than of their steatite counterparts. The above suggest that these were elite sphragistic objects that functioned as symbols of access to palatial administration.

Items with hapax inscriptions may constitute the objects with the highest value within the group. It is probably no chance that a gold four-sided prism and a silver *Petschaft* carry hapax sign-sequences[38]. It is likely significant that hapax inscriptions are commoner on four-sided prisms whereas most pieces with repeated inscriptions on all sides are three-sided prisms. Four-sided prisms are the «epitome» shape of the group and appear to have represented the highest ranking of all artefacts within it. This is not only suggested by the evident elaboration in their intaglios, imagery and script use. It is also hinted at by their overall similarity with one of the most significant administrative clay documents of the Cretan Hieroglyphic administration, the four-sided clay bar (Fig. 5). Not only do four-sided clay bars have the same shape as four-sided prisms, but they are also commonly inscribed with Hieroglyphic inscriptions on all faces[39]. The exceptional length of a four-sided prism that reaches 3.95 cm and its long hapax inscriptions typologically place it somewhere in between four-sided prisms and clay bars, underscoring the connection between the two artefact types (Fig. 5, NMA 8915). Four-sided prisms may, then, be seen as some kind of portable versions of four-sided clay bars that could be worn on the body to symbolise direct connection with the palatial Hieroglyphic administration.

Seals of the Malia Workshop Subgroup are situated in between the two groups above. Shapes characteristic of the steatite group, such as the truncated conoid, but also those of the Hieroglyphic Deposit Group, like the *Petschaft*, are encountered. The imagery of this group is close to that of the steatite seals in both motif choice as well as general execution and composition. The use of medium-hard stones and hard stones cut with the horizontal-spindle, however, distances these seals from the steatite group. Reminiscent of the steatite prisms is that Cretan Hieroglyphic inscriptions most often decorate only one face of a prism or, in one case, two sides[40]. The numbers of images with Hieroglyphic inscriptions are proportionately larger than in the steatite seals but smaller than in the Hieroglyphic Deposit Group. The majority of the inscriptions consist of two or three signs but there is perhaps larger variability in the encountered sign groups in comparison to the steatite seals in that only two out of seven inscribed seals display the same inscription and this is not, interestingly, the sign sequence CHIC 044-049[41]. Three out of an overall of seven inscriptions are hapaxes[42]. The number of seal impressions from this type of seals in MM II contexts is small but, as far as can be estimated from the impressions, it constitutes an approximate 13% of the number of existing seals[43]. This rises to ca. 22%

[38] CMS III no. 234; VI no. 126.

[39] For examples of such documents, see CHIC nos. 065-067, 112-115, 118.

[40] On the prism Krzyszkowska 2017: 151, no. 1249.

[41] The three-sided prisms Krzyskowska 2017: 150, no. PTSK14.2604; 151, no. PTSK12.1249.

[42] CHIC 041-025-065; CHIC 077-051; CHIC 068-009-011.

[43] CMS II,6 no. 189 (?); 197; 181; Anastasiadou 2019b: 155-156, SI2.

when impressions from the MM III Knossos Hieroglyphic Deposit are also added[44].

The users

Seals of the Malia Steatite Group appear to represent artefacts of a lower status in comparison to those of the other groups and available to a wider range of individuals. This is suggested by the following considerations: their large numbers; their readily available and easily abraded material; the uncomplicated technique; the crude intaglios; the scarcity of Hieroglyphic inscriptions; and their possibly serial production mode. The numbers of the group remain remarkably high even when the finds from the Malia Workshop, which could be considered exceptional because they were all found together, are excluded. With more than 550 representatives when the Malia Workshop finds are subtracted, the seals of this group still well-exceed the numbers of all other Protopalatial soft stone and hard stone groups.

The few MM II secure find contexts of these artefacts range from modest to above-average and highly prestigious. Among residential contexts only one piece has been recovered from the Malia Palace (Room ε)[45]. Apart from the Malia Workshop, such seals have also been recovered from Buildings A and B of Quartier Mu; the Potter's Workshop and also the South Workshop in Quartier Mu; and House Eβ in the vicinity of House E, a large mansion type of building situated in Quartier E ca. 150 m to the south of the Malia Palace[46]. Another piece comes from the Dye Workshop in Pefka which has been characterized by the excavators as a workshop of a palatial scale associated with a Minoan palace, and a further from debris suggested to have come from a Protopalatial central building in Myrtos-Pyrgos[47]. The majority of burial contexts are ossuaries where bones and artefacts lie in secondary deposition and may thus provide only scarce hints with regard to the users of these seals. The artefacts associated with such burials can range from a few pottery sherds to figurines, stone vases, and metal artefacts[48].

[44] CMS II,8 no. 36, 87.

[45] HMS 2209 (Pelon 1984: 881, 884, 885 fig. 7; Anastasiadou 2011: 551, no. 219). See also CMS II,2 no. 76 that was a stray find recovered in the central court of the palace.

[46] For House Eβ, see Hackens in Daux 1965: 1000; 1966: 1015; also Bradfer-Burdet 2005: 39-40. For House E, see Pelon 1970; Van Effenterre 1980: 411-414; Bradfer-Burdet 2005. A three-sided prism has also been recovered from Complex A in the hill of Troulli in Smari but since the building has not yet been published more information on its character is not available.

[47] Pefka: Betancourt *et al.* 2012: 184; Brogan in Apostolakou *et al.* 2020, 79-81; Betancourt, Brogan and Apostolakou in Apostolakou *et al.* 2020: 132. Myrtos-Pyrgos: Ferrara *et al.* 2016: 81-82, no. 2.

[48] CMS II,2 no. 259 (Ta Ellinika, Palaikastro): recovered together with some sherds and a probable bead from a single burial in a small burial or ossuary building (Dawkins 1903/04: 202); from another compartment of the same building were recovered several complete clay vases, a few bronze objects, a gold foil, a small stone vase and a piece of quartz. CMS II,2 no. 257 (Tou Galeti i Kefala, Palaikastro): ossuary where many complete clay vases, some stone vases, a small bronze implement, an earlier seal and a triton shell came to light (Bosanquet 1901/02: 292-297). Krzyszkowska 2012: 148-149 no. P.TSK09/1484 (House Tomb 4, Petras); 2017: 146-149 nos. PTSK12.1390, PTSK12.1624, PTSK14.2242, PTSK12.653, PTSK10.945 (House Tomb 10, Rooms 1 and 2): the burial context of the graves is not yet published. CMS V Suppl. 3 nos. 16, 17 (Evraiki, Kavousi): burial cave, where larnakes and one pithos were used for the burials; several clay vases and two simple stone vases were recovered from there (Tsipopoulou and Wedde in CMS V Suppl. 3: 93-94). CMS II,1 no. 427 (Trapeza): ossuary cave. CMS V Suppl. 1A nos. 40, 42-44, Betancourt 2003: 9 (Anastasiadou 2011: 490 no. 10) (Agios Charalambos): ossuary cave. In Trapeza and Agios Charalambos a large number of artefacts, including clay and stone vessels, metal objects, figurines, and seals were concentrated during a long period of time (Pendlebury *et al.* 1935/36; Betancourt *et al.* 2008). CMS II,1 no. 145 (Koumasa): Tholos A, disturbed upper burial layer (Xanthoudides 1924: 48, no. 528; CMS II,1: 152).

Since many of these objects were produced in the very heart of the Malia town, and several were consumed there, it is reasonable to assume that they would have acted as symbols of the Malia town on an ideological level. The manufacture of several of these seals in a workshop associated with an administrative complex situated close to the palace may well have provided them the status of an artefact related to elite culture[49].

The rare use of script on them would, however, suggest consuming environments where, at least in their majority, writing did not play a large role. It has been suggested that the Quartier Mu and its associated workshops were controlled by one of various elite groups active in the town of Malia in MM II but were producing artefacts of mediocre quality that were targeted at consumers with a lesser status, such as retinue and dependent workers[50]. The fact that most seals used in impressed nodules in Quartier Mu do not belong to the type produced at the adjacent workshop could support this view: the steatite seals might not have been meant for consumption in Quartier Mu and could, therefore, have had a less direct connection with economic administration[51]. Accordingly, the Malia Workshop products may have been largely destined for consumption in less-elite circles that were active in both the town and outside it. It is not impossible, as has been suggested in the past, that the objects had some kind of religious significance or were even related with religious affairs[52].

A tentative attempt to calculate the number of individuals who may have owned such seals provides some grounds for estimating their frequency in Maliote Protopalatial society. When a maximum of 250 years and thus 10 generations is calculated for MM II, the evidence from the steatite seals corresponds to an approximate 70 pieces per generation[53]. If this constitutes ca. 5% of the original output, as has been suggested, this would mean a production of ca. 1400 pieces per generation and thus a rather widespread use of these seals[54]. When only material from Malia is considered, this number drops to ca. 500 seals per generation. This corresponds to a considerable part but still not the totality of the population estimate of ca. 1.500-3.190 residents calculated by Whitelaw for the MM IB/II town[55].

In contrast to the steatite seals above, a series of evidently high status traits are combined on seals of the Hieroglyphic Deposit Group. These are the manufacture in hard stones, the elaborate imagery, the employment of script in complex manifestations as well as the use in palatial sealing administration. This hypothesis is strengthened by two considerations. One is the use of gold for one and silver for another of these seals. The other is the frequent employment of the four-sided prismatic shape that may, on account of its resemblance to Hieroglyphic clay tablets, be seen as a symbol of direct access to palatial administration[56].

[49] For the character of Quartier Mu as an elite complex, see Poursat 1992; Poursat-Knappet 2005: 197-200; Schoep 2002: 111-120; 2004: 255-264; also 2006: especially 51.

[50] Schoep 2010: 72.

[51] Steatite seals used in sphragistic instruments in Quartier Mu: CMS II,6 nos. 192 (weight), 193-194, 196 (impressed nodules).

[52] Poursat 1989: 222-223.

[53] For the absolute chronology of the Aegean Bronze Age Warren-Hankey 1989: 69 is followed. For the average life expectancy of 25-35 years in Minoan Crete, see Triantaphyllou 2010.

[54] Pini 1996: 1092 (Pini suggests that what we have max. 5-10% of the original output); also Krzyszkowska 2005, 1.

[55] Whitelaw 2012: 156 Table 4.2.

[56] For the subject of the value of metals in the Aegean, see Müller 2012. Metal seals will have probably survived in a

The limited number of these seals, which corresponds to ca. 1/6 of the number of the steatite seals, suggests a more restricted circle of users. These would have had access to materials and knowledge not readily available to all. They would, moreover, frequently be engaged in transactions with palatial or other central administration, as suggested by impressions of their seals in the Knossos and Malia palace as well as Quartier Mu[57]. A considerable proportion of them would also have had some kind of contact with active literacy, either by way of personal acquaintance with the script or interaction with an actively literate environment[58]. The recent discovery of such seals in the House Tomb 2 of Petras, which the excavator suggests stands out from the rest on account of its protected place in the cemetery, could be seen as a further indication of the high social status of the users of these artefacts[59].

Seals of the Malia Workshop Subgroup appear as starter or experimental versions of hard-stone seals. They cannot, however, be seen as predecessor versions of seals of the Hieroglyphic Deposit Group because they lack their elaboration. Moreover, the two groups are contemporaneous as they are attested in the same MM IIB destruction horizon in Quartier Mu: impressions of the Cretan Hieroglyphic Deposit Group seals were stamped on nodules recovered there and Malia Workshop Subgroup seals were manufactured in the Malia Workshop[60]. The similarities in the imagery of the Malia Workshop Subgroup seals to that of the steatite seals point to the former as some kind of hard-stone versions of steatite seals instead. The recovery of these seals alongside steatite seals in the Malia Workshop strengthens this hypothesis. Their state of preservation there suggests that, at the time of its destruction, the Workshop was experimenting with the engraving of harder materials. This is suggested by the following: all seals from the Workshop that are made in materials that are harder than soft stones are manufactured in medium-hard as opposed to hard stones; none among them has a string-hole channel; three-sided prisms have one unengraved seal face; one *Petschaft* is broken and displays an unintelligible motif; another *Petschaft* is only minimally engraved. This circumstance in conjunction with the restricted numbers and harder materials of these artefacts may well point to seals that were created in the same milieu as the steatite seals but were aimed at creating a more «precious» impression.

These seals may, accordingly, have been destined for a limited number of higher ranking consumers active in the same environment in which steatite seals were produced but aspiring to the use of more elite artefacts. The restricted number of seal impressions that may be attributed to seals of this type do not allow any more solid explanation for the exact significance of the objects. Still, it is noteworthy that the ratio of seal impressions to seals is comparable to that observed in the Hieroglyphic Deposit Group where seals appeared to have had a significant sphragistic function.

smaller number than stone seals since metal is usually recycled after the end of the life of an artefact.

[57] CMS II,6 nos. 168, 176-181, 183-188, 198-200; CMS II,8 nos. 20, 33, 37, 38, 44, 87, 89, 90, 62-83, 85, 88.

[58] For the opinion that knowledge of the script is not required when using a printing medium, see Karnava 2002: 231.

[59] For the seals from Petras, see Krzyszkowska 2012. For the character of the house tombs in Petras, see Tsipopoulou 2012: 119.

[60] Malia Workshop Subgroup seals from the Malia Workshop: CMS II,2 nos. 129, 130, 136 (?), 150, 168.

Concluding remarks

The shapes, materials and imagery of the three major Protopalatial seal groups of east-central and east Crete allow insights into their possibly different functions and users. The seals of the Malia Steatite Group display more traits of symbolic objects connected with personal beliefs or ideology and less those of administrative instruments. Their large number suggests availability to a wider circle of individuals than the others and, in at least some cases, possibly also serial production. The manufacture of the Malia Workshop objects in the immediate vicinity of Quartier Mu, Malia, may indicate control of their production by social groups active there. This could have laden the artefacts with some prestige in a low (?) sub-elite level related to their connection with an administrative complex close to the palace. Their close relation to Malia would most possibly have made them symbols of some kind of connection with this town in at least the areas around it. It is not yet known whether the recovery of a cluster of such artifacts at Petras points to the existence of a second workshop for these objects there.

Seals of the Hieroglyphic Deposit Group appear to have been a much more exclusive type of artefact than the steatite seals. The precious materials, elaborate engraving style and intricate imagery of these objects in conjunction with their strong connection with script point to elite artefacts of the highest status. They may be connected with a restricted number of high ranking individuals who would have often had administrative transactions with the palace and, at least part of them, also access to some form of active literacy. It is not possible to connect these objects with a specific production area but their distribution in the general area of east Crete shows a degree of popularity there. The absence of such seals from excavated contexts in Malia does not allow their connection with the town. The intense sphragistic use of these objects in Knossos does not necessarily connect them with the Protopalatial town because the Hieroglyphic Deposit of Knossos is probably somewhat later than MM IIB.

Finally, the seals of the Malia Workshop Subgroup should be seen as hard-stone versions of steatite seals. Their restricted numbers and more valuable materials could suggest items of a higher status than the steatite seals but their lack of elaboration in comparison to the seals of the Hieroglyphic Deposit Group makes them appear, at least to the modern eyes, sub-elite in comparison to the latter. While they could potentially have been used sphragistically more often than the steatite seals, this cannot be ascertained on present evidence. These seals were possibly products of workshops active in the same cultural environment in which the steatite seals were produced and several were certainly manufactured in Malia.

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«Written» seals as symbolic means of communication

Anna Margherita Jasink

Abstract: This contribution is intended to follow and deepen the argument presented in Ferrara-Jasink 2017, that some particular Hieroglyphic seals may have been meant more as personal markers and status-symbols than tools of Protopalatial bureaucracy and that these seals do not present any really written message. We discuss two seals, each of a unique shape: an 8-sided prism and an abnormally long 4-sided prism, both carved with Hieroglyphic signs. We argue that, in both cases, the seal-engraver intentionally cut a strange and *mirabilis* object in accordance with the wishes of his client, the future seal-owner. Neither the seals nor the engraved symbols are likely to have had any practical function within the administrative organization of the time, but were objects to be worn as body ornaments (pierced longitudinally pendant) and emblems of authority or social distinction.

Introduction

As repeatedly discussed, we suggest that neither the whole Corpus of Hieroglyphic seals listed in CHIC nor the seals engraved with single signs otherwise collected in the Corpus were necessarily used by scribes involved in bureaucratic administration during the Protopalatial period. It seems possible, even likely, that some may represent individual objects created for their owners without any necessary link to the organized system in the hands of palace functionaries. This viewpoint accords with the idea that the seal inscription may not only be conceived with the aim of being read but also with the purpose of inciting admiration by its being decorated with symbols which increase the beauty of the composition on each face of the seal. However, even some seals with no decorative ornamental or «iconic» symbols, but which use only a written formulary, could be completely separated from any practical use in administration, being ornamental pendants with groups of signs which result in an attractive piece of jewellery.

We consider here only two seals, very different from each other, but both without any certain link to an administrative system.

The 8-sided prism

One example of these particular objects can be found in the 8-sided prism in veined agate (sardonyx) (CHIC #114/CMS VI 102), acquired by Evans in Eastern Crete, at

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Neapolis, which for material and style has been dated to MM II (Fig. 1). In fact, a number of well-known sign-groups is carved on its faces, but it seems that a systematic reading of the whole of them should be ruled out. Moreover, the singularity or rarity of some symbols and the reoccurrence of others with different shapes could point to recognize in the object something peculiar; and in the carver a sort of copyist, not really involved in the meaning of the script, but rather in the beautiful appearance of the seal, intended as an artistic and original work, a harmonious whole of different elements.

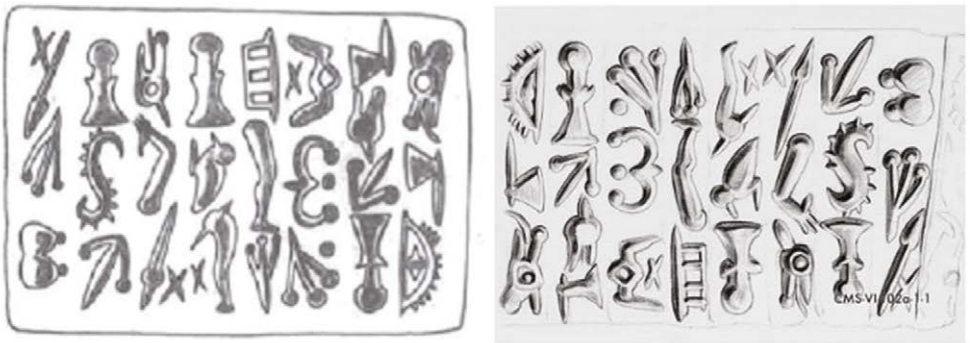


Fig. 1. The Neapolis seal: drawings from CHIC #314 (left) and from CMS VI 102 (right)

Many works have been written on this seal[1], trying a connection among its various faces. We too have been involved repeatedly on this topic[2] which we shall discuss here with this novel perspective intended, moreover, to clarify some difficulties of interpretation otherwise obscure.

Civitillo[3] sums up exactly in a few words the multiple uses of Protopalatial seals, specifically as amulets and sphragistic ones. But, perhaps, this principle, which is an essential requirement to explain most of the Hieroglyphic seals, in a few cases does not work out. Our difficulty to extrapolate the actual value of all the symbols or of groups of symbols, their reciprocal position or linking, their possible true reading or not, is perhaps a spurious problem.

While some aspects of the seal in question may be rightly questioned and solved, others depend exclusively on the creativity of the engraver, from one side, and the interests of the client, from the other. All these elements could move away an effective «reading» of the seal.

[1] Published by Myres 1949: 226-227, in the first main edition the seal's material has been defined by Kenna as «striped agate which may have been subjected to heat» (Kenna 1960: 111); Kenna stressed how this seal «bears the largest number of hieroglyphs on one seal, twenty-five groups in all». Starting from the idea that the seal belongs to the tools of the Minoan administration, Olivier (1996: 4) suggests to recognize in this seal a sort of «*super tampon*», while Jasink (2007: 94) a «kind of thematic dictionary». More recently see Civitillo 2016: 72-73 and 98-99; Jasink and Weingarten 2024: 85-88. Reference to a «first» face is highly subjective: *e.g.* face **α** in CHIC corresponds to face h of CMS (see Fig. 1).

[2] In particular Jasink 2007.

[3] Civitillo 2016 *passim;* Civitillo 2021: 104.

Dubious symbols

We begin our analysis from three symbols whose identity seems not clear: the «spiral» (face β/g), the «duck» (δ/f), the «eye(?)» (θ/a).

a. The first symbol[4] is deleted in the transcription of the script-signs of this seal. It was numbered in CHIC among *klasmatogrammes*, which kept it in some way within the Hieroglyphic patrimony, but only on three «particular seals»[5], which are defined as «matrix-seals»[6], and never on written administrative documents, where the function as a fraction would appear more convincing[7]. This symbol surely played an important role as a decorative motif since the Prepalatial period[8] but, even if it maintained a primary decorative role during the Protopalatial age as well, it undoubtedly belongs to the Hieroglyphic patrimony[9]. It is often connected to the most common so-called *formulas* «trowel-arrow» and «trowel-eye»; it seems impossible we are dealing with a decorative filler so we prefer to consider the symbol as an integral part of the *formulas*. Possibly, in these sequences, the «spiral» has not a syllabic value but represents a logogram (see also below).

On the 8-sided prism, the spiral is adorned with small linear decorative appendixes, which are also present in other seals, where again the symbol is omitted in the CHIC transcription. For example, CHIC #300/CMS X 52 (of unknown provenance, stylistically defined as «*Mallia Steatitgruppe*, MM II») (Fig. 2): on face a, the symbol is carved between «trowel» and «arrow» and obviously not numbered because considered an obstacle for the well-known *formula*, but the same treatment is reserved also to H 061 «zig-zag», inserted between H 014, «ass's head» and H 050 «spear», on face *d*. Both ending of «zig-zag» are formed by a sort of *triangle frangé* (the linear appendixes may be compared to those added to the «spiral»)[10]. When used as a decorative motif, the spiral is easily recognizable by its small dimensions – if on the same face of written signs –, or for the heraldic position, or as part of other ornamental motifs[11]. As noted above, this is one of the most common decorative motifs from (late) Prepalatial[12] throughout the whole Protopalatial period. Later, when the «spiral» becomes an important sign in the patrimony of the Linear scripts, its use as decoration declines.

[4] Jasink 2005: 23-29.

[5] CHIC #206, #291, #292. A likely dating for these three seals is at the beginning of the Protopalatial period.

[6] See Jasink and Weingarten 2024: also for previous bibliography on this group.

[7] The idea of such a significance as *klasmatogram* in Hieroglyphic likely derives from its value of fraction (A 703/D) in Linear A; but in Linear B it represents the syllable *we* (LB 75) and nothing opposes an use of the same symbol (both logographic and perhaps syllabic) also in the Hieroglyphic patrimony.

[8] Examples quoted in Jasink 2009: 135 and n. 124.

[9] Jasink 2009: 134-137.

[10] This last seal suggests two further considerations: 1) Evans 1909 identifies the «zig-zag» with a «snake» (SM No. 84), eliminated in the catalogue of CHIC and recovered by Jasink 2009: 87-89, 190. Already on a stamp cylinder from the Mochlos cemetery, CMS II.1 477, dated to EM II-III from the context but stylistically possibly belonging to EM III-MM I (according to CMS/ARACHNE), we find on both the bases two motifs likely appearing for the first time in the Aegean glyptic: on one of them a snake/zig-zag, supported by triangular forms next to a long line, and on the other a sitting man (Kenna 1960: 16; Yule 1980: 119 and Plate 1.6). This is one of the proofs that these three motifs – human figure, snake/zig-zag, spiral – are well known and engraved on seals before the beginning of the Hieroglyphic script. 2)Nearly all the motifs attested on this seal are carved also on our 8-sided prism: H 010, H 014, H 018, H 031, H 038, H 044, H 049, H 050, H 309. Only the zig-zag motif and eventually the «saw» H 045 (if this symbol, in partly lacking, is recognizable on face d: see Jasink 2009: 80) are missing.

[11] Various examples in Yule 1980: 160-161 and Plate 26.

[12] See CMS II.1 472, a bone cylinder from the EM II-III context in Mochlos necropolis, Grave II; *cfr.* the stamp cylinder in steatite found in the same necropolis, but in grave XVIII, recalled above, n. 10.

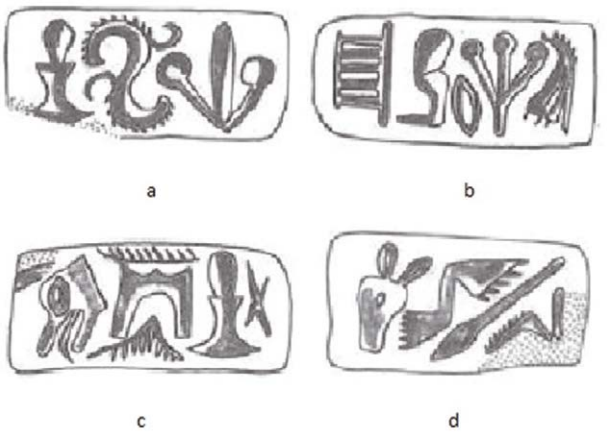


Fig. 2. The 4-sided prism in the Erlenmeyer Collection, Basel (from CHIC #300)

b. The «duck» or «seated bird» has not been completely ignored in CHIC, unlike the spiral («*décoration non signifiante évident*»: CHIC, 13), but transcribed as {!} («*décoration éventuellement signifiante non évident*»: CHIC, 14). However, this symbol was not numbered among the Hieroglyphic signs. According to our interpretation of the prism as a whole, it seems impossible that two symbols, as the spiral and the duck, engraved with the same size and the same visual impact of all the other script-signs, belong to a different typology of motifs[13]. However, while the first symbol may be frequently added to script signs to embellish and complete a seal face – this is not the case on our prism –, the duck, because of its animal shape, has mostly a more pregnant value and a logographic/syllabic meaning must be considered.

At least in another case a possible variant of the same «duck» may represent a script-sign. It deals with two identical sealings (Fig. 3) impressed twice on cup handles from Palaikastro (SM, P. 43, No. 82; CMS II.6 246), where a «duck» completes the composition of the face together with two symbols, of which only one has been numbered as script-sign in CHIC: the first is a vessel, specifically a «jug» (SM No. 43, H 053)[14], the second, (SM No.120), is in fact an «enigmatic symbol», but with the same dimensions and likely the same function (syllable or logogram?) of the others[15].

c. The eye H 005 is one of the most attested signs in the Hieroglyphic patrimony, generally accompanied by sign H 049 . But are we sure that the symbol , carved on face θ/a of our seal, is an eye? We don't have any other example on seals where only one

[13] Brice 1997 analyzed various examples of «seated bird», mostly concerning its probable presence on the «Arkhanes *formula*», pointing up how the symbol on our prism «is certainly not a decoration, nor an ornamental duplicate, nor a «signe expletif» (p. 96) and concluding that all the considered examples could belong to the category of Evans SM No. 80. For a more detailed discussion on this sign and on more generic «birds», with related bibliography, see Jasink 2009, 50, 140-141; on a different interpretation of this symbol on the «Arkhanes *formula*» see Perna 2019: 52-54.

[14] This symbol is numbered in CHIC, but not on this sealing, because the Authors of CHIC don't recognize as script-signs the other symbols and consider Hieroglyphic seal-faces only those having at least two script signs.

[15] In two previous works (Jasink 2007: 96, and 2009: 509) we proposed to recognize a «seated bird» similar to our duck also on the Knossos sealing CHIC #141, according to the drawing; but looking at the images of CMS II.8 086 (on ARACHNE) the representation of a schematic «regardant» quadruped seems more believable (see already Younger 1998: 399).

of the two sides of the eye is curved, and the other one straight, and without eyelashes. Moreover, the usually round or oval iris has here some unique lateral appendixes[16]. We could imagine that the engraver chose not to curve both sides of the eye, and that the symbol carved on face θ is simply a variant of the eye (CHIC, 387), albeit of the strange shape . But this seems doubtful because of the accurate execution of the other symbols; conceivably, the engraver drew an uncommon (script) symbol, simply unattested in our scanty documentation.



Fig. 3. The sealing from Palaikastro, impressed twice on cup handles (from CMS II.6 246)

Animal's head

On faces γ η θ we find an animal's head which usually has been interpreted as H 018 «wolf's head with protruding tongue». Two considerations show the difficulty to recognize, at least for the symbols carved on faces η and θ, exactly the same animal: first, it seems strange that two symbols, made by the same engraver and placed fairly close together, have such different shapes; second, on no written seal is the same group of two signs repeated on different faces[17], although our seal, a *unicum*, might not follow these rules. The animal's head on face η, without a visible protruding tongue, could be identified either as 017 (SM No. 68 «ass's head»), recognized in CHIC only on five seals with evident variants but never part of groups in administrative texts, or as 014 (SM No. 64 «calf's head»), recognized in CHIC on two seals, one sealing and three clay administrative documents. On the contrary, the animal's head carved on face γ is likely to be the same as on face θ – or, rather, a «variant» –, in a reversed position[18].

[16] Jasink 2009: 101.

[17] Civitillo 2016: 73. Civitillo rightly quotes as hypothetical the case of CHIC #266, which is a drawing by Evans from a 3-sided prism in gray jasper where, however, the group 044-049 on face b, differently from face c, is divided by the «tree with ascending branches» 025 . An analogous situation occurs also in our 8-sided prism, where on side β we find while on side θ the *formula* 044-049 has no intermediate signs.

[18] On the various occurrences of the «dog/wolf's head with protruding tongue» see Jasink 2009: 121-123, with an extensive bibliography. In particular, on the long life of this motif, see Weingarten 1989: 46-47 and 1992: 31. It recurs repeatedly from MM II to LM I becoming a characteristic symbol of an administrative Cretan system defined by Weingarten MSS (*Multiple Sealing System*).

The 𓃀 symbol and the formulas

So far we have analyzed single symbols, concentrating on their shape and only indirectly on their function. A major point is to define their significance on this seal: are they iconic symbols, logograms or syllables? May each one be interpreted, according to its position, with a different value? Obviously this problem is connected to our suspicion that the artist was not carving a document meant to be really read, but was primarily an engraver of ornamental and iconographic patterns whose purpose was the creation of an excellent work, a fine object attractive for his client, the seal-owner.

Nevertheless, we are inclined to assume that he was inspired exclusively by script-signs and groups of script-signs and that all the symbols may have a written value: therefore, each motif, bound in one of the eight sides together with other symbols, may be analyzed both for its own character and for its organization in the whole face as belonging to a signs-group.

With both these aims, we may start with the most common symbol in Hieroglyphic script, H 044 𓃀, which appears three times on the prism. The traditional interpretation as a «trowel» cannot be ruled out, but the hypothesis that the sign may refer to the most bureaucratic seal shape, the *Petshaft*, seems very attractive[19]. The engraver, who surely knew what the sign represented – even were he not especially involved with scribal administration –, put it in three different contexts:

a. On face β the artist likely drew inspiration from the contemporary 4-sided prism (CHIC #300/CMS X 52) quoted above analyzing the «spiral», or from analogous seals. The hypothesis that the most common *formula*, composed of two (𓃀𓂝) syllables, is simply divided by a «decorative» symbol, 𓆙, has been questioned above and we consider rather that the 𓆙 symbol is an integral part of a group of three signs[20].

b. On face δ the «duck», or «seated bird» (see above), divides two symbols recurring together on many seals and generally considered as a *formula*: H 046 𓋴 and H 044 𓃀. The interpretation of this «group» recalls the problems of the 𓃀𓂝 «group» attested on face β.

Two preliminary remarks are appropriate:

1. The «adze with handle» 𓋴[21], with the exception of our prism with the duck symbol in a middle position, is coupled with 𓃀 in almost all its occurrences on seals[22];

2. The small cross-symbol x (defined in CHIC as a *stiktogram*) accompanies almost always 𓋴: could this represent a proof for the reading direction of the «group» 𓋴𓃀[23]? But both symbols are almost always surrounded or flanked or divided by decorative motifs (Fig. 4), which could indicate a logographic value not only for 𓃀 but also, by analogy, for

[19] Ferrara and Cristiani 2016.

[20] Ferrara and Weingarten 2022: 116-117 suggest to decouple and deconstruct the sequences which depend on the «trowel» sign – exactly 𓃀𓂝 and 𓃀𓆑 –, supposing we are in front of a logographic writing.

[21] Evans 1909: No 21. According to Evans this tool has an Egyptianizing form.

[22] Only on the 4-sided prism CHIC #301γ 𓋴 is linked to another symbol: H 018 𓃾 «wolf's head with protruding tongue»! CHIC doubtfully suggests to recognize this sign on three administrative documents (#019γ, #030a, #049a), but this hypothesis is rather unbelievable.

[23] However, the use of the «small cross» on seals seems to differ from its role on clay documents, where it has the function to indicate the reading direction (Ferrara and Weingarten 2022: 113-114, suggest that Minoans applied this sign, on seals, next to a symbol «to distinguish what is iconic and what is writing *strictu sensu*»). As a consequence, we don't give a particular attention to the four «crosses» on our seal, linked on faces α and γ to H 050 𓌳, on face δ to H 046 𓋴 and on face ζ to H 036 𓌻.

[24]. If we accept this hypothesis, the same could be said for the three signs occurring on face β.

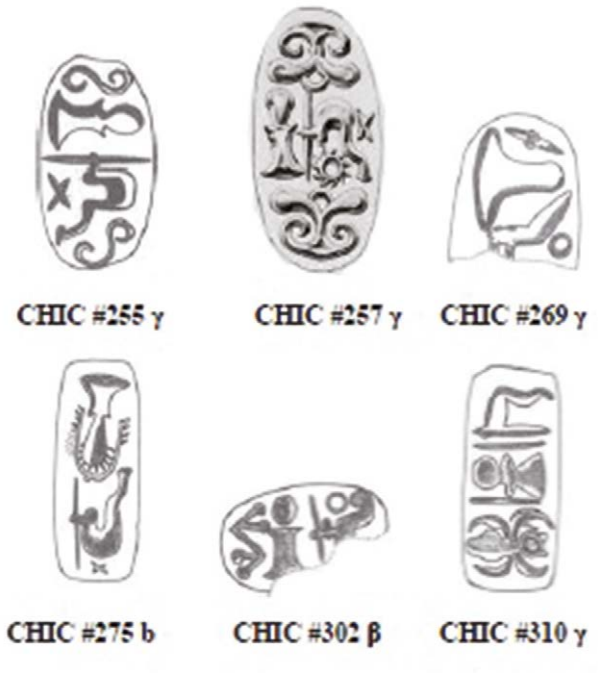


Fig .4. The «signs-group» 046-044 on Hieroglyphic seals (revised from CHIC)

Alternatively, we are in front of a group composed of three syllables. In any case, we are not dealing with a group of two signs!

c. On face η we find H 044 with a probable syllabic value, likely at the beginning of a group of signs. Again, we are inclined to exclude that is the first sign of the so-called *formula* «trowel-arrow»: possibly all four signs in the line constitute a single «word». As to the third and fourth symbols, a true «reading» is accepted only for the last sign: H 043 , the «axe»[25]. This symbol, different from the most famous sign, the «double axe» (H 042), occurs only on three seals[26]. On this prism it is again engraved on the last side, face θ, composing a group whose interpretation is still debated[27].

[24] In CHIC #255, a white carnelian 3-sided prism likely from Eastern Crete, both symbols are flanked at the opposite sides by a smaller spiral; likewise, in CHIC #257, a red carnelian 3-sided prism likely from Lasithi, two motives formed by two opposite scrolls are carved above and under the group. In CHIC #269, a fragmentary chalcedony 3-sided prism from Lasithi, a similar expedient is adopted, with two ornamental small symbols flanking both our motifs. In CHIC #275, a *moulage* of a green jasper 3-sided prism from Mirabelo, a part of is lacking, while from the other side of a zig-zag motif is carved. In CHIC #302, a chalcedony 4-sided prism of unknown provenance, while is simply preceded by the small cross, the head of the is encapsulated by a linear semicircular decoration. In CHIC #310, a carnelian 4-sided prism from Sitia, is separated from by a linear bar, and a second linear bar divides from another symbol, the «spider», (Evans 1909: No. 85). On this particular seal and the occurrence of , see Jasink and Weingarten 2024: 83-84.

[25] For the doubts on the third symbol, an «animal's head», see above.

[26] It occurs also on two administrative clay documents: two labels from Knossos, CHIC #039 and CHIC #042, which on face *a* present the group 043-070 , referring to unknown commodities.

[27] We could deal with one group formed by three symbols, the first two recognizable as H 018-043 but the third either a simple «variant» of the «eye» H 005 (CHIC, 387) or as a different symbol, the «semicircular complex symbol» (Jasink 2007: 98; Id. 2009: 101-102; see already above). CHIC proposes to distinguish two groups, the first

Further symbols and sign-groups

We briefly conclude the analysis of signs and groups of signs which characterize the 8-sided prism, starting from faces α and γ. These two sides of the prism seem to begin, conventionally, with the same symbol, H 050 , the «spear», which is linked to the «small cross». The «groups» formed by three symbols on both faces constitute a *unicum*: H 050-031-034 and H 050-007-018 , respectively. As to the symbols, we stress our doubts on the identification with «mountains» – H 034 – for the third symbol on face α[28].

Differently, the groups on ε and ζ occur on many seals and sealings, although never carved on clay documents. As to the first group, H 038-010-031 , see, among the others, Jasink[29]. As to the second, H 036-092-031 , we underline how a «small cross» (similar to those next to and to) has been engraved inside H 036 , «the template»; but, as it happens, for instance, for , in many cases this small symbol seems to represent only one of the ornamental elements which accompany and individualize on seals the most important Hieroglyphic signs: its presence is not necessarily in contrast with the interpretation of as the first syllable of the group!

The exceptionally long prism CHIC #294

The second seal we are going to discuss is equally a *unicum*[30]. Acquired by Evans, but of unknown provenance, it is a white steatite 4-sided prism (Fig. 5), stylistically dated to MM II. Faces α and γ are slightly wider than β and δ. The seal is exceptionally long (3.95 cm). While the two narrower sides seem to bear symbols that are script-like, the other two faces present symbols that are likely to be of a different kind. We may begin just from these last sides.

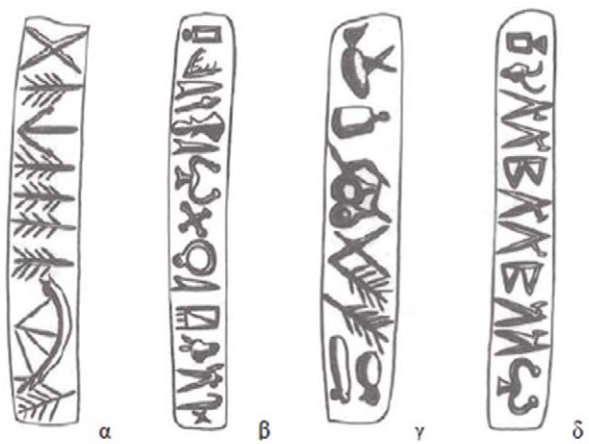


Fig. 5. The exceptionally long 4-sided prism in white steatite (from CHIC #294)

composed by and the second by <>, giving to the sign of face η the possibility to be «read» also on the next face θ, forming, as needed, both *formulas* and .

[28] On our doubts on the identification of this last symbol with the «mountains sign» rather than with the deleted symbol of Evans No. 4 «woman's breasts» or the «two joined ovals» H 077 see in the following. On the supposed «variants» of the «mountains sign» see also Jasink *et alii* 2007: 83-88.

[29] Jasink 2002: 213-215, and 2007: 96.

[30] Many works have been written also on this seal. For its description, a discussion on the suggested hypotheses and new suggestions see Civitillo 2016: 73-74 and Civitillo 2023).

Face α

On face α there are six tree-like signs, four in the middle of the design, a fifth between a big «cross» and an «arrow», and a sixth, in a sloping position, divided from the four central trees by a «ship». According to CHIC (14-15), the big cross is equivalent to the «small cross» and could indicate the direction of the «inscription», while the «tree» corresponds to H 025  , the «arrow» to H 049  , and the «ship» to H 040 ; the «tree» appears mechanically repeated. «Reading» this face of the seal in this way is entirely hypothetical (as CHIC's authors themselves admit). We find difficult to accept the possibility that the engraver who, as we shall see, has harmoniously composed faces β and δ, is suddenly confronted with a problem on face α and «*n'a pas su quoi faire de tout l'espace dont il disposait*». If, on the contrary, we start from the idea that the craftsman was not involved in the scribal administration and was engraving a seal not meant to be read but which only resembled a script-seal, the repetition of the «trees» and the three larger symbols (cross, arrow and ship) on this face may be explained more simply as ingenious tricks. Perhaps, the interpretation of the seal by Evans[31], who remarked that the strong iconicity of the ship and the trees «seem to point to oversea traffic in timber», is perhaps likely to be correct. Why not? The client of the engraver could be a rich merchant, not involved in palace adventures, but wanting a striking pendant seal as a personal marker of his importance!

Face γ

Side γ has also a strange pattern[32], with again two sloping «trees» and the big cross in the middle. Next to the «trees» are two strange symbols, one above the other, described by CHIC, 15 as «*signes bizarres*» and not transcribed although drawings are later presented (CHIC, 422, as ), inside a list of symbols entitled - • -: in the transcription of various inscriptions all these symbols are represented only by a small disc. On the other side of the cross are four symbols, two of them recognizable as H 061  «zig-zag» and H 056  «mallet». The symbol next to the big cross has been variously interpreted: Evans proposed «woman's breasts» (eliminated in CHIC) rather than the «mountains» (Evans 1909, No. 4  and No. 114  , respectively), while CHIC choose H 077  , the «two joined ovals»[33]. Last, another «*signe bizarre*» according to CHIC, the symbol  , attached, it seems, to a medium-size cross, for which we[34] suggested a variant of the «seated/crouched bird» (as also appears on CHIC #314δ). We can hardly imagine that the engraver aimed to make a true inscription on this face of the seal (nor for face α).

[31] Evans 1909: 154, P. 26.

[32] Jasink 2009: 54.

[33] This symbol was already recognized by Evans (as No. 122), but only on another seal, P. 28b (CHIC #290δ, a green jasper 4-sided prism from Sitia) and on the sealing P. 51a (CHIC #139 «boulette»). In CHIC, with the exception of #290δ and #295β, this symbol as been always considered by the authors as dubious on seals, while a «similar» shape in many variants is accepted on many clay inscriptions. We are not sure of the exactness of such interpretation, because both the «variants» on clay documents are very different from each other and no one resembles without doubt the «variants» on seals. In a previous work we proposed to recognize this symbol H 077 just on the two seals discussed in this paper, and on CHIC #295β (Jasink 2009: 100).

[34] Jasink 2009: 54.

Face β and δ

On face β (corresponding to Evans 1909: P. 26d) a sequence of signs is engraved, all of the same size, with a small cross indicating (?) it to be read from left to right, although, as we shall see, this consideration has almost no consequence for a possible reading. Fig. 6 shows the drawings of the file (according to Evans and to CHIC), the related transcription and CHIC numeration for the individual signs. We take with the identifications but one exception: H 057 𓋴 «*sistrum*»; according to our interpretation, which partially goes back to Evans[35], this sign might better be seen as SM No. 27 ≻ «plough»[36], a symbol deleted in CHIC. Some of the signs are upside down, but this is not disturbing as it is commonly found on many seals. However, it seems certain that it is impossible to find a reading for any of the sequences of signs. The composition of this face is likely a sequence of signs without any meaning – but attractive in themselves and when put together. This is clearer when we look at the three central symbols – «*croix pommeé*» (H 070 𓏲), «strainer» (?) (H 047 ●) and «pronged instrument» (H 092 𓌹) – which occupy a larger space with respect to the other signs and, almost dividing the pseudo-inscription in two parts, are especially eye-catching.

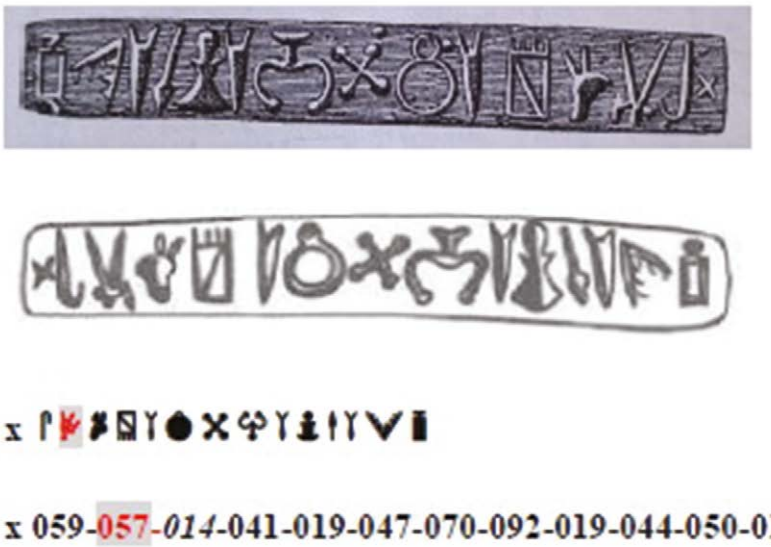


Fig. 6. Interpretation of face β of CHIC #294 (drawings from Evans 1909 and CHIC)

On face δ the engraver uses a different scheme to obtain an attractive pattern (Fig. 7). The observer, looking from the center, sees two opposite series formed by the same four

[35] Evans 1909: 190-191. Evans correctly numbers in sequence the two symbols, as No. 27 «plough» ≻ (the standardized symbol of Evans is somehow different from the analogous symbol in CHIC) and No. 28 «*sistrum*», having observed their resemblance.

[36] Jasink 2009: 98-99. Although these two symbols are almost similar, we may find two features to distinguish them: concerning the first one, the *plough* always presents an acute angle intersection between the two arms (pole and share beam), while the horn-shaped sides of the *sistrum* join with a curved line; concerning the second, the plough has only a «key», which sometimes extends inside the instrument, while the plectrum attached to the musical instrument is clearly separated from the strings that connect its opposite sides (the strings may be three, two or one, but always not on the same line of the plectrum) (Jasink 2009: 98).

signs: 𐄁𐄁𐄁𐄁. This group is followed on one side by the «pronged instrument» (H 092 𐄢) and on the other by two signs, which occupy the same space as 𐄢, the «goat's head» (H 016 𐄀) and the «mallet» (H 056 𐄃). None of these sign-groups is otherwise known, probably because they are meaningless. Differently from Fig. 6 (face β), in Fig. 7 we present, beside the images from Evans and CHIC, transcription and CHIC numeration – where only signs to «be read» are put in a sequence (the remaining symbols being eliminated as duplicates or put into parentheses (● ?) – and our different interpretation.

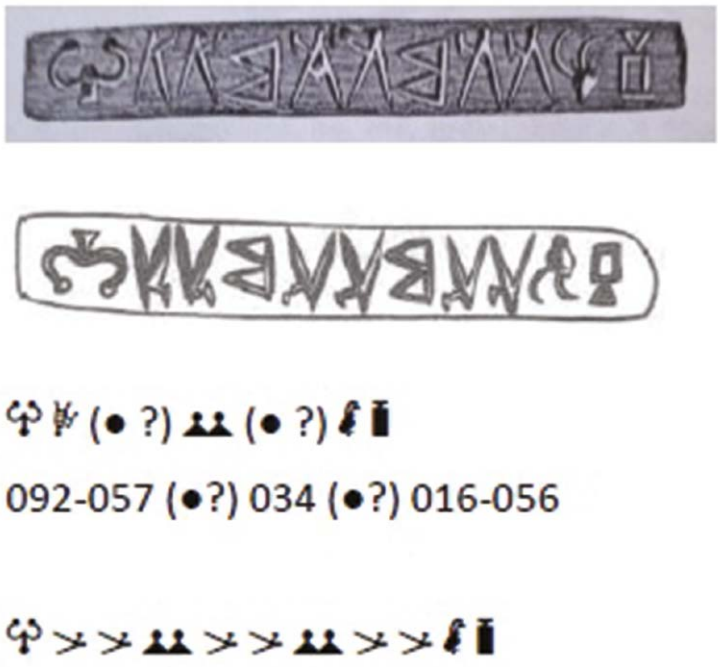


Fig. 7. Interpretation of face δ of CHIC #294 (drawings from Evans 1909 and CHIC)

The shape of the seal and its use

It is possible that, in its general lines, both the shape of this seal and the patterns on the individual faces where chosen by the person who acquired the object: s/he wanted to have a 4-sides prism, white of color[37], with carved Hieroglyphic symbols, similar to the written bureaucratic seals which were fashionable at that time: in other terms, a jewel to enhance the prestige of its owner. Or possibly the object was conceived as well as crafted by the seal engraver, but still with the same aim, as a striking ornamental object. Any functional use within a bureaucratic palatial administration seems to be ruled out[38].

[37] Perhaps imitating ivory: suggestion by J. Weingarten.

[38] While we completely agree with Anastasiadou (in this same volume) on a connection between 4-sided prisms and clay bars (see already Ferrara and Jasink 2017: 50-51), we do not consider this prism as having had any role in such a question.

Conclusions

A necessary premise to a general conclusion of the examined objects relies unfortunately on the uncertainty of the site of provenance and of the period of their making. But, with a small margin of doubt, it seems possible to affirm, from one side, a provenance from the north-eastern area of Crete – the first seal, in particular, from the Lasithi area – and, from the other side, a belonging to the MM II period on the stylistic dating. In MM II, especially at the beginning of this period, the Hieroglyphic seals seem to reach their highest diffusion, gravitating overall on Mallia and the Eastern coasts[39]. The administrative clay documents, to which the majority of seals will be linked, become perhaps in use a little later, at the end of MM IIB[40]. It is possible that many notable people are involved in the acquisition of such valuable objects, although not for bureaucratic interest. If this is true, we may argue that our two seals belong to this group of objects, not directly linked to the administration of a palace, whoever was their owner.

The analysis of the two seals, although they differ for material, shape and approach to the content of the single faces, aims to point out similar intent and result: the artists, who have at disposal two very peculiar objects, want to present to the seal's owners two spectacular seals with characters completely different from other analogous objects linked to administrative functions. One of the two artists starts from Hieroglyphic signs and groups of signs, which are treated according to a global design which will result unique among written seals. The other starts from iconic and ornamental motifs, but introduces also Hieroglyphic symbols to reach a global design, equally unique. The final result seems to aim, in both cases, at intentionally incomprehensible seals, giving only unclear hints which seem provocative. We propose that the seal's owner is someone not to be identified as belonging to a category of persons making a chain inside the palace functionaries. His social prestige could be also outside the boundaries of the palace hierarchy: therefore, his seal must not be used in a bureaucratic administration, as a functional tool, but rather as a personal marker free from links. However, the presence of Hieroglyphic signs or sign-groups might augment the value of the seal in the eyes of illiterate persons who saw them[41], regardless of a truly inscribed message or of symbols simply imitating writing.

Acknowledgments

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Images of the seals are taken from ARACHNE (CMS) and CHIC, with acknowledgments. The fonts used for the Cretan Hieroglyphic signs can be accessed and downloaded from the project DBAS (http://dbas.sciant.unifi.it), of the University of Florence.

[39] On the distribution of Protopalatial seal groups and, in particular, of prismatic seals which use the Cretan Hieroglyphic script, see Anastasiadou 2016, *passim*.

[40] Ferrara and Weingarten 2022: 111.

[41] Civitillo (2021: 92) dwells upon this aspect of Hieroglyphic or «pseudo-Hieroglyphic» seals, stressing their importance as markers of status-symbols, especially towards illiterate Minoan people.

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CHIC = Olivier and Godart 1996
CMS = *Corpus der Minoischen und Mykenischen Siegel*
SM = *Scripta Minoa*, Evans 1909

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Potter's marks from two protopalatial house tombs in the Petras necropolis

Metaxia Tsipopoulou

Abstract: This paper presents in an analytical way the potter's marks of the Protopalatial period excavated in the elite Pre- and Protopalatial cemetery at Petras, Siteia, eastern Crete. The various types of potter's marks, the shapes on which they are found, their position on the vessels, as well as their context are described. Furthermore, comparisons are drawn with signs of the Cretan Hieroglyphic script. It is significant that Petras, unlike most Cretan sites, produced a large amount of potter's marks on vases and on loom weights, both from the palace and the urban settlement. Also: a) at Petras was excavated an Hieroglyphic archive in the destruction layer of the Protopalatial palace and b) many of the seals of the same period that came to light in the cemetery have hieroglyphicv inscriptions.

Introduction

The elite unplundered Minoan cemetery at Petras, Siteia has been excavated since 2004. To date have been excavated 29 large house tombs, most of them with complex plans, one burial rock shelter and nine burial structures of various types[1] (Fig. 1 and 2). There are also 33 more architectural features, including two large ceremonial areas, periboloi, corridors, retaining walls etc. The use of the cemetery spans from EM IB to MM IIB. The cemetery is connected to the palatial settlement of Petras. In the LM III period there was ritual activity on top of the west part of the remains of the (then) ancient cemetery[2].

Potter's marks, as it is known from previous publications, came to light in many deposits at Petras, both in the settlement and the palace, dated to the Protopalatial as well as to the Neopalatial periods[3]. Potter's marks are absent, at least based on the present knowledge of the Petras material, in the Prepalatial and in the Postpalatial periods. Thus, the finding of potter's marks in the Petras cemetery was not surprising. Two of the Protopalatial House Tombs already studied, House Tombs (HTs) 4 and 10 produced six potter's marks each, while from the West Platform attached to House Tomb (HT) 10 and its immediate vicinity 20 more examples of potter's marks came to light.

[1] Tsipopoulou 2017.

[2] Rupp and Tsipopoulou 2022.

[3] Tsipopoulou 1990, 1995, 2016.

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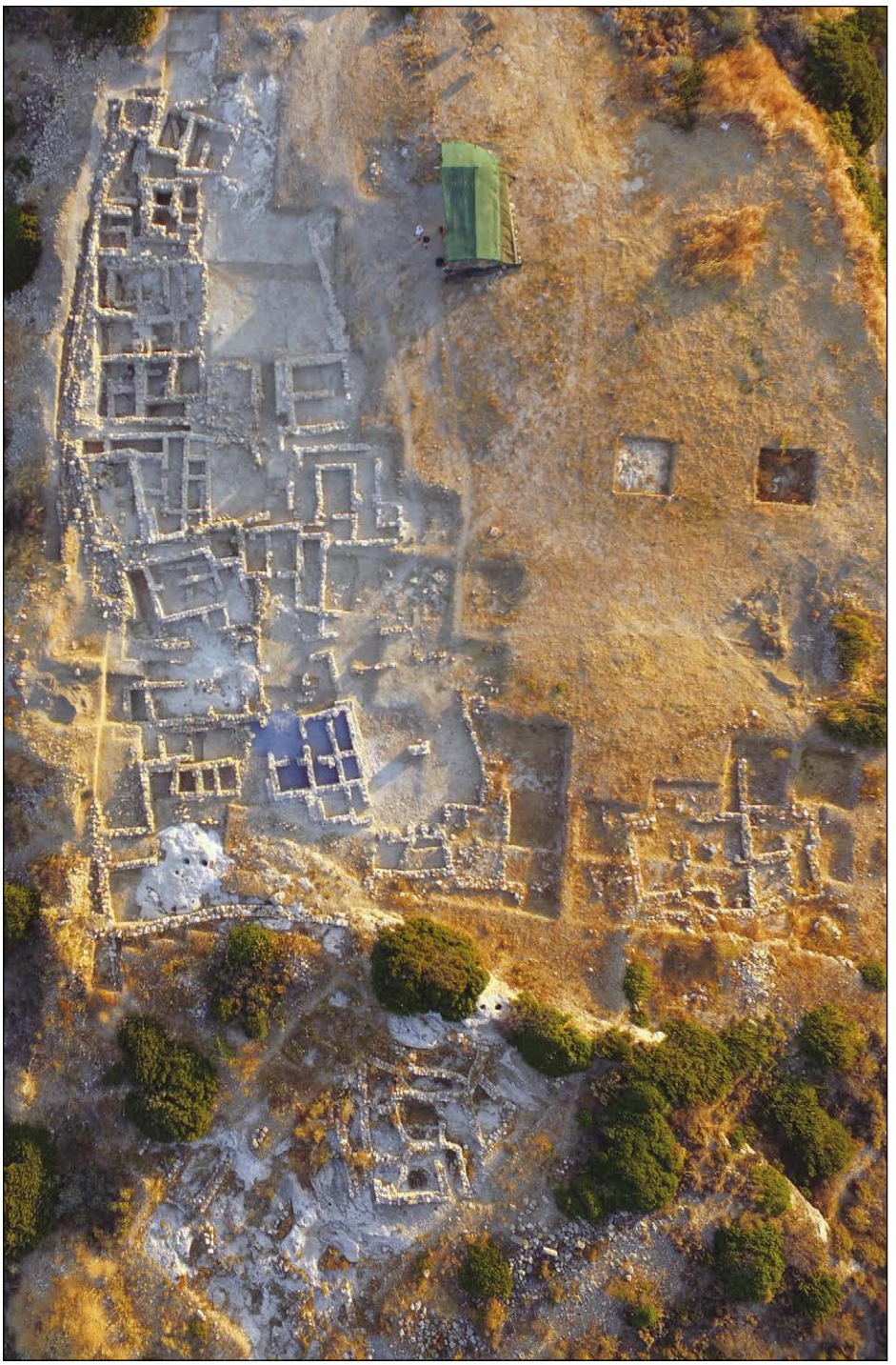


Fig. 1. Aerial photo of the Petras cemetery



Fig. 2. General plan of the Petras cemetery

Catalogue[4]

House Tomb 4 (Fig. 3)

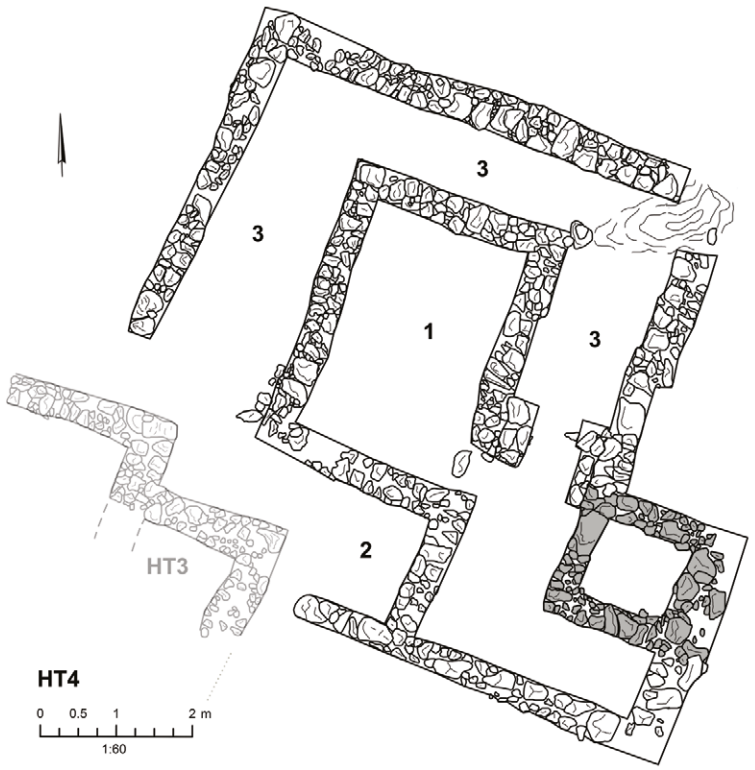


Fig. 3. Plan of House Tomb 4

4.PM 1-P 22. (06/264, Room 1, Lr V, Fig. 4 and 5). Jug, base and lower body fragment, mended from 22 sherds. H. pres. 10.8; base d. 5.2; max. d. 11.2. Base: flat; body: S-profile as pres., initially piriform. Fine 10 YR 7/2 (dull yellow orange) clay. Wheel marks int. Thick slip of same color. 5 YR 4/8 (reddish brown) very worn paint. Wide band on lower part of body. PM underneath base: deeply incised V, 1.8 x 1.7.

4. PM 2-P 40. (12/1148, Room 3, Lr III, Fig. 4 and 5). Plate, 1/3 extant, full profile, mended from 13 sherds. Base: slightly raised, rough underneath; body: shallow conical, slightly curved profile; rim: elliptical section, following body profile. Medium 2.5 YR 6/8 (orange) ranging to 10 R 6/6 (reddish orange) clay, unevenly fired, many inclusions, worn int. surface. Self slip. 2.5 YR 5/3 (dull reddish brown) matt, very worn, traces of added

[4] All measurements are in cm.

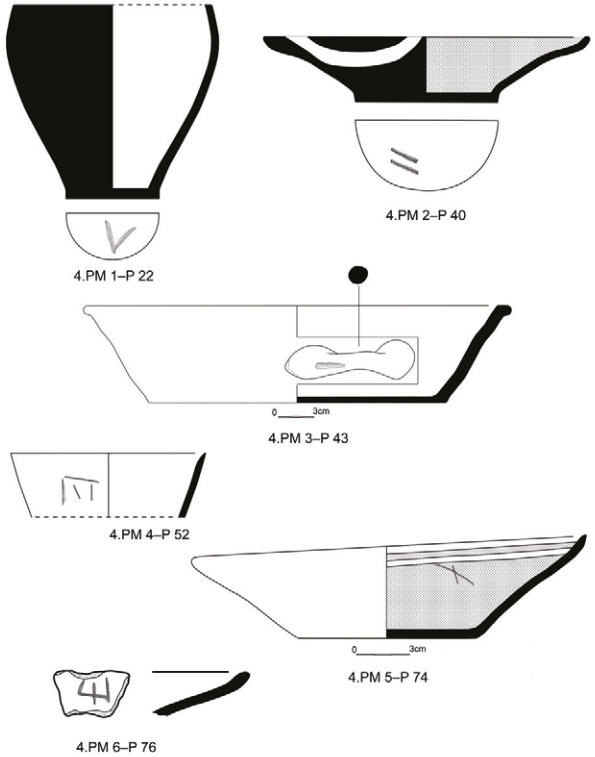
white paint. Monochrome int., wide arched band on rim ext. Finger prints for smoothing ext. surface. PM on base: two shallow horizontal parallel lines, 1.8 long.

4. **PM 3-P 43**. (13/267, Room 3, Lr V, Fig. 4 and 5). Basin, base, body, rim and handle fragment, mended from 10 sherds. H. 8.2; base d. 25; rim d. > 40; th. 1. Base: flat, rough underneath; body: conical; rim: horizontal, triangular section, outcurving. Probably coil made. Incision around upper surface of base; handle: horizontal, circular section, oblique, on mid-body. Medium 2.5 YR 6/6 (orange) clay, many inclusions. Self slip. PM: a wide incision on handle, 2.4 long.

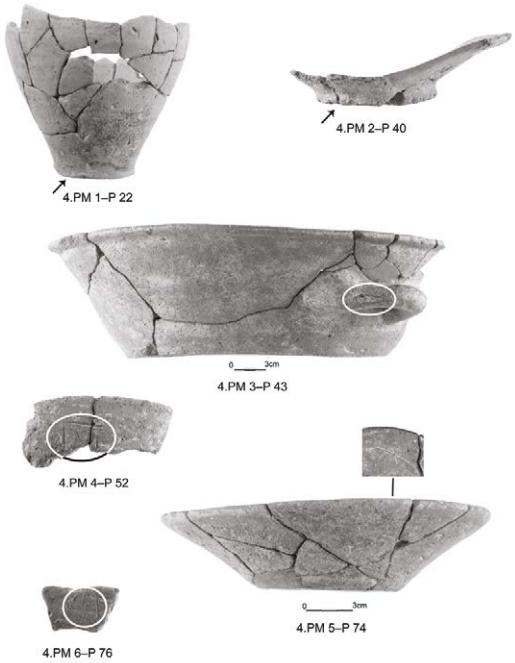
4. **PM 4-P 52**. (06/437, Room 3, Lr V, Fig. 4 and 5). Handleless conical cup, rim fragment, mended from two sherds. Max. dims. 3.6 x 7.4 x 0.4. Body: conical; rim: thin, following body profile. Fine 5 YR 6/8 (orange) clay, few inclusions. No slip preserved. PM: below rim, pictogram of cloth (H 041) 1.6 x 2.

4. **PM 5.P 74**. (08/35, Platform, Lr I, Fig. 4 and 5). Bowl, almost complete, mended from 24 sherds. H. 5.8; base d. 10.2; rim d. 22.3; th. 0.4. Base: flat; body: conical; rim: semi-elliptical section, following body profile. Fine 5 YR 6/6 (orange) clay, many small inclusions. Self slip. Traces of black, matt, very worn, and added white paint. Probably monochrome and two white thin bands int. PM deeply incised X on upper body internally, 1 x 2.5.

4. **PM 6-P 76**. (08/33, Platform, Lr I, Fig. 4 and 5). Plate, rim sherd. Max. dims. 3 x 4.9 x 0.3. Body: conical. Medium 2.5 YR 6/6 (orange) clay, many inclusions, worn surfaces. PM: deeply incised trident below rim, 0.6 x 0.9.



House tomb 4. Vases with potter's marks. Jug (**4.PM 1–P 22,1:2**); plates (**4.PM 2–P 40**, **4.PM 5–P 74**, **4.PM 6–P 76**, scale 1:2, except **4.PM 6–P 76**, 1:1); basin (**4.PM 3–P 43**, 1:3); handleless conical cup (**4.PM 4–P 52**, 1:2).



House tomb 4. Vases with potter's marks. Jug (**4.PM 1–P 22,1:2**); plates (**4.PM 2–P 40**, **4.PM 5–P 74**, **4.PM 6–P 76**, scale 1:2, except **4.PM 6–P 76**, 1:1); basin (**4.PM 3–P 43**, 1:3); handleless conical cup (**4.PM 4–P 52**, 1:2).

Figs. 4-5. House tomb 4. Vases with potter's marks. Jug (4.PM 1–P 22,1:2); plates (4.PM 2–P 40, 4.PM 5–P 74, 4.PM 6–P 76, scale 1:2, except 4.PM 6–P 76, 1:1); basin (4.PM 3–P 43, 1:3); handleless conical cup (4.PM 4–P 52, 1:2)

House Tomb 10 (Fig. 6)

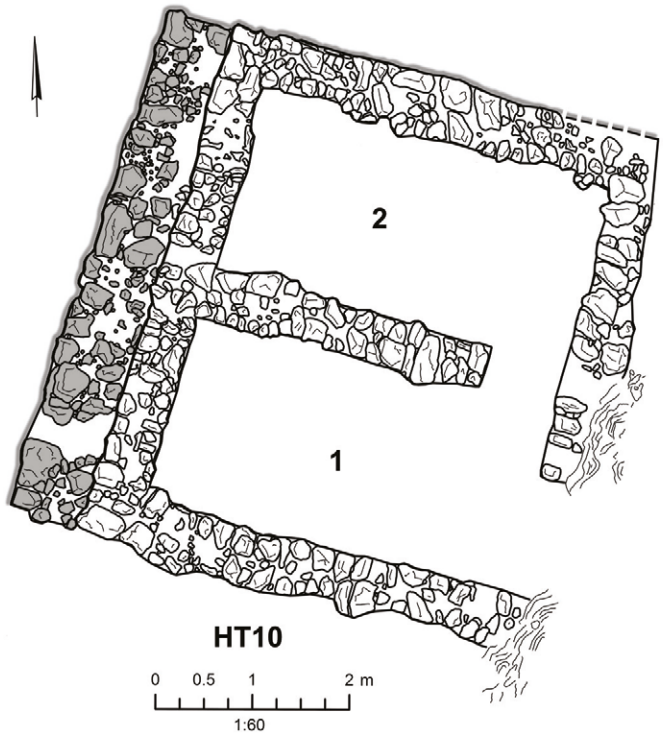


Fig. 6. Plan of House Tomb 10

10. PM 1-P 1. (04/427, Room 1, Lr I, Fig. 7 and 8). Pithoid jar, body sherd. Max. dims. 5 x 4.9. Medium 5 YR 6/4 (dull orange) clay. PM: three parallel deeply incised vertical lines, measuring 4 x 3.4.

10. PM 2-P 16. (12/2444, Room 1, Lr IV Fig. 7 and 8). Handleless conical cup-lamp, almost complete. H. 6.3; base d. 6.1; rim d. 10.3; th. 0.4. Base: flat, rough underneath. Body: conical, slightly S-profile; rim: thin, following body profile. Medium, 2.5 YR 5/8 (bright brown) clay; traces of smoothing with fingers. Burnt, worn surface, especially ext. PM: shallow incised wavy line, 3.8 long.

10. PM 3-P 18. (12/1004, Room 2, Lr I, Fig. 7 and 8). Jug, almost complete. H. 24.8; base d. 9.7; rim d. 6.9; max d. 15.6; th. 0.7. Base: flat, rough underneath; body: piriform; neck: high, cylindrical, junction of neck/body smooth int.; rim: thin, following body profile, narrow high spout; handle: circular section, rim to max. d. Medium 10 R 6/4 (dull reddish orange) clay, many medium sized inclusions, handmade, 7.5 R 5/2 (grayish red) core. Thin 5 YR 5/8 (bright reddish brown) very worn, slip. PM: on handle, near rim: vertical deeply incised line, 2.5. Finger prints on body and base.

10. PM 4-P 39. (13/1846, Room 2, Lr IV, Fig. 7 and 8). Jug, base and lower body fragment. H. pres. 5.6; w: 8.7; th. 0.4. Base: flat, rough underneath; body: conical, as pres. Medium 5 YR 7/4 (dull orange) clay, wheel marks int. Thick 10 YR 5/4 (dull yellowish brown) slip, uneven firing, PM oblique line on lower body, 1.5 long.

10. PM 5-P 52. (13/1851, Room 2, Lr IV, Fig. 7 and 8). Plate, 1/5 extant, full profile. H. 3.2; base d. 10; rim d. 20.5; th. 0.9. Base: flat, very thin; body: conical, slightly curved profile; rim: elliptical section, following body profile. Medium 5 YR 5/8 (bright reddish brown) clay, many limestone inclusions. Thin slip ext. thick int., same color. Ext. surface rough. 2.5 YR 4/6 (reddish brown) paint, monochrome int. PM: deeply incised oblique line on edge of base, 0.7 long.

10. PM 6-P 53. (13/1855, Room 2, Lr IV, Fig. 7 and 8). Plate, part of upper body and rim, mended from four sherds. Three associated fragments: a) max. dims. 7.4 x 10.8. b) max. dims. 4.2 X 5.8. c) max. dims. 1.5 x 7.1 x 0.3-0.6. Body: shallow conical; rim: outcurving, wide, trapezoid section. Medium 5 YR 7/6 (orange) clay, many inclusions. Thick slip, same color ext. Reddish brown paint, ranging to brownish-black. Spatter decoration ext. PM: two oblique incisions on rim, one int., 0.8 long and one ext. 2 long.

10. PM 7-P 66. (14/1709 and 14/2412, West Platform, Lr III, Fig. 9 and 10). Jug: a) 14/2412, neck, shoulder and rim fragment. Max. dims. 7.4, x 8.2 x 0.4. Neck: short, curved profile; rim: thin, following neck profile. Fine 10 YR 8/3 (light yellow orange) clay, many inclusions, handmade. Thick slip, same color. Black, very worn, paint. Band on base of neck. Traces of smoothing tool. b) 14/1709, shoulder and handle fragment. Max. dims. 10.8 x 8.2 x 0.4. Shoulder: curved profile; handle: vertical, circular section. Black vertical band on handle. PM: deep incised vertical line on handle, 5 long.

10. PM 8-P 73. (14/2785, West Platform, Lr III, Fig. 9 and 10). Globular cup, three associated fragments, two mended from two sherds. Body: globular; rim: thin, following body profile; handle: vertical, circular section. Fine 7.5 YR 7/2 (light brownish gray) clay. Black, very worn paint. Monochrome ext. and wide band on rim int. PM nail impression on lower handle attachment, 0.7 long.

10. PM 9-P 74. (14/1742, West Platform, Lr III, Fig. 9 and 10). Carinated cup, base, body and rim fragment, mended from 12 sherds, six more associated sherds. H. 8.3, base d. 5.7; th. 0.4. Base: discoid; body: S-profile; rim: thin, outcurving, following body profile. Fine 7.5 YR 7/1 (light brownish gray) clay. Black, matt, very worn paint, monochrome int. and ext. Finger prints ext. On body two PMs a) horizontal and vertical line deeply incised, 2.8 x 1 as preserved. b) vertical line to the right of (a), 1.8 long.

10. PM 10-P 76. (14/3023, West Platform, Lr III, Fig. 9 and 10). Carinated cup, body and handle fragment. Max. dims. 4.9 x 2.9. Body: conical, curved profile, as pres.; handle: vertical, wide, strap. Fine 10 YR 8/2 (light gray) clay, very few inclusions. Thick 7.5 YR 7/4 (dull orange) slip. 5 YR 5/8 (bright reddish-brown) matt, very worn paint. Monochrome ext. and on back of handle. PM: deeply incised cross below rim, 1.2 x 1.2.

10. PM 11-P 78. (14/1708, West Platform, Lr III, Fig. 9 and 10). One-handled conical cup, 1/3 of body/rim preserved, one more associated sherd. H. 7.2; base d. 5.8; rim d. 10.5; th. 0.4. Base: flat; Body: conical; rim: following body profile. Fine 5YR 7/6 orange clay, few inclusions. Worn surface. Self slip, very worn. Traces of white paint, two opposite groups of concentric triangles on body. PM: incised V int., 1.2 x 1.

10. PM 12-P 79. (14/1710, West Platform, Lr III, Fig. 9 and 10). One-handled conical cup. Missing part of base and most of handle; mended from four sherds, one associated handle sherd. H. 5.8 (incl. handle): 8.5, base d. 6, rim d. 11.2, th. 0.3. Base: flat, rough underneath; conical body; thin rim, following body profile; handle: vertical, raised above rim, curving towards int. Fine 5 YR 7/1 (light brownish-gray) clay. 5 YR 3/1 (brownish-black), unevenly fired, worn and added white paint. Monochrome, two oblique white bands on back of handle. PM: on lower part of handle deep vertical incision, 0.8 long.

10. PM 13-P 83. (14/1707, West Platform, Lr III, Fig. 9 and 10). Handleless conical cup, missing small parts of rim. H. 6.1; base d. 9.9; rim d. 9.9; th. 0.2. Base: flat, rough underneath; body: conical; rim: thin, triangular section, following body profile. Medium 5 YR 6/8 (orange) clay, many small inclusions, handmade. Self slip. PM: cross on mid-body, 3 x 2.4. Finger impressions on base.

10. PM 14-P 87. (14/2393, West Platform, Lr III, Fig. 9 and 10). Handleless conical cup, base, body and rim fragment, mended from two sherds. H. 7.3; base d. 6; max. d. 8.6; th. 0.6. Base: flat; body: conical, slightly curved profile; rim: thin, triangular section, following body profile. Medium 7.5 YR 7/6 (orange) clay, many calcite and phyllite inclusions, unevenly fired. Worn surface. PM: two nail impressions at edge of base, 0.5 long.

10. PM 15-P 108. (14/2106, West Platform, Lr IV, Fig. 9 and 10). Juglet. H. pres. 7.3; base d. 6.5; max. d. 10; th. 0.5. Base, part of body/shoulder. Medium 2.5 YR 6/6 (orange), 7.5 R 5/2 (grayish red) core, several inclusions. Self slip. Traces of 5 YR 4/8 (reddish brown) paint on lower body. PM: deeply incised arrow on lower body pointing to base, 2.8 long.

10. PM 16-P 118. (14/2600, West Platform, Lr IV, Fig. 11 and 12). Jug, shoulder, neck, rim and handle fragment, many associated body sherds. H. pres. 9.7; neck d. 5.6; rim d. 7.8; th. 0.7. Shoulder: curved profile; neck: wide, slightly S-profile; rim: thin, following body profile, beak-spout; handle: vertical, circular section, neck to shoulder. Medium 10 YR 5/6 (yellowish-brown) clay. Worn surface. PM: on handle, deep vertical incision, 1.8 long.

10. PM 17-P 123. (14/2919, West Platform, Lr IV, Fig. 11 and 12). Jug, base and lower body fragment, mended from five sherds. H. pres. 7.1; base d. 7.4; th. 0.4. Base: flat; body: conical, as pres. Medium 5 YR 8/4 (pale orange) clay, few inclusions. Thick slip, same color. PM: two sets of converging lines on mid- to lower body and probably part of a third one represented by an oblique line, measuring 5 x 5.

10. PM 18-P 124. (14/2924, West Platform, Lr IV, Fig. 11 and 12). Jug, spout fragment, mended from two sherds, many more associated sherds. L. spout 5.2; th. 0.4; handle d. 1.6. Neck: short, cylindrical, curved profile, smooth junction neck/shoulder; rim: triangular section; handle: vertical, circular section, rim to shoulder. Medium 2.5 YR 7/1 (light reddish gray) clay. Self slip. Black matt, worn paint. Wide horizontal band on body, bands on rim of spout int. and ext., two more on neck. PM: Deep incision on lower part of handle, 5.2 long.

10. PM 19-P 126. (14/2938, West Platform, Lr IV, Fig. 11 and 12). Jug, handle, rim and upper body fragment. Max. dims. 7.9 x 7.3 x 0.4. Rim: slightly outcurving, following body profile; handle: vertical, round section, rim to upper body. Medium 5 YR 7/4 (dull orange) clay, many inclusions. Self slip, worn. PM: deeply incised line on upper part of handle, 1.4 long.

10. PM 20-P 128. (14/2947, West Platform, Lr IV, Fig. 11 and 12). Jug, two associated fragments. a) body fragment, mended from nine sherds. Max. dims. 13.1 x 14.3 x 0.5. Globular-ovoid. Coarse 10 YR 7/4 (dull yellow orange) clay, many large black inclusions. Self slip. 10 YR 4/1 (brownish gray) ranging to 7.5 YR 7/6 (orange), matt, very worn paint. Monochrome ext. b) neck fragment, mended from two sherds. Neck d. 6.3; h. pres. 4.9; th. 0.7. PM: X on mid- body, 4.9 x 2.6.

10. PM 21-P 153. (14/2647, West Platform, Lr IV, Fig. 11 and 12). One-handled bell cup, full profile, mended from seven sherds. H. 5.9; w. 6.2; th. 0.3. Base: flat; body: slightly curved profile; rim: thin, following body profile. Fine 5 YR 7/4 (dull orange) clay. Self slip. 2.5 YR 5/6 (bright brown) ranging to 2.5 YR 5/2 (grayish red) matt, worn paint. Monochrome ext. PM: two deeply incised oblique lines from rim, 0.4 long.

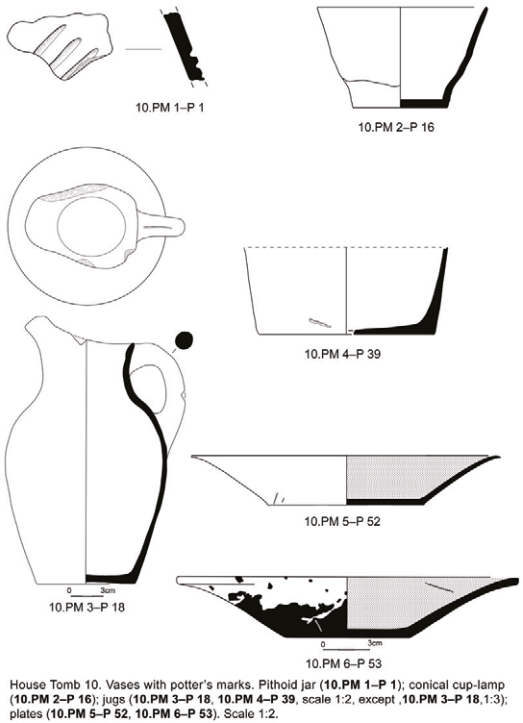
10. PM 22-P 158. (14/2392, West Platform, Lr IV, pl. XXX, Fig. 13 and 14). Handleless conical cup, base and lower body fragment. H. pres. 4.6; max. w. 8; base d. 5.6; th. 0.6. Base: flat, sand on lower surface; body: conical as pres. Smoothing with fingers on lower part ext. Medium 2.5 YR 6/8 (orange) clay. Thick slip, same color. 2.5 YR 5/4 (dull reddish brown) matt, very worn paint. Initially monochrome ext. PM: nail impression on lower surface of base, 0.8 long.

10. PM 23-P 172. (14/2900, West Platform, Lr IV, Fig. 13 and 14). Plate, 1/5 extant, full profile. H. 4.8; w. 5.8; th. 0.6. Base: flat, slightly rough underneath; body: shallow, S-profile; rim: wide, following body profile. Medium 2.5 YR 5/3 (dull reddish brown) clay, several inclusions. Self slip. Traces of 5 YR 4/3 (dull reddish brown) paint on base and body. PM: Two incised oblique lines on upper body, 0.4 and 0.8 long respectively.

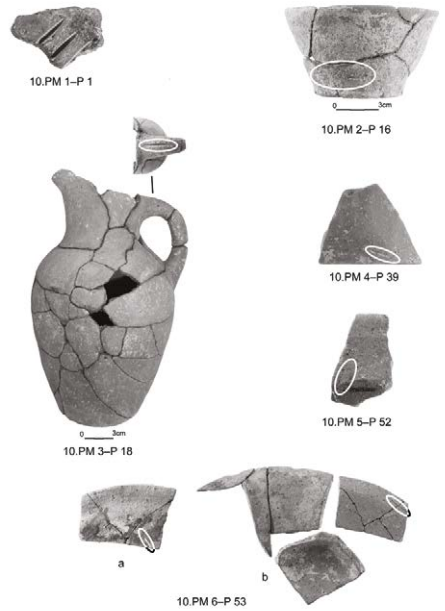
10. PM 24-P 173. (14/2913, West Platform, Lr IV, Fig. 13 and 14). Plate, ½ extant, mended from 12 sherds. H. 3.8; base d. 10.4; th. 0.6. Base: flat, rough underneath; body; conical, slightly curved profile; rim: rounded, following body profile. Medium 2.5 YR 5/6 (bright brown) clay, 7.5 YR 5/4 (dull brown) core. 5 YR 5/8 (bright reddish-brown) thin slip, int. and on upper part ext. PM: deeply incised X on upper body, 5 x 3.3.

10. PM 25-P 174. (14/2916, West Platform, Lr IV, Fig. 13 and 14). Plate, 1/5 extant, mended from three sherds. H. 4; w. 7.4; th. 0.5. Base: slightly raised, rough underneath; body; shallow, conical, curved profile; rim: wide, outcurving. Fine 5 YR 7/3 (dull orange) clay, few inclusions. Self slip. 5 YR 4/8 (reddish-brown), worn paint, dipped in paint int. wide arched band ext. PM: on lower body: deep nail impression, 1.3 long.

10. PM 26-P 180. (17/2325, West Platform, Lr V, bag 155, Fig. 13 and 14). Bridge-spouted jar, base and lower body fragment, mended from six sherds. H. pres. 8; base d. 7; max d. 12; th. 0.4. Base: flat, rough underneath; body: conical as pres. Fine 2.5 YR 7/3 (pale reddish-orange), many black inclusions. Self slip. 7.5 YR 4/2 (grayish brown) paint, ranging to 5 YR 4/3 (dull reddish brown), monochrome ext., and partially on lower surface of base. PM: nail impression on lower body ext., 0.5 long.

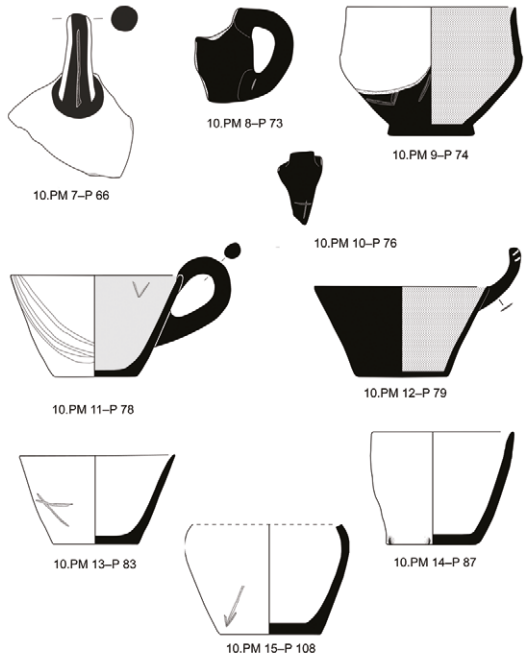


House Tomb 10. Vases with potter's marks. Pithoid jar (**10.PM 1–P 1**); conical cup-lamp (**10.PM 2–P 16**); jugs (**10.PM 3–P 18**, **10.PM 4–P 39**, scale 1:2, except ,**10.PM 3–P 18**,1:3); plates (**10.PM 5–P 52**, **10.PM 6–P 53**). Scale 1:2.

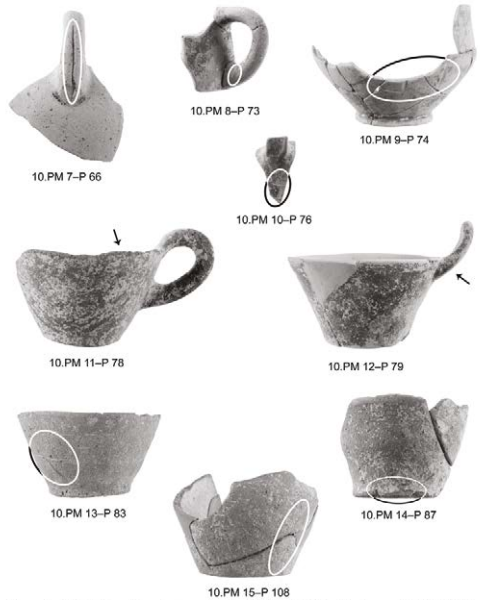


House Tomb 10. Vases with potter's marks. Pithoid jar (**10.PM 1–P 1**); conical cup-lamp (**10.PM 2–P 16**); jugs (**10.PM 3–P 18**, **10.PM 4–P 39**, scale 1:2, except ,**10.PM 3–P 18**,1:3); plates (**10.PM 5–P 52**, **10.PM 6–P 53**). Scale 1:2.

Figs. 7-8. House tomb 10. Vases with potter's marks. Pithoid jar (10.PM 1–P 1); conical cup-lamp (10.PM 2–P 16); jugs (10.PM 3–P 18, 10.PM 4–P 39, scale 1:2, except ,10.PM 3–P 18, 1:3); plates (10.PM 5–P 52, 10.PM 6–P 53). Scale 1:2

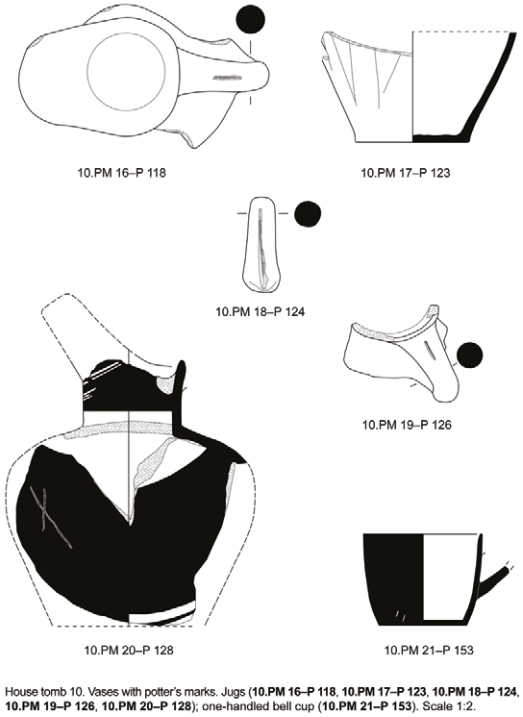


House tomb 10. Vases with potter's marks. Jug (**10.PM 7–P 66**); globular cup (**10.PM 8–P 73**); carinated cups (**10.PM 9–P 74**, **10.PM 10–P 76**); One-handled conical cups (**10.PM 11–P 78**, **10.PM 12–P 79**);handleless conical cups (**10.PM 13–P 83**, **10.PM 14–P 87**); juglet (**10.PM 15–P 108**). Scale 1:2.

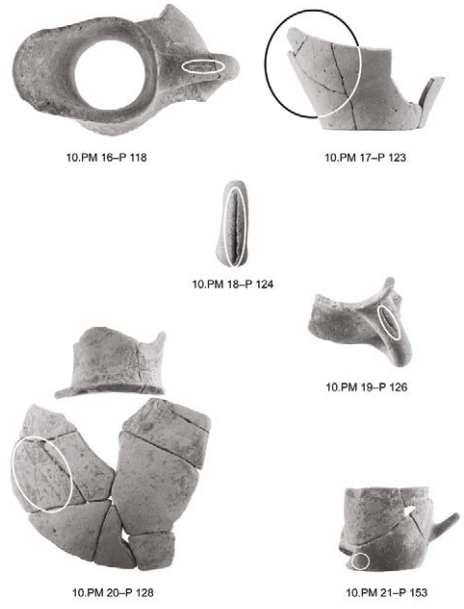


House tomb 10. Vases with potter's marks. Jug (**10.PM 7–P 66**); globular cup (**10.PM 8–P 73**); carinated cups (**10.PM 9–P 74**, **10.PM 10–P 76**); One-handled conical cups (**10.PM 11–P 78**, **10.PM 12–P 79**);handleless conical cups (**10.PM 13–P 83**, **10.PM 14–P 87**); juglet (**10.PM 15–P 108**). Scale 1:2.

Figs. 9-10. House tomb 10. Vases with potter's marks. Jug (10.PM 7–P 66); globular cup (10.PM 8–P 73); carinated cups (10.PM 9–P 74, 10.PM 10–P 76); One-handled conical cups (10.PM 11–P 78, 10.PM 12–P 79);handleless conical cups (10.PM 13–P 83, 10.PM 14–P 87); juglet (10.PM 15–P 108). Scale 1:2

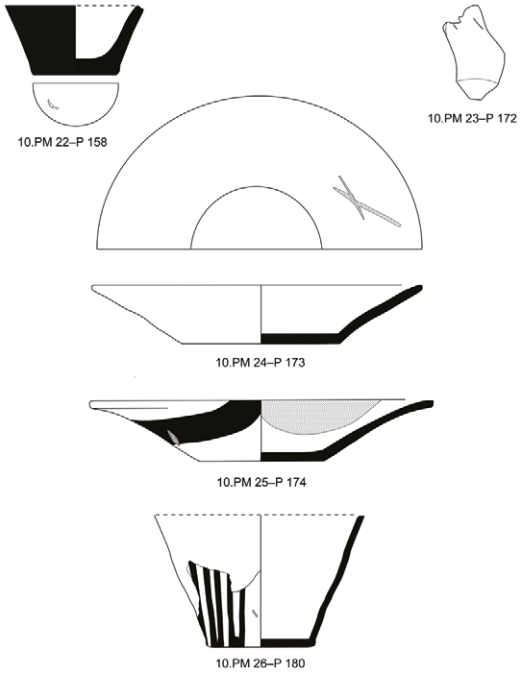


House tomb 10. Vases with potter's marks. Jugs (**10.PM 16–P 118**, **10.PM 17–P 123**, **10.PM 18–P 124**, **10.PM 19–P 126**, **10.PM 20–P 128**); one-handled bell cup (**10.PM 21–P 153**). Scale 1:2.

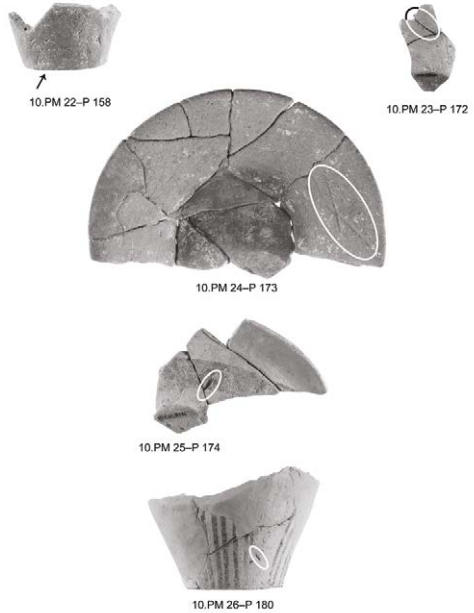


House tomb 10. Vases with potter's marks. Jugs (**10.PM 16–P 118**, **10.PM 17–P 123**, **10.PM 18–P 124**, **10.PM 19–P 126**, **10.PM 20–P 128**); one-handled bell cup (**10.PM 21–P 153**). Scale 1:2.

Figs. 11-12. House tomb 10. Vases with potter's marks. Jugs (10.PM 16–P 118, 10.PM 17–P 123, 10.PM 18–P 124, 10.PM 19–P 126, 10.PM 20–P 128); one-handled bell cup (10.PM 21–P 153). Scale 1:2



House tomb 10. Vases with potter's marks. Handleless conical cup (**10.PM 22–P 158**); plates (**10.PM 23–P 172**, **10.PM 24–P 173**, **10.PM 25–P 174**); jug (**10.PM 26–P 180**). Scale 1:2.



House tomb 10. Vases with potter's marks. Handleless conical cup (**10.PM 22–P 158**); plates (**10.PM 23–P 172**, **10.PM 24–P 173**, **10.PM 25–P 174**); jug (**10.PM 26–P 180**). Scale 1:2.

Figs. 13-14. House tomb 10. Vases with potter's marks. Handleless conical cup (10.PM 22–P 158); plates (10.PM 23–P 172, 10.PM 24–P 173, 10.PM 25–P 174); jug (10.PM 26–P 180). Scale 1:2

Description

In HT 4 six potter's marks came to light (Table 1), one on a jug, two on plates, one on a bowl, one on a handleless conical cup and one on a basin. Three of these vessels, the jug and two plates are decorated and the other three are plain. The marks that are encountered are the V, on the base of the jug; two horizontal parallel lines, on the base of a plate; a wide line, on the handle of the basin; the pictogram for cloth, on the upper body of the handleless conical cup; an X on the upper body of the bowl; and a trident, on the upper body of the second plate. One of these marks can be connected with signs of the Cretan Hieroglyphic, H 041 (the pictogram for cloth), and two more are similar to signs of Linear A and Linear B (V, L 78, AB 10), and the trident L 54, AB 31. The connection with the Linear scripts is of course accidental and irrelevant as all vases with potter's marks in the context of the Petras cemetery are Protopalatial.

Mark Position	H / L / AB	Context	Date
Base	L 78 / AB 10	HT 4, R 1, Lr V	
Base		HT 4, R 3, Lr III	
Handle		HT 4, R 3, Lr V	
Upper body	H 041	HT 4, R 3, Lr V	
Upper body		HT 4, R 3, Lr V	
Upper body	L 54 / AB 31	HT 4, Platform, Lr I	
Body		HT 10, R 1, Lr I	
Mid-body		HT 10, R 1, Lr IV	
Handle, upper part		HT 10, R 2, Lr I	
Lower body		HT 10, R 2, Lr IV	
Edge of base		HT 10, R 2, Lr IV	
Rim, int. and ext.		HT 10, R 2, Lr IV	
Handle, lower part		HT 10, Platform West, Lr III	
Handle, lower attachment		HT 10, Platform West, Lr III	
Mid-body	H 037, *157, *172	HT 10, Platform West, Lr III	
Upper body	L 22 / AB 2	HT 10, Platform West, Lr III	
Upper body, int.	L 78 / AB 10	HT 10, Platform West, Lr III	
Handle, lower part		HT 10, Platform West, Lr III	
Mid-body		HT 10, Platform West, Lr III	
Edge of base		HT 10, Platform West, Lr III	
Lower body	H 050, *176 / L 78 / AB 10	HT 10, Platform West, Lr IV	
Handle, upper part		HT 10, Platform West, Lr IV	
Mid-body		HT 10, Platform West, Lr IV	
Handle, lower part		HT 10, Platform West, Lr IV	
Handle, upper part		HT 10, Platform West, Lr IV	
Mid-body		HT 10, Platform West, Lr IV	
Lower body		HT 10, Platform West, Lr IV	
Base		HT 10, Platform West, Lr IV	
Upper body		HT 10, Platform West, Lr IV	
Upper body		HT 10, Platform West, Lr IV	
Lower body		HT 10, Platform West, Lr IV	
Lower body		HT 10, Platform West, Lr V	

Tab. 1. Summary of PM evidence from Petras HT 4 and 10

In HT 10 were found six potter's marks from the interior of the tomb, two in Room 1 and four in Room 2. A further 20 potter's marks came from the West Platform of HT 10 and were found either on the platform or fallen to the west of it, thus they were intimately connected with Ceremonial Area 2. The potter's marks from the interior of the HT are

found on a pithoid jar, three parallel vertical lines on the body, a conical cup used as a lamp, a wavy line on the mid-body, two jugs, one with a vertical line on the handle and the other with an oblique line on the lower body, two plates both with an oblique line, on the first at the edge of the base and the second on the upper body and the rim. None of these signs can be identified with any sign of the Cretan Hieroglyphic, and none was similar to Linear A or Linear B signs.

From the West Platform and its immediate area came 20 potter's marks: seven jugs, two with a vertical line on the upper part of the handle, one with an arrow on the lower body, two with a vertical line on the lower part of the handle, one with three groups of converging lines on the mid-body, one with an X on the mid body; one globular cup with a nail impression on the lower attachment of the handle; two carinated cups, one with a (possible) rectangle topped by a triangle (similar to H037, *H157, *H172), combined with a vertical line to the right on the mid-body, the second with a cross (L22, AB2) on the upper body; two one handled conical cups, the first with a V (L 78, AB 10) on the upper body internally and the second with a vertical line on the lower part of the handle; three handleless conical cups, one with a X on the mid-body, the second with two cut marks at the edge of the base and the third with a nail impression on the base; a one handled bell cup with two oblique lines on the lower body; three plates, one with two oblique lines on the upper body, one with an X on the upper body and the third with a nail impression on the lower body; finally there is also a bridge-spouted jar which has a nail impression on the lower body.

The comparison between the potter's marks found in Sector I in the settlement[5] with those of the HT 4 and 10, shown on Table 2 (in Appendix), is quite interesting as it reveals both common elements and many differences, between various periods and different functions of the same site. First it should be noted that Sector I comprised two distinct phases of occupation that produced potter's marks, MM II and LM IA. The two HTs on the other hand are only Protopalatial, i.e. roughly contemporary with the early occupation of Sector I. Furthermore, the function of the various contexts in Sector I is different from that of the house tombs, domestic as opposed to funerary. A third difference observed is that various vessel types or shapes were not common in the two different areas of Petras, even when contemporary contexts are examined.

As far as Sector I of the settlement is concerned, the following potter's marks are encountered only in the LM IA period: multiple nail impressions, a nail impression in various combinations: combined with a vertical line, with a dot, with an arched line, with two arched lines, with a Z, and two nail impressions combined with an oblique line; two finger impressions; four horizontal lines, five horizontal lines, a horizontal combined with a vertical line, and with two vertical lines; two oblique converging lines, two converging lines combined with a dot; six intersecting lines; an angle combined with a dot; an arched line combined with two oblique parallel lines, with a Γ, with a vertical converging line; a T combined with three oblique lines.

The signs common to the Protopalatial phase of Sector I and the cemetery are: a single nail impression, a single oblique line; two parallel oblique lines, a single vertical line, a single horizontal line, an X and a V.

[5] Tsipopoulou 2016.

In Crete sites which produced potter's marks in different quantities, along with Petras[6], are Malia-Quartier Mu, presumably all dated to the MM IIB destruction[7], the sanctuary at Syme-Viannos, dated to various periods of occupation[8], the peak sanctuary at Vrysinas[9], also dated to various MM and LM periods, and more recently Mochlos, all MM II[10]. A comparative presentation of the potter's marks from these sites and from Petras Sector I and Petras HTs 4 and 10 is presented on table 3. In the comparison were also included the potter's marks from Kea. Given the different contexts, the geographical origin, and some chronological differences, this can serve as an initial step for a wide-range database, which should include other Cretan sites with fewer potter's marks and other Aegean sites such as Melos, Aigina etc.

The data of the above-mentioned comparison are as follows: 144 types, variants and combinations of potter's marks are included, plus four more examples of unidentified examples from Malia. From Petras, Sector I there are 269 examples; from the two MM II HTs 4, and 10 in the Petras cemetery, 33 examples; while from Quartier Mu at Malia there were 297 examples, all MM IIB in date; from Syme 98; from Vrysinas 43; and from Kea 190.

As far as the frequency of the various signs is concerned, one observes that while some signs are present in more than one sites, and also in more than one chronological periods, there are certain signs that are encountered only in one of the sites examined for the present discussion. Thus, 22 signs are present only at Petras, Sector I (Table 3 in Appendix). Their variety is interesting, as the list comprises both simple and composite signs; these signs are: multiple nail impressions (twice), two arched lines (three times), four horizontal lines (once), five horizontal lines (once), two converging lines (three times), two finger impressions (twice), six intersecting lines (once), the spiral (once), a horizontal line combined with a vertical line (once), a nail impression combined with a dot (once), a nail impression combined with an arched line (once), an angle combined with a dot (once), an arched line combined with an oblique line (once), an arched line combines with two oblique lines (once), an arched line combined with a Γ (once), an arched line combined with a vertical converging line (once), two converging lines combined with a dot (once), a T combined with three oblique lines (once), an oblique line combined with two nail impressions (five times).

Only two signs are present exclusively in the two house tombs of the Petras cemetery, with one example each, the three sets of converging lines and a rectangle topped by a triangle combined with a vertical line. Interestingly enough they are both composite signs.

In the two HTs only two potter's marks are unique and not known from the deposits of Sector I, three sets of converging lines and a rectangle topped by a triangle combined with a vertical line.

The comparison between the two Petras HTs and the Malia deposit shows 10 signs in common: a single oblique line, two parallel oblique lines, a single vertical line, three

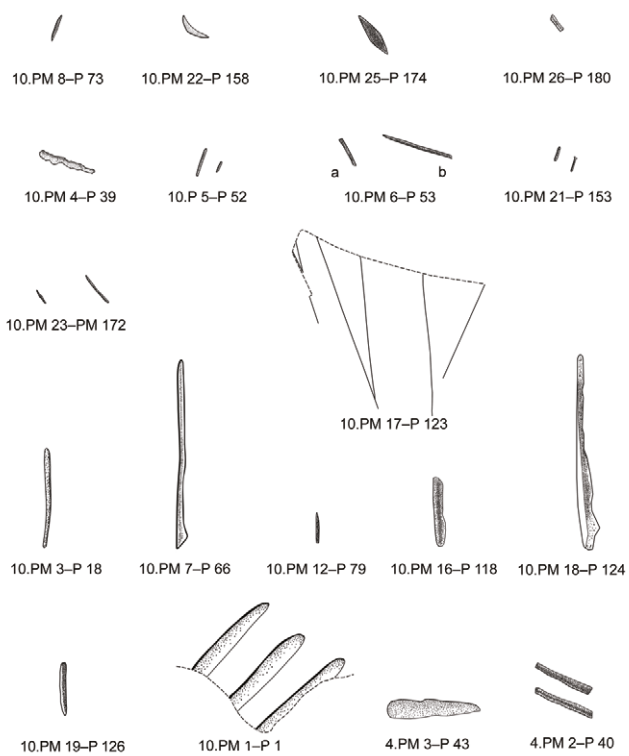
[6] Tsipopoulou 1990, 1995, 2016.
[7] Poursat 1978; Detournay *et al.* 1980.
[8] Christakis 2014.
[9] Giokaridaki-Skandali 2008.
[10] Doudalis 2019 and in this volume.

vertical lines, a single horizontal line, two horizontal parallel lines, an X, an arrow, a cross, a V.

The comparison between Petras Sector I and the two HTs and the material from the Syme sanctuary, diachronically shows the following common signs: two parallel oblique lines, a single vertical line, two vertical lines, three vertical lines, a triangle, a T, an X, a cross, a V, and a double axe.

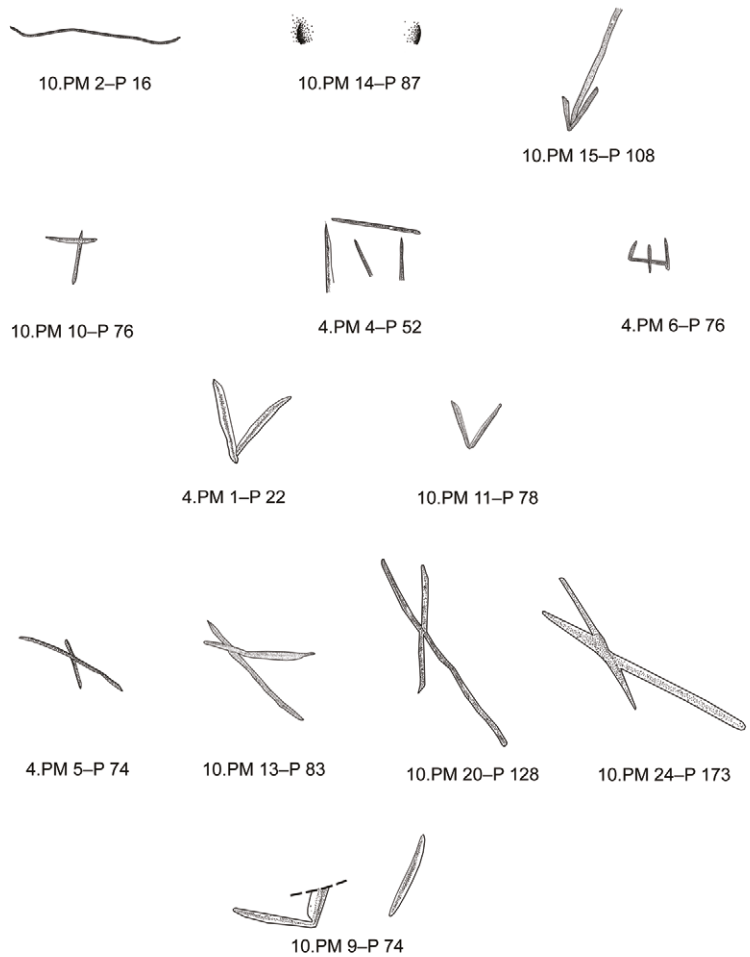
The comparison between Petras Sector I and the two HTs and the material from the Vrysinas peak sanctuary diachronically, shows the following common signs: a single nail impression, two cut marks, two parallel oblique lines, three parallel oblique lines, a single vertical line, a single horizontal line, an arched line, a wavy horizontal line, an angle, two concentric angles, an X, a branch, and a V.

The signs can be grouped into the following types (Fig. 15 and 16):



House tombs 4 and 10. Types of potter's marks. Nail impressions (**10.PM 8–P 73**,**10.PM 22–P 158**, **10.PM 25–P 174**, **10.PM 26–P 180**); oblique lines (**10.PM 4–P 39**, **10.P 5–P 52**, **10.PM 6–P 53**, **10.PM 21–P 153**); two parallel oblique lines (**10.PM 23–PM 172**); three sets of converging lines (**10.PM 17–P 123**); vertical lines (**10.PM 3–P 18**, **10.PM 7–P 66**, **10.PM 12–P 79**, **10.PM 16–P 118**, **10.PM 18–P 124**, **10.PM 19–P 126**); three vertical lines (**10.PM 1–P 1**); Horizontal line (**4.PM 3–P 43**); two horizontal parallel lines (**4.PM 2–P 40**). Scale 1:1.

Fig. 15. House tombs 4 and 10. Types of potter's marks. Nail impressions (10.PM 8–P 73, 10.PM 22–P 158, 10.PM 25–P 174, 10.PM 26–P 180); oblique lines (10.PM 4–P 39, 10.P 5–P 52, 10.PM 6–P 53, 10.PM 21–P 153); two parallel oblique lines (10.PM 23–PM 172); three sets of converging lines (10.PM 17–P 123); vertical lines (10.PM 3–P 18, 10.PM 7–P 66, 10.PM 12–P 79, 10.PM 16–P 118, 10.PM 18–P 124, 10.PM 19–P 126); three vertical lines (10.PM 1–P 1); Horizontal line (4.PM 3–P 43); two horizontal parallel lines (4.PM 2–P 40). Scale 1:1



House tombs 4 and 10. Types of potter's marks. Wavy line (**10.PM 2–P 16**); two cut marks (**10.PM 14–P 87**); arrow (**10.PM 15–P 108**); cross (**10.PM 10–P 76**); pictogram of cloth (**4.PM 4–P 52**); trident (**4.PM 6–P 76**); V (**4.PM 1–P 22**, **10.PM 11–P 78**); X (**4.PM 5–P 74**, **10.PM 13–P 83**, **10.PM 20–P 128**, **10.PM 24–P 173**); rectangle topped by triangle combined with vertical line (**10.PM 9–P 74**). Scale 1:1.

Fig. 16. House tombs 4 and 10. Types of potter's marks. Wavy line (10.PM 2–P 16); two cut marks (10.PM 14–P 87); arrow (10.PM 15–P 108); cross (10.PM 10–P 76); pictogram of cloth (4.PM 4–P 52); trident (4.PM 6–P 76); V (4.PM 1–P 22, 10.PM 11–P 78); X (4.PM 5–P 74, 10.PM 13–P 83, 10.PM 20–P 128, 10.PM 24–P 173); rectangle topped by triangle combined with vertical line (10.PM 9–P 74). Scale 1:1

A. *Linear marks, simple*

1. **Nail impressions:** A single nail impression is present 44 times in Sector I at Petras, four of them dated to MM II and 40 dated to LM IA; four times in HTs 4 and 10, dated to MM II; It is also found at Vrysinas, four times, dated to the early Neopalatial; at Aghia Irini two times, dated to the Middle Bronze Age. Two nail impressions are present 14 times at Petras, Sector I, all dated to the LM IA and 12 times at Aghia Irini, dated to the Middle Bronze Age. Three nail impressions are present three times at Sector I at Petras, LM IA, and 14 times at Aghia Irini from the Middle Bronze Age. Multiple

nail impressions are encountered on two LM IA examples from Petras, Sector I. At Vrysinas, there is a single example of two converging nail impressions, of uncertain date. In conclusion the nail impressions are mainly a Neopalatial phenomenon at Petras, and a Middle Cycladic one at Aghia Irini. It should be noted, however, that nail impressions can easily be neglected and/or considered as accidental, and consequently not included in the counting of potter's marks at other sites. In any case the absence from MM II Malia is concurrent with the very few examples of the same date from the Petras cemetery.

2. **Marks made with a (probably wooden) tool:** A single impression from Vrysinas dated to LM IA (?). From Kea came eight examples, five of them dated to the MBA, two to the MC III and one to the LC I. Two impressions are known on 23 examples from Kea, 15 of them dated to the MBA, five to the LC I, three to the LC II. Three impressions are found on two MM IB examples from Syme, and 13 examples from Kea, eight dated to the MBA, two dated to the MC III, two dated to the LC I, and one dated to the LC II. Two pairs of impressions are encountered on five examples from Kea, four of them dated to the MBA and one to the LC II. Four impressions are found on two more examples from Kea, dated respectively to the MBA and the LC II periods.

3. **Two cut-marks** made probably with a metal sharp knife are found on one example coming from the West Platform of HT 10 at Petras, dated MM II, and also on four examples from Vrysinas, dated to MM II and MM III/LM I(?), and three examples from Kea, dated to the MBA. Three cut marks are found on one example from Vrysinas, dated probably to LM III and eight from Kea seven of them dated to the MBA and one to the LC I.

4. **Dashes** are found on various LC II examples from Kea, three punched dashes in line are on a LC II example; the variant consisting of three punched dashes in line combined with one more above is known on two examples; four punched dashes in a quadrant are on three examples. Related is the sign called «quincus» which is found on two LC II examples from Kea and on three MM IB examples from Syme; six punched dashes are also known on a single example from Kea.

5. **Finger impressions:** Two finger impressions are found on two LM IA examples from Petras, Sector I. Three finger impressions in a triangular arrangement came from Vrysinas on a MM II-III example. Also three impressions are found on four MBA examples from Kea.

6. **Lines:** The lines, single or multiple, horizontal, vertical or oblique, in various combinations, are apparently the most common potter's marks on every site. This is a common sign, in various subtypes and combinations. There are 36 examples from Petras, Sector I, four of them dated to the MM II period, and 32 to the LM IA; from the Petras cemetery there are four MM II examples from Room 2 of HT 10; from Malia there are 10 examples of the same period; from Kea there is a further example, dated to the MBA. Two oblique converging lines came from two examples of Malia; two parallel oblique lines are found on 14 examples from Petras, Sector I, three of them dated to the MM II and 11 LM IA; from the Petras cemetery there are two MM II examples from HT 10, West Platform; from Malia came 26 examples; from Syme there are two more MM IB

examples; from Vrysinas there are six examples, dated to the MM II-III and LM I. There are also variants with three sets of converging lines, one of MM II date, from HT 10, West Platform at Petras. Three parallel oblique lines are found on seven examples from Petras, Sector I, one of them MM II and six LM IA; two MM II examples from Malia; one more MM III example from Vrysinas and one LC II example from Kea. Three oblique lines in different directions are found on two LC II examples from Kea. Four oblique lines are found on four LM IA examples from Petras, Sector I, and one LC II example from Kea. A single vertical line is found 32 times in Sector I at Petras, seven of them MM II in date and 25 LM IA. From the Petras cemetery there are six MM II examples of a single vertical line, one from HT 10, Room 2, and five from the West Platform; at Malia 11 more examples were found; from Syme came 18 examples, 16 dated to the MM IB, one to the MM IIB and one to the MM IIIB/LM IA periods; from Vrysinas there are six further examples, MM III and LM IA. A «vertical incision» of uncertain date is reported from Vrysinas. Two vertical lines are found on five LM IA examples from Sector I; on one example from Malia; from Syme came seven examples of straight vertical lines, six of them to the MM IB, and one to the MM IIB; another example came from Kea, dated to the LC II. Three vertical lines are found on one LM IA example from Petras Sector I, and one MM II example from the Petras cemetery, HT 10, Room 1; from Malia came two examples; at Syme were found seven more examples, four of them MM IB, and three MM IB or MM II; Kea produced a further 10 examples, six of them dated to the MBA, two to the LC I and two to the LC II. Four vertical lines are represented by one example at Malia, six MM IB examples from Syme; from Kea there is a further LC I example. Six vertical lines are known only on one LC I example from Kea. A vertical line and three transverse horizontal lines are peculiar to Syme with 20 MM IB examples. Also, two vertical lines and one transverse oblique line are found only at Syme, dated to the MM IB or MM IIB. Two converging lines are only known from Petras, Sector I, one three LM IA examples. From the same context came a single example of six intersecting lines. A simple horizontal line is a much more common sign, which is found in almost all sites, except for Syme: there are 21 examples from Petras Sector I, three of them MM II and 18 LM IA; one further example came from the Petras cemetery, HT 4, Room 3, MM II in date; Malia produced nine examples; at Vrysinas the horizontal line is found on two MM III examples; one more example was found at Kea, dated to the LC I. Two parallel horizontal lines are on one MM II example from the Petras cemetery, HT 4, Room 3; at Malia were found eight examples; two more examples, MBA and LC II respectively, came from Kea. Three horizontal lines are only known on one example from Malia. Four horizontal lines are found on one LM IA example from Petras, Sector I. Five horizontal lines come from the same context.

7. **Arched lines** are very common in most sites. A single arched line is found at Sector I at Petras on 22 LM IA examples; one more MM III example came from Vrysinas. Two arched lines were found on three examples from Petras, Sector I, one of them MM I and two LM IA. Two concentric arched lines are found on two examples from Malia. Two «curved lines» probably the same as «arched lines» were on one LC II example from Kea; also, there is another example from the same site and dating which has «two curved intersecting lines»; a possible semicircle is known from a MM IIB example from Syme.

8. **The wavy line** is known on an example from Malia; a vertical wavy line was found on a MM III example from Vrysinas; a horizontal wavy line came from the Petras cemetery, HT 10, Room 1 dated to the MM II; a similar sign is found on one MM III-LM IA example from Vrysinas.

9. **The angle** is a sign especially popular at Malia. An angle is found on two LM IA examples at Petras, Sector I; another LM III example came from Vrysinas; an angle looking left is present on 18 examples from Malia; from the same site there are 26 more examples of an angle looking right, four examples on an angle looking down, and three examples of an angle looking up. Two concentric angles are found on a LM IA example at Petras, Sector I; two more LM IA examples came from Vrysinas. Two concentric angles inscribed (?) in a circle are known from a single example from Malia.

10. **Two branches** are known from two examples from Malia. Two branches and two wavy lines between them were found on a LC II example from Kea.

11. **A rectangle** is known on two MM IB examples from Syme.

12. **Two horseshoe** shaped incisions are found on a LC II example at Kea.

13. **The zigzag** is known only from an example at Malia.

14. **A sort of «pseudo inscription»** consisting of eight intersecting lines is found at Petras, Sector I, dated to the LM IA period; a similar sign consisting of five intersecting lines came from Malia.

15. **A spiral** is known only from a MM II example from Petras, Sector I.

16. **A triangle** is found on a LM IA example from Petras, Sector I and two MM IB examples from Syme. A bisected triangle is known from one LC I example from Kea.

17. **A square bisected diagonally** is found on a single LC II example from Kea.

B. *Composite Linear signs*

These are idiosyncratic signs, resulting from the combination of usually of two simple linear signs.

1. A vertical line combined with an oblique line is found on a LC II example from Kea. Two vertical lines crossed by two horizontal lines are found on an example from Malia. Three vertical lines combined with two hooked oblique lines is found on one LC I example from Kea. A V combined with three vertical lines below is found on a LC I example from Kea.

2. A horizontal line combined with a vertical line, and a horizontal line combined with two vertical lines are found on one LM IA example from Petras, Sector I each.

A horizontal line combined with two impressions, perpendicular with three cur marks, three horizontal lines combined with a vertical perpendicular line, and a horizontal line combined with small impressions at the end are found on an example each from Malia. Three parallel horizontal lines perpendicular to a longer vertical line are found on three examples from Kea, two of them dated to the LC I and one to the LC II. An E combined with an inverted V is known also from Kea, dated to the LC II. Four parallel horizontal lines perpendicular to a vertical longer line are found on a LC I example from Kea.

3. An angle combined with a dot is found on a LM IA example at Petras, Sector I.

4. An arched line combined with an oblique line is also known from a MM II Petras, Sector I example. An arched line combined with an impression is found on a LC I example from Kea. An arched line combined with two oblique parallel lines and an arched line combined with a Γ are found on two LM IA examples from Petras, Sector I. An arched line combined with two parallel oblique lines, came from Petras, Sector I, LM IA in date. In the same context was found an arched line combined with a Γ, an arched line combined with a vertical converged line, and two converging lines combined with a dot. A probably LM arched line combined with three impressed dots came from Vrysinas. Two arched lines and a vertical line between them on either side, were also found at Vrysinas, dated to MM IB-II.

5. An oblique line combined with two nail impressions was found at Petras, Sector I, dated to the LM IA. An oblique line between two impressed dots was found at Vrysinas, dated probably to the MM III. Two oblique lines and a third intersecting oblique line are found on a LC II example from Kea.

6. A nail impression combined with a dot, a nail impression combined with an arched line, a nail impression combined with two arched lines, a nail impression combined with a vertical line, as well as a nail impression combined with a Z were found on one LM IA example each at Petras, Sector I. Two nail impressions combined with two parallel horizontal lines are found on a probable LM IA example from Vrysinas. A vertical line combined with two nail impressions are found on a LM I example from Vrysinas.

7. An «eye» combined with a branch and two oblique lines is found at Malia, on 10 examples.

8. Two impressions combined with four more impressions below them are found on a LC I example from Kea.

C. Signs similar to letters of the alphabet

1. A I is found on a MM IIB example from Syme.

2. A T is found on a MM II example from Petras, Sector I; on three examples from Malia; on a MM IIB example from Syme; one three more LC II examples from Kea. A T combined with three oblique lines came from Petras, Sector I, LM IA in date.

3. A double V is found on two examples from Kea, EBA and LC II respectively. Three V in column are also found on two examples from Kea, LC I in date.

4. An X is found on four examples from Petras, Sector I and another four possible examples, preserved in a fragmentary state, three of them dated to the MM II and five dated to the LM IA; from the Petras cemetery there are four examples, one from HT 4, Room 3, and the other three from the West Platform of HT 10; from Malia there are 16 examples; from Syme there are five examples, two of them dated to the MM IB, two dated to the MM IB or MM IIB and one dated to the MM IIIB-LM IA; from Vrysinas there is a further example, possibly dated to the MM III period. An X combined with an oblique line is known from Syme, dated to the MM IIB.

5. A Π is found on an example from Vrysinas of uncertain date. An inverted Π is found on three LC II examples from Kea.

D. Signs similar, but not identical, to signs of the Hieroglyphic[11]

1. A tree motif with two branches is found on a MC III example from Kea. An inverted tree motif is also known from Kea, on an example dated to the LC II. Similar are the branching stems, known also on a LC II example from Kea.

2. A circle with a horizontal diameter is found on an example from Malia.

3. A «*porte*» is found on seven examples from Malia.

4. A swastika is known on an example form Malia.

5. A silphium (or crocus?) is also known from a single example from Malia.

6. A star is found on four examples from Malia.

7. A rhomboid is found on one example from Malia; on two MM IB examples from Syme; on one LC II example from Kea.

8. The so called «*grain de blé*» is found on a single example from Malia.

E. Hieroglyphic and Linear A[12] *and B signs*[13]

1. Branch, H 068 is found on a LM IA example from Petras, Sector I; four examples from Malia; one more, MM II-III, example from Vrysinas.

[11] For the denomination of the Hieroglyphic Signs (Godart and Olivier 1996: 17).
[12] For the Linear A signs (Raison and Pope 1977: 74).
[13] For the Linear B signs (Ventris and Chadwick 1956: 50, fig. 10).

2. Arrow, H 050, and *176, L 78, AB 10 is found on two LM IA example from Petras, Sector I; one MM II example from the Petras cemetery, House Tomb 10, West Platform; one example from Malia; two more examples, MBA and MC III respectively, from Kea.

3. Cross L 22, AB 2 is found on two LM IA examples from Petras, Sector I, and one example from the Petras cemetery, HT 10, West Platform; from Malia there are five examples; from Syme there are four MM IB, and MM IIB examples; also there are nine more examples from Kea, two of them dated to MC III, four to LC I and three to LC II.

4. The pictogram for cloth (TELA), H 041 is found on two LM IA examples from Petras, Sector I and one MM II example from HT 4, Room 3 at the Petras cemetery.

5. The pictogram for wine (VINUM), B 131 is found on an example from Malia, and the pictogram for wine combined with L 53/B 60 reversed is found on a LC II example, from Kea.

6. A rectangle topped by a triangle, H 037, *157 and *172 is found on four examples from Petras, Sector I, one of them MM II in date and the other three LM IA; at Malia it is found on two examples. A rectangle topped by a triangle combined with a vertical line is found on one MM II example from the Petras cemetery, HT 10, West Platform.

7. A trident, L 54, AB 31 is found on one example from the Petras cemetery, HT 4, of MM II date; one LC I from Kea.

8. An S, L94, AB 25, on an example from Malia.

9. A V, L 78, AB 10 was found on two examples from Petras, Sector I, of MM II and LM IA date, as well as on two MM II examples from HT 4 of the Petras cemetery; from Malia there is one example; from Syme five examples, two of them MM IB-IIB and three LM IA; from Vrysinas there is a further MM III-LM IA example; two EBA and MBA examples respectively came from Kea.

10. A Y, L 31, AB 27 is found on one MM III-LM IA example from Syme; there is also a LC II example from Kea.

11. A Γ, H 060 is found on two LM IA examples from Petras, Sector I.

12. The double axe is a common potter's mark encountered both in the Middle and the Late Bronze Age in various sites. At Petras, Sector I is found on one certain and three fragmentary preserved examples, two of them dated to the MM II and two to the LM IA; at Malia it is known from five examples, one of them having the sign twice; also there are five MM II examples from Syme; two LC I and LC II examples respectively came from Kea.

13. The hieroglyphic sign H 091 is found on one MM IB example at Syme.

14. The Linear A and B sign L 26, AB 58 is found on a LC II example at Kea.

15. The Linear A and B sign L 30, AB 1 is found on three LC II examples from Kea.

16. The Linear A and B sign L 43, AB 67 is found on a single LM IA or LM IB example from Syme.

17. The Linear A and B sign L 56, AB 12 is found on a MC III example from Kea.

18. The Linear A and B sign L 75, AB 21 is found on a LC I example from Kea.

19. The Linear A and B sign L 81, AB 45 is found on four examples from Kea, three of them dated to the MC III and one to the LC II.

20. The Linear A and B sign L 92, AB 5 is found on three MC III examples from Kea.

21. The Linear A and B sign L 103, AB 53 is found on a LC I example from Kea.

22. The hieroglyphic sign called «*mains croisées*» H 003 is found on three examples from Malia.

23. The hieroglyphic sign called «*croix pommetée*» H 070 is found on two examples at Malia.

24. The hieroglyphic sign called «*main gantée*» H 009 is very common at Malia where it is found on 49 examples.

25. The bucranium, H 086 is found on 37 examples from Malia.

26. The hieroglyphic sign called «*eye*» H 005 is found on two examples from Malia; one more example came from Kea, on a LC II example.

27. Finally there are four non-identified examples from Malia.

Discussion

Various older and recent studies have examined potter's marks. The subject, contrary to other ceramic studies, which have shed light on important aspects of many civilizations, still remains rather obscure, or as N. Hirschfeld, rightly pointed out, it is «*a no man's land*»[14]. As mentioned above, in Crete sites which produced potter's marks in different quantities, along with Petras, are Malia-Quartier Mu, the sanctuary at Syme-Viannos, the peak sanctuary at Vrysinas, and more recently Mochlos. The comparative study of these assemblages can, potentially, be very useful. Up to date, the only generally accepted conclusion about the potter's marks is that they were made before the firing

[14] Hirschfeld 2008: 120.

of the vessels. The study and the publication, in any case, despite the difficulty for a convincing explanation of their use and function, aimed at forming assemblages, examining possible common features, as far as the signs are concerned, as well as about their use, in the hope that the creation of a model for their understanding would be possible in the future.

Along with the presentation of various assemblages have been published also theoretical studies, examining the possible social, administrative, economic or technological reasons for the use of the potter's marks by certain ancient societies, often drawing anthropological parallels from more recent, pre-modern cultures, in an effort to identify possible common trajectories for the understanding of ancient potter's marks.

What is really important is that these signs are on vessels, and every vessel had a specific maker and a specific recipient, as Christakis pointed out[15]. His approach, probably for the first time in Aegean potter's marks is so explicitly anthropocentric instead of vessel-centric, as most previous studies were, and he tried to identify the potters as products themselves of their particular socio-economic context, focusing especially on their choices of the modus operandi, both of the vase making as well as of the marking[16]. Christakis also discussed in a most detailed way, the relationship between the vessel and the marks and produced comparative tables of all Cretan sites that offered evidence for potter's marks, the most important among them, both for quantity and variety of the assemblages being Malia, Petras and Syme-Viannos. He suggested, very rightly to my opinion, that pottery specialists should study the potter's marks rather than script specialists. Furthermore, Beller[17] pointed out that, although it is very well known that pottery in general expresses ideological, technological and sociological characteristics that are necessary for the understanding ancient (but apparently also traditional) societies, for an understanding of the potter's marks, many more studies are necessary. All scholars studying potter's marks agree on this point, as no generally acceptable interpretative theory for the purpose(s) of this widespread practice has been advanced as yet. In any case it is quite possible that potter's marks did not have the same meaning in all periods, cultures or geographical areas of the world. The hypotheses concerning their function are many, ranging from simple decorative purposes to an early form of scripture, and including identification of particular ceramic workshops or potters, and reference to administrative structures, or particular users who had special social characteristics.

The only certain idea is that the potter's marks represent a symbolic meaning of the person who made the vessel, addressed to the person who is using (or just seeing) the particular object. This message could be related or not related to the user.

At Petras, all potter's marks already published and those included in the present study are made before the firing of the vases. For similar marks found at Aghia Irini on Keos, Bikaki[18], suggested that they were related to the producer and not the user in particular or the unit (social, administrative etc.) for which they were destined.

[15] Christakis 2014: 34.
[16] Christakis 2014: 63-65.
[17] Beller 2014: 1.
[18] Bikaki 1984.

If one applies the above mentioned hypotheses to the Petras material, as analyzed by Beller[19], a) decoration; b) identification of the potter; c) identification of the workshop; d) administrative signs; e) signs referring to the vessel type; f) pre-writing system, on the potter's marks from Petras, the following observations can be made:

a) The hypothesis of the decoration could be accepted for some of the signs, such as the double axe, the pictogram for cloth, the so-called «pseudo-inscriptions», the arrow, and the rectangle topped by a triangle. On the other hand, the simple lines, straight or arched, in various directions and/or combinations, sometimes combined with impressed dots, and also the nail impressions, quite common during the Neopalatial periods can hardly be considered as decorative. For the identification of a possible decorative purpose an important factor is the position of the sign on the vessel, and at Petras it is observed that almost all of the above-mentioned signs are clearly visible by whomever uses the vase or just looks at it, as they are found on handles, rims or the exterior part of the body. On the contrary, a sign on the lower part of the base, which is not easily visible, seems like it is there for someone who will search for it. Consequently, the signs on hidden parts of the vase seem to have had a special (indeed even mystic) meaning, and anyway not addressed to a general audience. I believe that the hypothesis of the decorative function should be abandoned, first of all because potter's marks are very rarely the only decoration of the Middle and Late Minoan I vases, and also in many cases there are practically covered by painted decoration.

b) The second hypothesis is that they served to the producer to distinguish his/her own products in the workshop and the kiln. It cannot be excluded that some of the potter's marks, especially the simpler ones as well as those on the lower surface of the bases could have been used for the identification of a particular potter, especially if many were using the same kiln, as often it would be the case. Yet, this hypothesis fails to explain the small number of the vessels with potter's marks compared to the totality of the production of a particular site at a particular period of time.

c) The third hypothesis is that the potter's marks constitute a sign from the producers to the users, and has a meaning at the time of the purchase of a vessel. In other words, they are like «trade marks» aiming at showing certain special technical characteristic of a particular ceramic workshop and probably also its superiority, compared to other workshops operating at the same time in the same area. Something similar is known from various traditional ceramic workshops, which on the base of the vessels they produce, write either the full name or the initial(s) of the potter, or use some stamp with letters and/or symbols. In some ethnographic parallels one can see even the year of the production written on the base[20]. The fact that at sites where a large number and a notable variety of potter's marks are encountered, particular groups of them can be identified, represented by various examples each, could potentially constitute an argument in favor of this hypothesis. Alternatively, the marks could imply that the particular vessel was of a «superior quality» and thus be like an «advertisement» of particular products of a workshop. Unfortunately, given the relatively small percentage of the vessels with potter's marks at each site, this hypothesis cannot have any value.

[19] Beller 2014: 2.
[20] Beller 2014: 5.

d) The idea that the potter's marks represent signs of administrative character as presented by Beller[21], could be connected with a central administration, or a trade network, or even a religious structure. As Beller argues «*This hypothesis is applicable in societies with a high level of social organization and in some cases extensive economic and religious institutions*». Thus, it is possible that in Minoan Crete, especially at palatial sites, where was established a high social organization, at least a part of the ceramic production was connected with the palaces or depended upon them. Given that the palaces were also trade centers and areas of cult activities this hypothesis could be applicable. Especially for signs easily recognizable, such as arrows, double axes, stars, trident etc., which could also have had an administrative connotation and be also religious symbols, such a hypothesis seems plausible, especially in palatial sites, such as Malia and Petras. Consequently, it cannot be excluded that the continuation of the studies and publications at Petras would show that there is a connection between the potter's marks found in the cemetery and those found in the first palace or in other important elite buildings connected with the palatial administration.

e) The fifth hypothesis focuses on the vessels themselves, suggesting that the potter's marks were used to identify the nature or the quantity of their content. This is also a simplistic idea, as very often vases of different capability and/or different use, (e.g. closed or open), had the same marks.

f) The last hypothesis is connected to a form of script in societies which either did not had yet a script, or where the literacy was not wide-spread, as was the Minoan society. There are certainly potter's marks on Minoan vessels, Protopalatial as well as Neopalatial, which coincide with signs of the Cretan Hieroglyphic or the Linear A script. Similar is the situation in Cyprus, where various signs of the Cypro-Minoan script are found on vessels as potter's marks, especially during the Mycenaean period, when they formed a large corpus[22]. Even during the Early and the Middle Cypriot periods simple signs were found on Cypriot vessels[23].

A combination of the above-mentioned hypotheses is more likely, or rather the more I study potter's marks, the more I am convinced that they did not all have the same meaning, they did not all intended to give the same message and they did not all have the same symbolism, nor were they addressed to the same audience, either users or producers. Anyway, new studies of potter's marks both from Crete and the Aegean in general are very welcome as they add more data to the general corpus. Furthermore, comparative studies shed light in a detailed fashion, on the spreading of this phenomenon, its general characteristics, valid for all sites, as well as the idiosyncratic parameters of every particular site.

The approach to the study of the potter's marks, proposed by Christakis[24] includes, the measurements of the similar/identical signs form the same site to identify the direction of the incisions, in trying to verify the existence of one or more hands. He believes that the examination of the depth of the signs and their direction could lead to the identification of particular persons and not workshops in general, as other scholars suggested.

[21] Beller 2014: 6-7.
[22] Hirschfeld 2008.
[23] Hirschfeld 2008: 124-125.
[24] Christakis 2014: 163-165.

Consequently, the marking of a vessel would represent a message of the potter to the user and the community in general i.e. «a dialogue of memory», or perhaps a memory of a corporeal experience. Thus, the marked vessels would represent «a mnemonic statement of a whole action, or rather a series of actions carried out by the potter, which give the vessel a historical substance». If one accepts this interpretative approach, special places, such as the Petras palace (whatever meaning one gives to this word), the Neopalatial House I.1[25], the elite Pre- and Proto-palatial cemetery, as well as the important sanctuary of Syme, are places where actions of social memory would be very significant for the owners of the marked vessels, as well as for the ways in which they were able to purchase them and to use them, either in real or symbolic ways.

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Appendix: Table 2

Petras PM: data comparison between the settlement and the tombs

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Pithoi	Two intersecting lines	1			4		LM IA	
	Four oblique lines	1					LM IA	
	Rectangle topped by triangle	1					MM II	
	X	1					MM II	
Pithoid Jar	Horizontal line	5			26	1	MM II (1), LM IA (4)	
	Rectangle topped by triangle	2					LM IA	
	Two intersecting lines (double axe?)	1					MM II	
	Double axe	1					MM II	
	Oblique line	6					MM II (1), LM IA (5)	
	Two oblique lines	2					LM IA	
	Three oblique lines	1					MM II	
	Vertical line	4					LM IA	
	T	1					MM II	
	T combined with three oblique lines	1					LM IA	
	Branch	1					LM IA	
	V	1					MM II	
			Three parallel vertical lines	1				MM II

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Basins	Oblique line	1			2	1	LM IA	
	Horizontal line	1					LM IA	
			Wide horizontal line	1				MM II
Tripod cooking pots	Vertical line	6			12		LM IA	
	Oblique line	2					LM IA	
	Horizontal line	1					MM II	
	Four horizontal lines	1					LM IA	
	Oblique line combined with two nail impressions	1					LM IA	
	Cloth pictogram (TELA)	1					LM IA	
Cooking pots (tripod?)	Multiple nail impressions	2			2		LM IA	
Cooking plates	Oblique line	1			2		LM IA	
	Two converging lines	1					LM IA	
Tripod cooking tray	Vertical line	1			1		MM II	
Kalathoi	Angle	1			8		LM IA	
	Arched line	1					LM IA	
	Oblique line	1					LM IA	
	Two oblique lines	2					MM II, LM IA	
	Three oblique lines	1					LM IA	
	Two converging lines (double axe?)	1					LM IA	
	Rectangle topped by triangle	1					LM IA	

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Amphorae	Vertical line	5			9		MM II (2), LM IA (3)	
	Arrow	1					LM IA	
	Oblique line	2					LM IA	
	Pseudo-inscription	1					LM IA	
"Palatial type" amphora	Oblique line	1			1		LM IA	
Jugs	Arched line	1			11	10	LM IA	
	Two oblique lines	3					MM II, LM IA (2)	
	Three oblique lines	1					LM IA	
	Vertical line	4		5			MM II (2), LM IA (2)	
	Nail impression	1					LM IA	
	Oblique line	1		1			LM IA	
			V	1				MM II
			X	1				MM II
			Arrow	1				MM II
			Three sets converging lines	1				MM II
Bridge-spouted jar	Vertical line	1	Nail impression	1	1	1	LM IA	MM II
Wide-mouthed jug	Arched line	1			1		LM IA	

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Closed shapes	Oblique line	2			13		MM II, LM IA	
	Two oblique lines	3					LM IA	
	Three oblique lines	1					LM IA	
	Vertical line	3					MM II (1), LM IA (2)	
	Horizontal line	1					LM IA	
	Two intesecting lines	1 and 1 probable double axe					LM IA	
	Horizontal line combined with vertical line	1					LM IA	
Semi-closed vessel	V	1			1		MM II	
Fruitstand	Oblique line	1			1		MM II	
Globular cups	Vertical line	1			4	1	LM IA	
	Horizontal line	1					LM IA	
	Oblique line	1					LM IA	
	Nail impression	1		1			LM IA	
Staight-sided cup	Two nail impressions	1			4		LM IA	
	Oblique line	1					LM IA	
	Vertical line	1					LM IA	
	Two parallel lines	1					LM IA	
One-handled bell cup			Two oblique lines	1	1			MM II

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
One-handled conical cup	Nail impression	1			1	2	MM II	
			V	1				MM II
			Vertical line	1				MM II
Carinated cup	Five horizontal lines	1			1	2	LM IA	
			Cross	1				MM II
			Rectangle topped by triangle combined with vertical line	1				MM II
Footed cup (crinkled rim)	Vertical line	1			1		LM IA	
Tumbler	Horizontal line	1			1		MM II	
Tripod cup	Oblique line	1			1		LM IA	
Cups	Two nail impressions	1			3		LM IA	
	Three oblique lines	1					LM IA	
	Vertical line	1					LM IA	
Handleless	Nail impression	18		1	61	4	MM (2), LM IA (16)	
	Two nail impressions	7					LM IA	
	Three nail impressions	1					LM IA	
	Arched line	9					LM IA	
	Two arched lines	3					MM II (1), LM IA (2)	
	Oblique line	6					LM IA	
	Two oblique lines	2					LM IA	
	Three oblique lines	1					LM IA	

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
conical cups	Vertical line	2					LM IA	
	Two vertical lines	1					LM IA	
	Horizontal line	1					LM IA	
	Two converging lines	1					LM IA	
	Two concentric angles	1					LM IA	
	Two intersecting lines (X?)	2					LM IA	
	Two shallow depressions	1					LM IA	
	Spiral	1					MM II	
	Γ left facing	1					LM IA	
	Nail impression combined with dot	1					MM II	
	Nail impression combined with arched line	1					LM IA	
	Z combined with nail impression	1					LM IA	
			X	1				MM II
			Pictogram of cloth	1				MM II
			Two cut marks	1				MM II
Handleless globular cup	Nail impression	1			2		LM IA	
	Γ	1					LM IA	

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Bowls	Nail impression	19			59	1	LM IA	
	Two nail impressions	10					LM IA	
	Three nail impressions	2					LM IA	
	Oblique line	7					LM IA	
	Two oblique lines	2					LM IA	
	Converging arched lines	1					LM IA	
	Arched line	8					LM IA	
	Horizontal line	5					LM IA	
	Two finger depressions	1					LM IA	
	Two nail impressions combined with oblique line	1					LM IA	
	Nail impression combined with vertical line	1					LM IA	
	Nail impression combined with two arched lines	1					LM IA	
	Arched combined with two oblique parallel lines	1	X	1			LM IA	MM II
Open vases	Horizontal line	1			3		LM IA	
	X	1					MM II	
	Two vertical lines	1					LM IA	

Shapes	Potter's Marks				Total Number		Chronology	
	Petras I	Number	Petras III	Number	Petras I	Petras III	Petras I	Petras III
Plates			Nail impression	1		7		MM II
			Oblique line	3				MM II
			Two oblique lines	1				MM II
			X	1				MM II
			Two horizontal parallel lines	1				MM II
			Trident	1				MM II
Lamps	Nail impression	1			5	1	LM IA	
	Pseudo-inscription	1					LM IA	
	Arched line	1					LM IA	
	Two nail impressions	1					LM IA	
	Two oblique lines	1					LM IA	
			Wavy line	1				MM II
Lids	Nail impression	1			2		LM IA	
	Vertical line	1					LM IA	
Rhyton	Three oblique lines	1			1		LM IA	
Scuttles	Vertical line	2			7		MM II, LM IA	
	Three vertical lines	1					LM IA	
	Oblique line	1					LM IA	
	Three oblique lines	1					LM IA	
	Horizontal line	1					LM IA	
	X	1					LM IA	
Incense burner	Two arched lines	1			1		LM IA	
Stand	X	1			1		MM II	
Strainer	Vertical line	1			1		LM IA	
TOTAL		254		33				

Table 3

Comparison of the PM evidence from Petras settlement, Petras cemetery, Malia, Syme, Vrysinas and Kea

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Nail impression	44	4 MM II, 40 LM IA	4	MM II					4	MM III, MM III-LM IA, (?), (?)	2	MBA
Two nail impressions	14	LM IA									12	MBA
Three nail impressions	3	LM IA									14	MBA
Multiple nail impressions	2	LM IA										
Two converging nail impressions									1	(?)		
One impression									1	LM IA (?)	8	MBA, MC III (2), LC I (1)
Two impressions											23	MBA, LC I (5), LC II (3)
Three impressions							2	MM IB			13	MBA, MC III (2), LC I (2), LC II (1)
Two pairs of impressions											5	MBA, LC II (1)
Four impressions											2	MBA, LC II

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Two cut marks			1	MM II					4	MM II, MM III/LM I (?), MM III, two MM III (?), (?)	3	MBA
Three cut marks									1	LM III (?)	8	MBA, LC I (1)
Three punched dashes in line											1	LC II
Three punched dashes in line combined with an one more above them											2	LC II
Four punched dashes arranged in a quadrant											3	LC II
"Quincunx"							3	MM IB			2	LC II
Six punched dashes arranged in a rectangle											1	LH IIIA
Two finger impressions	2	LM IA										
Three impressions in triangular arrangement									1	MM II-III		
Three depressions											4	MBA

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Oblique line	36	4 MM II, 32 LM IA	4	MM II	10	MM II					1	MBA
Two oblique converging lines					2	MM II						
Two parallel oblique lines	14	3 MM II, 11 LM IA	2	MM II	26	MM II	2	MM IB	6	MM II-III, LM I, two MM III, MM II	1	LC II
Three sets of converging lines			1	MM II								
Three parallel oblique lines	7	1 MM II, 6 LM IA			2	MM II			1	MM III	1	LC II
Three oblique lines											2	LC II
Four oblique lines	4	LM IA									1	LC II
Vertical line	32	7 MM II, 25 LM IA	6	MM II	11	MM II	18	MM IB (16), MM IIB (1), MM IIIB-LM IA (1)	6	MM III, LM III (?), MM III-LM IA		
Vertical incision									1	(?)		
Two vertical lines	5	LM IA			1	MM II	7	MM IB (6), MM IIB (1)			1	LC II
Three vertical lines	1	LM IA	1	MM II	2	MM II	7	MM IB (4), MM IB or MM IIB (3)			10	MBA, LC I (2), LC II (2)
Four vertical lines					1	MM II	6	MM IB			1	LC I
Six vertical lines											1	LC I

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Vertical line and three transverse horizontal lines							20	MM IB				
Two vertical lines and one transverse oblique line							1	MM IB or MM IIB				
Two converging lines	3	LM IA										
Six intersecting lines	1	LM IA										
Horizontal line	21	3 MM II, 18 LM IA	1	MM II	9	MM II			2	MM III	1	LC I
Two horizontal parallel lines			1	MM II	8	MM II					2	MBA, LC II
Three horizontal parallel lines					1	MM II						
Four horizontal lines	1	LM IA										
Five horizontal lines	1	LM IA										
Arched line	22	LM IA							1	MM III		
Two arched lines	3	1 MM II, 2 LM IA										
Two concentric arched lines					2	MM II						
Two curved lines											1	LC II
Two curved intersecting lines											1	LC II
Semi-circle (?)							1	MM IIB				

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Wavy line					1	MM II						
Wavy line vertical									1	MM III		
Wavy line horizontal			1	MM II					1	MM III-LM IA		
Angle	2	LM IA							1	LM III		
Angle looking left					18	MM II						
Angle looking right					26	MM II						
Angle looking down					4	MM II						
Angle looking up					3	MM II						
Two concentric angles	1	LM IA							2	LM I, LM IA (?)		
Two concentric angles inscribed (?) in circle					1	MM II						
Two branches					2	MM II						
Two branches and two wavy lines between them											1	LC II
Rectangle							2	MM IB				
Two horseshoe-shaped incisions											1	LC II
Zig-zag					1	MM II						
"Pseudo-inscription"	1 (eight intersecting lines)	LM IA			1 (five intersecting lines)	MM II						
Spiral	1	MM II										
Triangle	1	LM IA					2	MM IB				
Bisected triangle											1	LC I
Square bisected diagonally											1	LC II

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Vertical line combined with an oblique line											1	LC II
Two vertical lines crossed by two horizontal lines					1	MM II						
Three vertical lines combined with two hooked oblique lines											1	LC I
V combined with three vertical lines below											1	LC II
Horizontal line combined with a vertical line	1	LM IA										
Horizontal line combined with two vertical lines	1	LM IA										
Horizontal line combined with small impressions at the end					1	MM II						
Two impressions combined with three cut marks, perpendicular to a horizontal line											1	LC I

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Three horizontal lines combined with a vertical perpendicular line					1	MM II						
Three parallel horizontal lines perpendicular to a longer vertical line (E)											3	LC I (2), LC II
E combined with an inverted V											1	LC II
Four parallel horizontal lines perpendicular to a vertical longer line											1	LC I
Angle combined with a dot	1	LM IA										
Arched line combined with an oblique line	1	MM II										
Arched combined with two oblique parallel lines	1	LM IA										
Arched line combined with a Γ	1	LM IA										
Arched line combined with a vertical converging line	1	LM IA										

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Two converging lines combined with a dot	1	LM IA										
Arched line combined with three impressed dots									1	LM (?)		
Impression combined with a arched line											1	LC I
Two arched lines and a vertical line between them on either side									1	MM IB-II		
Oblique line combined with two nail impressions	5	LM IA										
Oblique line between two impressed dots									1	MM III (?)		
Nail impression combined with a dot	1	LM IA										
Nail impression combined with an arched line	1	LM IA										
Nail impression combined with two arched lines	1	LM IA										
Nail impression combined with a vertical line	1	LM IA										

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Z combined with a nail impression	1	LM IA										
Two parallel horizontal lines combined with two nail impressions									1	LM I (?)		
Vertical line combined with two nail impressions									1	LM I		
"Eye" combined with a branch and two oblique lines					10	MM II						
Two impressions combined with four more below											1	LC I
Two oblique lines and a third intersecting oblique line											1	LC II
"I"							1	MM IIB				
T	1	MM II			3	MM II	1	MM IIB			3	LC II
T combined with three oblique lines	1	LM IA										
Double V											2	EBA, LC II
Three V in column											2	LC I

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
X	4 and probable 4 another	3 MM II, 5 LM IA	4	MM II	16	MM II	5	MM IB (2), MM IB or MM IIB (2), MM IIIB-LM IA (1)	1	MM III (?)		
X combined with oblique line							1	MM IIB				
Π									1	(?)		
Inverted Π											3	LC II
Tree motif with two branches											1	MC III
Inverted tree motif											1	LC II
Branching stems											1	LC II
Circle with an horizontal diameter					1	MM II						
Porte					7	MM II						
Swastika					1	MM II						
Silphium (or crocus?)					1	MM II						
Star					4	MM II						
Rhomboid					1	MM II	2	MM IB			1	LC II
Grain de blé					1	MM II						
Branch, H 068	1	LM IA			4	MM II			1	MM II - III		
Arrow, H 050 and *176, L 78, AB 10	2	LM IA	1	MM II	1	MM II					2	MBA, MC III

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
Cross, L 22, AB 2	2	LM IA	1	MM II	5	MM II	4	MM IB, MM IB or MM IIB, MM IIB (2)			9	MC III (2), LC I (4), LC II (3)
Pictogram for cloth (TELA), H 041	2	LM IA	1	MM II								
Pictogram for wine (VINUM), B 131					1	MM II						
Pictogram for wine, B 131, combined with L 53/B 60 reversed											1	LC II
Rectangle topped by triangle, H 037, *157, and *172	4	1 MM II, 3 LM IA			2	MM II						
Rectangle topped by triangle combined with a vertical line			1	MM II								
Trident, L 54, AB 31			1	MM II							1	LC I
S (L 94, AB 25)					1	MM II						
V (L 78, AB 10)	2	MM II, LM IA	2	MM II	1	MM II	5	MM IB or MM IIB, MM IIB (1), MM IIB-LM IA (3)	1	MM III-LM IA	2	EBA, MBA
Y (L 31, AB 27)							1	MM III-LM I			1	LC II
Γ (H 060)	2	LM IA										
Double axe, H 042, L 52, AB 49	1 and probable 3 another	2 MM II, 2 LM IA			5 (one twice)	MM II	5	MM IIB			2	LC I, LC II

Mark Type	Petras I	Date	Petras III	Date	Malia	Date	Syme	Date	Vrysinas	Date	Kea	Date
H 061							1	MM IB				
L 26, AB 58											1	LC II
L 30, AB 1											3	LC II
L 43, AB 67							1	LM IA or IB				
L 56, AB 12											1	MC III
L 75, AB 21											1	LC I
L 81, AB 45											4	MC III (3), LC II
L 92, AB 5											3	MC III
L 103, AB 53											1	LC II
Mains croisées, H006					3	MM II						
Croix pommetée, H 070					2	MM II						
Main gantée, H 009					49	MM II						
Bucranium, H 086					37	MM II						
"Eye", H 005					2	MM II					1	LC II
Unidentified					4	MM II						
Total	269		33		297		98		43		190	

What is Mine is Not Yours: Potters' Marks as Indicators of Local Pottery Production and Territoriality in the Protopalatial Period

Georgios Doudalis

Abstract: This paper explores local pottery production and notions of competition among potters during the Protopalatial period. The study addresses the concept of territoriality on the part of workshops in and around Mochlos from the Middle Minoan (MM) IIA through the Middle Minoan IIB period (ca. 1850-1700 B.C.E). The discussion focuses on and integrates a study of potters' marks and a statistical analysis of pottery from six deposits found beneath the Neopalatial buildings as well as from a Middle Minoan II house at the western edge of the settlement.

While there are no extant physical remains of Protopalatial pottery workshops at Mochlos, other evidence, such as potters' marks, can shed some light on the competition for and the acquisition of resources. In Mochlos the potters' marks appear first in MM IIA and continue into the MM IIB period. They are pre-firing marks that consist of three general categories divided into sub-types. These three categories are: two parallel incised lines, a single incised line, and a combination of a straight and a curvy line. A variety of open and closed vessels were marked, all made with local clays tempered with phyllites, silver mica, or metamorphic rocks. This is quite important because the presence of the mark brands the final product and represents the source of clay and the processes behind the production of the vessels.

This paper explores the idea that potters' marks along with ceramic production and consumption evidence territorial workshop practices that prohibited the use of clay sources by potters from other regions. Potters from nearby sites also participated in these practices by signing their own vessels with their own distinctive marks. These practices were established to define ownership of resources and market share. This complicates the model of production and consumption in the Bay of Mirabello because it disrupts the presumed centralized role of Gournia in the production and distribution of pottery. Instead, it requires an understanding of a more complex system where pottery workshops actively competed by controlling their resources and local markets. Thus the potters' marks were not used by the potters only to distinguish their vessels in the kiln, but they were used also as signifiers of ceramic workshops and distinguished potters' productions in a given region.

This paper explores territoriality amongst potters, as evidenced by the distribution of the potters' marks in a variety of vessels from Mochlos in the Protopalatial and into the beginning of the Neopalatial period. Territoriality is «*the tendency of people to defend or*

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to hold a particular domain or sphere of influence or interest»[1]. At Mochlos, that general «sphere of interest» might include the land and sea surrounding the settlement. For a potter's workshop, that interest is restricted to whatever resources were required to produce pottery. Thus, this discussion of territoriality focuses on the examination of potters' marks with attention to shapes that are marked and in what fabric, whether local or imported. The paper concludes by reviewing the results of these inquiries and how they relate to a broader understanding of local and regional economies.

Theoretical Background and Literature Review

The present understanding of the sociopolitical structure in the Protopalatial period is an ever-evolving one, but many consider that the island was parsed into decentralized polities, each including a «center».

In the history of the research on Palaces and their territories, like the ones of the Neopalatial period, J. Cherry and C. Renfrew in their theory of peer-polity interaction identify «primary» and «secondary» states[2]. Through this distinction, a state includes a territory in which the people who belong to it can move freely and use the resources[3]. Their research postulated a clear social and hierarchical distinction between the elites who occupied Palatial sites and the people who lived in their territory, based on the political centralization that controlled the production, distribution, and consumption of materials between the central settlement and the peripheral ones[4].

Alternative theories involved a different theoretical model than that of the top-down relationships between the Centers and their peripheries. These theories considered the «states» as a phenomenon that describes interaction between heterarchical social structures and their corporate strategies related to the control of the production, distribution, and consumption of material culture[5]. Therefore, the main focus in the research shifted from a general center-periphery model to the relationships between different social agents within their settlements and region.

Thus the new researchers created a system for interpreting the scales of interaction, that of micro-, meso-, and macroscale[6]. This multi-scalar approach provided a framework with which to consider local and regional relationships between and among social agents in a heterarchical system whereby agents that are unranked or of lower rank acquire the means to gain social status and become an elite[7]. This observation is crucial in the analysis of potters' marks in Mochlos since it is possible to identify connections between and control of the local workshops by households and relations of other Mochlos households with the regional workshops in a competitive environment of the Mirabello Bay. Assuming that different tribal groups occupied various parts of the natural landscape from the end of the Prepalatial period[8], it seems that the population increase,

[1] https://www.britannica.com/topic/territoriality; https://www.merriam-webster.com/dictionary/territoriality.
[2] Renfrew 1972: 368; Renfrew 1986: 1; Cherry 1986: 21.
[3] Renfrew 1986: 1; Doudalis 2022: 6.
[4] Branigan 1988: 13-14; Van Effentere 1983: 63; Yoffee 1993: 69-71.
[5] Schoep 2002a: 18; Blanton 1998: 149; Doudalis 2022: 7.
[6] Parkinson and Galaty 2010: 10.
[7] Crumley 1995: 3; Doudalis 2022: 7.
[8] Cadogan 2011: 27.

which began at the beginning of the Protopalatial period, catalyzed the development of new social structures based on the control of the resources as well as ideology[9], that negotiated their status within the community, as evidenced in cemeteries and mortuary practices[10]. Even at Palatial sites such as Malia, architectural analysis[11] indicates that later Palatial architectural characteristics, such as the lustral basin or the Minoan hall, were dispersed throughout quarters and houses, suggesting the dispersal of authorities even in Palatial sites. This process seems to have been started in Malia since the MM I[12] in which the occupants were negotiating their identities not only on a hierarchical level but possibly at a heterarchical level dispersed in a more heavily populated community.

The exploration of material from Palatial settlements has shown that these dispersed authorities legitimized their status through the control of material culture including pottery[13]. They also competed or cooperated in the same urban and natural environment, either local or regional, possibly exercising various levels of power[14].

Within regions, similar architecture and material culture are sometimes shared between sites and the Palatial centers, which reflects a distribution of power from the centers into the settlements in the region, which followed the same trends in production and consumption of material culture as at the centers[15]. Thus in this heterarchical system of power, elites or heterarchies that lived in the peripheries acknowledged the status of those living in the centers, and they adopted and imitated the material culture produced and consumed there. In addition, the local elites seem to have controlled the artisanal workshops, including those dedicated to pottery, in order to exercise and show their status in their active local and regional environment. This is quite important since ceramics were one of the most extensively produced materials, and its consumption and control of production was probably quite important for the expression of status.

In the examination of interregional interaction on the macro-scale, the research identified connections between Cretan settlements and other regions of the Eastern Mediterranean such as the Levant and Egypt, where bureaucratic systems and monumental buildings were developed in the same period[16]. These connections were already established by the end of the Early Bronze Age[17], and continued through the Protopalatial period, with Crete showing similarities and perhaps imitations in material culture such as script[18] and architecture[19].

Important for this study, Crete also adopted the pottery wheel in ceramic manufacture. At first, the wheel was used for the production of elite decorated pottery such as Kamares[20] and the provincial polychrome ware, and it later expanded to the construction of small and medium vessels, both coarse and fine.

[9] Haggis 1999: 70-71.
[10] Legarra-Herrero 2016.
[11] Schoep 2006: 40-41.
[12] Legarra-Herrero 2016: 359.
[13] Poursat 2012: 181-183.
[14] Schoep 2010: 66-77.
[15] Schoep 2006: 39; Tsipopoulou 2002.
[16] Schoep 2002b, 2010, 2006: 53; Parkinson and Galaty 2007: 119..
[17] Panagiotopoulos 2001.
[18] Olivier 1986.
[19] Watrous 1987; Schoep 2006: 55-58.
[20] Schoep 2006: 54.

In East Crete, C. Knappett has argued that Malia is an example of a center that extended cultural, economic, and social influence over the eastern part of Crete, specifically by comparing wares from Malia and Myrtos Pyrgos[21].

At Mochlos this dynamic is expressed within the pottery as certain affinities of shape and decoration, first in Middle Minoan IIA and expanding into the Middle Minoan IIB, at which point the site also reveals connections with other Palatial centers such as Petras and Malia. We might also consider that the increase in population in the Mirabello area, based on the data from several surveys and excavated sites, brought technological innovations such as the potter's wheel as well as new ceramic shapes from the area around Malia during the Protopalatial period.

The Mirabello Gulf

To better understand the notion of territoriality in the Mochlos material, we have to understand the changes that occurred in the Mirabello area throughout the Protopalatial period, and particularly how the changes in production, distribution, and consumption of ceramic material are connected to the social and cultural transformation that happened in the area.

Five surveys were conducted in the late 1990s and early 2000s in the Gulf of Mirabello that show some interesting results regarding the distribution of sites in this geographic area and its natural resources. The surveys in the area of Gournia[22], Kavousi[23], Vrokastro[24], Pseira[25], and Chryssokamino[26], demonstrate similarities in the occupation of the Mirabello area from the beginning of the Middle Bronze Age and the Protopalatial period.

During EM III and MM IA, there is a decrease of sites from the previous period (EM IIB) and nucleation of larger sites such as Gournia and Vasiliki[27]. This nucleation also affected the status expression of social agents such as in the elite tombs at Mochlos, Gournia, and Myrtos Pyrgos, which show continuous use from EM III-MM IA and indicate the distinction of elites from the lower classes that occupied the area.

Toward the end of the MM IA and into the MM IB period, a significant growth of sites around water resources and central settlements can be identified[28]. Such an example is the intensification of sites in the area of Kavousi starting from the coast of Tholos to the upland area of Avgo around sites 44 and 68. These two sites are monumental and are considered central for controlling the agricultural plain and the communication networks between the eastern and western parts of the Mirabello[29]. This expansion of sites was possibly a result of regional migrations[30] that catalyzed the development of heterarchies

[21] Knappett 1999; Knappett 2012.
[22] Watrous *et al.* 2012.
[23] Haggis 2005.
[24] Hayden 2005.
[25] Betancourt *et al.* 2005.
[26] Betancourt 2006.
[27] Watrous and Schultz 2012a: 40.
[28] Watrous and Schultz 2012b: 42; Haggis 2005: 69-70; Doudalis 2022: 5.
[29] Haggis 2005.
[30] Doudalis 2018.

and a diffusion of old and new elites, who were competing for control of natural resources.

During Middle Minoan IB and II, the increase of population in the Mirabello area seems even more drastic and some researchers have written about it as a «population explosion»[31], creating a clearer idea about the social organization and the settlement patterns during the main phases of the Protopalatial period (MM IIA-MM IIB). From the beginning and into the main phase of the Protopalatial period, the settlements of Gournia[32], Mochlos[33], Pseira[34], Vasiliki[35], and Myrtos Pyrgos[36] show growth, and their elites acted in heterarchies in an expanded cultural and social landscape where people, products, and ideas moved and connected.

The results of these surveys are important in order to understand the production, distribution, and consumption of ceramic material, and the notion of territoriality is incorporated into this framework. The population growth and the occupation of uplands, lowlands, and the hills[37] included potters and workshops that had to cover the market needs of an expanded population by utilizing old and new natural clay sources.

Mochlos Protopalatial Deposits and Clay Fabrics

Eight fragmentary deposits of Protopalatial material found underneath Late Minoan I houses have been excavated within the Mochlos settlement, together with a half-excavated Protopalatial House (Fig. 1, Tables 1-2). Thus far the study has focused on these deposits and on gleaning information about the production and consumption of pottery at Mochlos. These deposits are not restricted to a single area, which means that the Protopalatial settlement covered much of the same ground as in the later Neopalatial period, giving a fresh interpretation of the importance of the settlement during the Protopalatial.

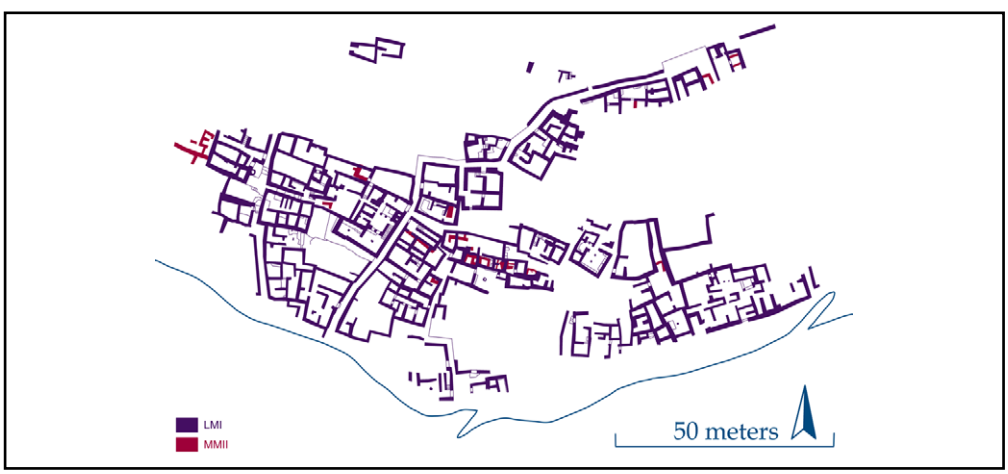


Fig. 1. Map of the Protopalatial deposits (drawing by Douglas Faulmann)

[31] Hayden 2005: 93.
[32] Boyd *et al.* 1908.
[33] Soles and Davaras 1996: 426-428.
[34] Betancourt *et al.* 2005: 286.
[35] Zois 1992: 279.
[36] Cadogan 1980.
[37] Watrous and Schultz 2012b: 44; Hayden 2004: 97-98, 115.

Mochlos Protopalatial deposits and their chronology							
Chronological Phases	Deposit underneath House C.12	Deposit Underneath House C.3	Deposit underneath House C.7	Deposit underneath House C.7	Deposit underneath House C. 7	Deposit underneath Ceremonial Complex House B.2	Deposit underneath Ceremonial complex B.2
Mochlos III (MM IIB)	Level 1: D2 2823, 2824.1	Deposit 1: E3 5905, 5930: Upper storey collapse	Deposit 2 E3 4334, 4335: Floor	Deposit 3: E3 42/5245, 42/5246: Floor/votive deposits	Deposit 4: E3 31/3204-31/3224: Fill	Deposit 5: E3 5471: Floor/votive deposit	Deposit 6 E3 5521: Bin
Mochlos II (MM IIA)	Level 2: D2 2824.2,2825, 1803, 2826.1: Floor and upper storey collapse						
Mochlos I (Late MM IA-MM IB)	Level 3: D2 28262: Fill						

Table 1. Mochlos Protopalatial deposits and their chronology

Table 2: House 1: Deposits and Chronological Sequence						
Chronological Phases	Middle Minoan House 1	Room 1	Room 2	Room 3	Room 4	Area 1
Mochlos III (MM IIB)		Layer1: D2 1802.1-4 Upper storey collapse,			Layer 1: D2 1804.1-3: Upper storey collapse	D2 811, 1810: Floor
		Layer 2: D2 1802.5: Floor	Layer. 2: D2 1803.2-3, 1812.1-3: Fill	Level. 2:D2 1803.4, 1813.1-4: Fill	Layer 2:D2 1804.4 Floor	
Mochlos I (Late MM IA-MM IB)		Layer 3:D2 1802.6: Fill above bedrock	D2 1812.4-7: Fill above bedrock	D2 1813.5-6: Fill above bedrock	Layer.3: D2 1804.7-9: Fill above the bedrock	

Table 2. House 1 Deposits and Chronological Sequence

The analysis of fabrics available in the area is crucial to an understanding of territoriality because fabric indicates whether a vessel was made of local or imported clays. This lends a preliminary glimpse into the chain of production, distribution, and consumption at Mochlos and, in the case of locally sourced vessels, demonstrates the intensive use of clay sources around the site during the Protopalatial period. As a starting point, the two general wares are fine ware and coarse ware. Fine ware is classified as such when it maintains minerals less than 10% of the clay percentage. Coarse ware is

defined as the fabrics that include 10% of minerals in the clays[38]. Medium fabrics are considered the fabrics that maintain minerals of a little more than 10% and statistically they are classified along with the coarse ware fabrics. All Mochlos potters' marks in Mochlos belong to the coarse or the medium category, an interesting observation that may show that the plain and undecorated vessels acted as the identifiers of the workshops because they were the ones circulated in the largest numbers within the community. Moreover, the distinctness of their clay coloration and inclusions relative to other clay sources in the regions is far more obvious in coarse and medium clays.

The fine ware fabrics are divided into three different fabric types: fine orange (red), fine buff tan, and fine pink clay. Three imported fabrics have been recognized macroscopically. The first includes large white-and-black granodiorite inclusions combined sometimes with gold biotite mica[39]. It appears in the western Mirabello Gulf in the area between Kalo Chorio, Vrokastro, Priniatikos Pyrgos, and the major Minoan site of Gournia[40]. This fabric is important because it presents a small number of potter marks during the MM IIB, but vessels that come from the area of Mirabello appear both in MM IB and the MM IIA all unmarked in the Mochlos deposits. The second imported fabric is a South Coast fabric that contains angular inclusions originating in the area between Myrtos Pyrgos and the Messara[41]. Only in the MM IIB period do examples of this fabric exist, but none of them are marked. The third and final imported fabric comes from East Crete and has pinkish clay with a dark core[42]. This fabric appears mostly in vessels collected from the MM IIA and MM IIB strata. There are four local coarse ware fabrics in Protopalatial wares from Mochlos, all including phyllite inclusions, either combined with silver micaceous, white metamorphic, or calcite minerals. Examples of potters' marks appear exclusively in semi-fine and coarse wares, and, because those inclusions are known to come from specific localities in Crete, the origins of the workshops that were using them are also known to us. The local phyllitic coarse fabric (hereafter PP), is the most common in Mochlos and can be found in the geological environs south and west of Mochlos in the Kavousi[43] and Limenaria areas[44]. The silver micaceous fabric (hereafter SM) appears nearby in sources north and east, in the area between Myrsini and Mesa Mouliana[45] and is also considered local. The third local fabric, a combination of phyllite and white metamorphic rocks (PP/white meta) is not common and the exact source is not yet identified, but it is surely local because of the presence of phyllitic inclusions.

The Middle Minoan IB period is identified solely in the ceramic material in Mochlos. This pottery is recognizable through fills underneath a few well-preserved MM IIA and MM IIB fills and floors. A continuation in consumption patterns from the previous Middle Minoan IA period is attested by the typological and statistical analysis of the ceramic material. The consumption of imported pottery in both storage, cooking, and drinking vessels from the Mirabello area made of granodiorite is profound and more popular than

[38] Barnard and Brogan 2003: 3; Doudalis 2022: 25.
[39] Doudalis 2022: 21; Haggis 2012: 136, Gessel *et al.* 1988; Hayden 2004.
[40] Barnard and Brogan 2003: 7-8.
[41] Poursat and Knappett 2005: 21-23.
[42] Nodarou 2010; Smith 2010.
[43] Haggis 2005: 168-170.
[44] Papastamatiou *et al.* 1959.
[45] Barnard and Brogan 2003: 8; Doudalis 2022: 20.

the local ones. The decorated examples were painted in light-on-dark, but now the basic distinction from the EM III-MM IA is the introduction of wheel-made examples, the painting of the interior, and the introduction of polychrome ware. The appearance of short tumblers and semi-globular and proto-carinated cups is another innovation, along with jars with horizontal handles. The preference for the imported vessels with granodioritic fabric shows that Mochlos was attached to the workshops in the western Gulf of Mirabello, while the local workshops were barely active, producing a minimum number of vessels.

It seems that Middle Minoan IB, at least in the Mirabello Gulf, was a period of transition with new technologies like the wheel being used by workshops as a result of migrations of groups of potters from regions in the west (eg. Malia) and the east (eg. Petras)[46]. These new potters participated in and emulated the strong East-Cretan pottery tradition, before adopting and modifying the production of different kinds of pottery that were already developed in the Palatial centers in MM IA and MM IB, like polychrome ware and the carinated cup. However, the absence of potters' marks from this period, as well as the markedly low percentage of local vessels in relation to the imported, indicates that the exploitation of the local resources in Mochlos was minimal during this period.

During the Middle Minoan IIA period, the use of the wheel became increasingly common, especially in the manufacture of small and mid-sized vessels. All the wheel-made examples preserve straight, parallel striations on the underside of the base, which shows that they were made with the slow wheel technique[47]. The variety of vessels also increased from the previous period, and the repertoire of cup shapes expanded with the introduction of different types, such as tumblers, one-handled conical cups with strap handles, straight-sided cups, and grooved or ungrooved carinated cups. The decoration, when it exists, is monochromatic, or includes a few examples of light-on-dark metallic slip and polychrome, different from those of the Middle Minoan IB period. The appearance of flared-rim bowls whose most parallels are from Petras[48], evidences intensive connections of Mochlos settlers in patterns of consumption with this major settlement of East Crete. Other connections are also evidenced, such as tumblers and one-handled conical cups with strap handles that are similar to those from the Palatial site of Malia[49].

In this period (MM IIA), Mochlos shows a continued pattern of consumption of closed vessels from the western Mirabello area made with granodiorite, which comprises 17% of all closed vessels in this subperiod. However, the majority of the vessels (60%) were made with local fabrics. The most significant difference from the previous period is the production of cooking vessels, which had been made exclusively from granodioritic clays, but in MM IIA are made almost exclusively from silver mica and phyllite. The rest of the percentage from this deposit belongs to fine clays, either buff or orange. This is also the period in which the first potters' marks appeared, something that was probably tied to the increase in local production and the openness of Mochlos to different regions other than just the western part of the Mirabello.

During the Middle Minoan IIB period, the shapes found in Mochlos are standardized, similar to those that appear in Malia during the same phase, but also following the

[46] Doudalis 2018.
[47] Berg 2015.
[48] Tsipopoulou 2012; 2017.
[49] Knappett and Pomadere 2017.

regional variations. The conical tumbler that was very popular in Malia appears in Mochlos' locally-made examples with a thicker base. Similar to Malia, the carinated cups of Mochlos have a middle to high carination and much thinner and regular grooves than in the former period. Most of the examples of this shape are decorated with dark or red metallic slip, sometimes with supplemental decorations of light-on-dark motifs. The one-handled conical cups follow the same changes that appear in Malia, and they have rolled or rounded handles[50]. The closed vessels, such as jugs, jars, and amphorae have rounded shoulders and conical or piriform profiles.

In MM IIB the numerous shapes produced and therefore consumed are standardized within two to three sub-types, while in the preceding MM IIA period, each different shape had many different sub-types, showing experimentation in production strategies. The MM IIB standardization perhaps is a reflection of the political organization developed in the last phase of the Protopalatial period. Mochlos and the Mirabello region show a regionally bound homogeneity, identified in the regional similarities across vessel typologies. This could possibly be attributed to the appearance of a center, perhaps a Palace at Gournia[51], which might have been under the cultural influence of the Palatial settlement at Malia. The coarse ware vessels consumed during the MM IIB period were produced from the same sources as those that appeared in MM IIA. However, there is a significant drop in the number of vessels made with silver micaceous clays, while there is an increase in the exploitation of the local phyllitic sources, which the local Mochlos workshops used for the construction of many types of open and closed vessels. The connections with the western part of the Mirabello were still strong, especially regarding closed transport and pouring vessels with dark-on-light decoration. Statistically, some of the households seemed to prefer vessels made from granodiorite. For example, granodiorite made up 58% and 69% of two of the deposits underneath House C.7, respectively. The rest of the households in the settlement seemed to consume vessels made from local fabrics with greater frequency. 55% of the deposit underneath House C.3, 60% of Area 1 in House 1, and 60% of the MM IIB level underneath house C.12 are made with phyllite and less with silver mica.

The diversification in the consumption of ceramic material is attached to the relations between households and ceramic workshops from the local or regional surroundings. Through these micro-scale connections, territorial relationships can be identified, since the stronger the market and the connections of the producers and the consumers are, the stronger the need for possession of the sources from which the product (in this case the vessels) is made.

To understand the relationship between households and producers on the local and regional level, a brief analysis of the potters' marks inside their contexts and in relation to the general statistical analysis of the entire ceramic material in them is needed.

The Potters' Marks

Twelve examples of potters' marks were identified in Mochlos ceramics dated to the Middle Minoan IIA stratum underneath Neopalatial House C.12 (Table 3).

[50] Poursat and Knappett 2005: 970.
[51] Buell and McEnroe 2017.

MM IIA Potter's marks					
P #	Locus	Description	Preservation	Fabric	Potter's mark
P 12615	D4 1803.2	Bowl with horizontal handle	About one quarter extant	PP	One deep long pre-firing incision on the handle
P 12594	D4 1803.2	Mischellanepous open	Less than one quarter extant	PP	Two symmetric pre-firing diagonal incisions
P 12549	D4 2825.1	Conical tumbler	About one quarter extant	PP/White meta	Two symmetric pre-firing diagonal incisions above the base
P 12598	D4 1803.2	Scuttle	About two quarters extant	PP	Two diagonal pre-firing parallel incisions with the lower being larger than the higher one
P 12599	D4 2826.1, 2825.2, 1803.2	Flaring bowl or Kalathos	Less than two quarters extant	SM	Two symmetric pre-firing diagonal incisions on rim interior
P 12562	D4 2825.2	Open vessel	Less than one quarter extant	PP	Two diagonal parallel curvy incisions on top of the handle
P 12561	D4 2825.2	Closed vessel	Less than one quarter extant	PP	Two symmetric pre-firing diagonal parallel incisions on the handle.
P 12523	D4 2824.2	Open vessel	Less than one quarter extant	PP	Two symmetric pre-firing diagonal parallel incisions on the handle.
P 12545	D4 2825.1	Miscellaneous closed vessel	Less than one quarter extant	PP/White meta	Two pre-firing vertical and symmetric parallel incisions with pointed edges
P 12547	D4 2825.1-2	Miscellaneous closed vessel	About one quarter extant	PP	Two symmetric pre-firing diagonal incisions on the right part of the handle.
P 12614	D4 1803.1	Miscellaneous closed vessel	Less than one quarter extant	PP	Two thick pre-firing diagonal parallel incisions
P 12560	D4 2825.2	Miscellaneous closed vessel	Less than one quarter extant	SM	Two symmetric diagonal incision on the side of the handle

Table 3. MM IIA Potter's marks

Six of them were marked on open vessels and six on closed vessels. The closed vessels consist of five miscellaneous closed vessels (Fig. 3)[52]. In addition, the open vessels included a conical tumbler (Fig. 4)[53], a flared-rim bowl (Fig. 5)[54], three miscellaneous open vessels that preserved only the handle (Fig. 6)[55], a deep bowl with an inverted rim and upraised horizontal handle (Fig. 2)[56], and one scuttle (Fig. 7)[57]. The potters' marks can be classified into two broad types in the MM IIA phase of the settlement. The first type has two diagonal incisions and the second is composed of a single diagonal incision. All the marked vessels were made in local clays with inclusions of phyllite or phyllite combined with white metamorphic rocks or silver mica. The marks on both open and closed vessels were incised in highly visible parts of the vessels. Cups are either one-

[52] P 12561, P 12545, P 12547, P 12614, and P 12560 (Table 3).
[53] P 12549 (Table 3).
[54] P 12599 (Table 3).
[55] P 12594, P 12562, P 12523 (Table 3).
[56] P 12615 (Table 3).
[57] P 12598 (Table 3).

handled conical or carinated cups with strap handles and are marked either on the low exterior wall above the base or on the top of the handle. The one bowl that is marked features a mark high on the interior wall below the rim, while the closed vessel examples that belong to pitchers or jars, as well as the scuttle, preserve the mark on the handle.



Fig. 2. P 12615: Jar with horizontal handle. Photo by Georgios Doudalis



Fig. 3. P 12547: Miscellaneous closed vessel or pitcher? Drawing by Douglas Faulmann

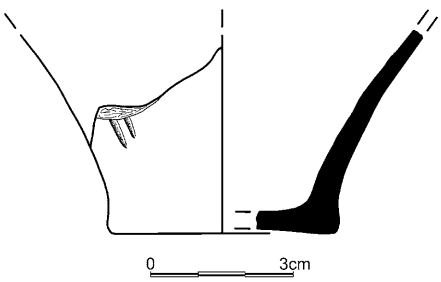


Fig. 4. P12549: Conical tumbler. Drawing by Douglas Faulmann

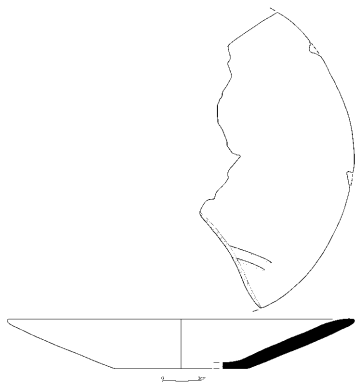


Fig. 5. P 12599: Flared rim bowl. Drawing by Douglas Faulmann

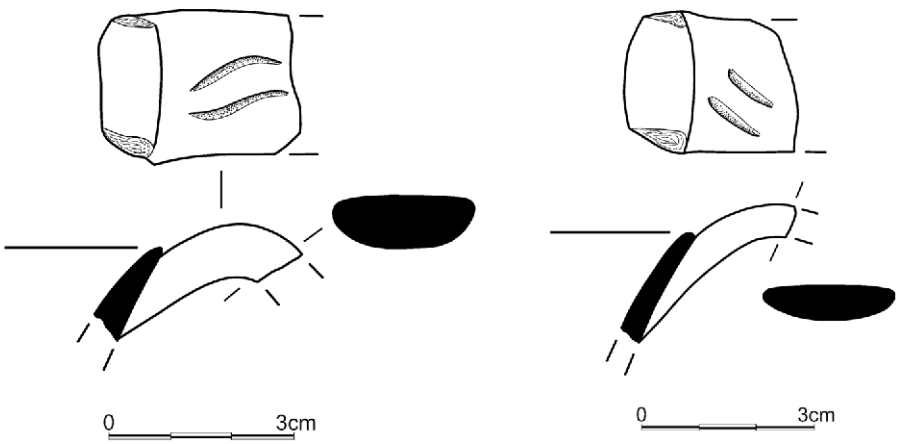


Fig. 6. P 12562; P. 12523: Miscellaneous cup. Photo by Douglas Faulmann

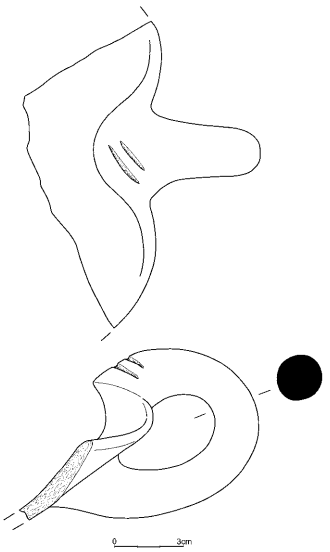


Fig. 7. P 12598: Scuttle. Drawing by Douglas Faulmann

Most of the preserved marks appear in the Middle Minoan IIB period (Table 4). Thirty-one examples have been identified in the deposits.

The two variations that appear in MM IIA continue into the MM IIB period. One new mark appears, but only in one cooking dish that is created by the combination of a horizontal and diagonal incision, appearing something like an arrow point, but this is a very rare example and possibly is a variation of the mark composed of two oblique incisions.

In this period, the conical tumbler is the most frequently marked type. Ten examples were catalogued as P 4474, P 1866, P 4414, P 4417, P 1872, P 13218, P 4412, P 8548, P 6385, P 12492, P 12507 (Fig. 8, Table 4). They are marked on the lower exterior wall above the base, which is a practice that continued from the MM IIA period. All the marked conical tumblers are made of local medium-fine orange/red clays with white metamorphic rocks, purple phyllite, or silver mica. When the examples are made from coarse ware, they are tempered with silver mica. A second type, that of flared-rim bowls, is marked in the interior of the rim. From this type, two examples are preserved, one of which is of purple phyllitic clay and the other with silver mica.

Two different types of marks can be observed in the flared-rim bowls. P 4312 (Fig. 9, Table 4) is marked with two diagonal incisions high on the rim interior with the left being longer than the right one, while P 12850 is marked with a single horizontal incision high on the wall interior below the rim.

Three miscellaneous cups also exist[58], one marked on the body and two on the handles (Fig. 10). They were made in three diagnostic, local Protopalatial fabrics, two with coarse fabrics, phyllite and silver mica, and one medium-fine example consisting of fine orange-red clay combined with purple phyllite. These examples bear the mark of two diagonal,

[58] P 13252, P 12591, P 13205 (Table 4).

parallel, pre-firing incisions. One basin[59] made from silver micaceous clay also bears the mark of two pre-firing oblique incisions on the top flat part of the rim.

MM IIB Potter's marks					
P#	Locus	Description	Preservation	Fabric	Potter's Mark
P 4312	E3 5905.12	Flared-rim bowl	Less than one quarter extant	PP	Two diagonal incisions below the rim higher incision longer than the lower
P 4474	E3 5930.3	Conical tumbler	About three quarters extant	FFO/PP	Two diagonal symmetric parallel incisions above base
P 1866	E3 5930.1, E3 5930.2, E3 5930.4	Conical tumbler	About two quarters extant	FFO/PP	Two symmetric horizontal parallel incisions
P 4414	E3 5905.11	Conical tumbler	About two quarters extant	SM	Two symmetric pre-firing diagonal incisions above base
P 4417	E3 5905.10	Conical Tumbler	About three quarters extant	FFO/PP	Two deep parallel diagonal incisions above base
P 1872	E3 5930.4	Conical tumbler	About two quarters extant	FFO/PP	Two pre-firing parallel incisions above base
P 13218	E3 5905.11	Conical tumbler	About one quarter extant	SM	Two symmetric diagonal parallel incisions above base
P 4412	E3 5905.11	Conical tumbler	About three quarters extant	FFO/PP	Two vertical parallel incisions above base
P 13270	E3 5905.11	Miscellaneous closed vessel	Less than one quarter extant	SM	Two symmetric diagonal incisions on the top of the handle
P 13252	E3 5905.10	One-handled conical cup	Less than one quarter extant	SM	Two diagonal pre-firing incisions on the top of the handle
P 8548	E4 42/5246.3	Conical tumbler	About two quarters extant	SM	Two symmetric diagonal incisions above base
P 6385	E4 42/5244.2	Conical tumbler	About three quarters extant	PP/White meta	Two symmetric diagonal incisions above base
P 9519	E3 5521.4	Pitcher	About four quarters extant	PP/SM/White meta	Two short diagonal pre-firing incisions
P 13205	E3 5521.1	cup	Less than one quarter extant	FFO/ PP	Two long Horizontal/oblique pre-firing incisions
P 12829	D2 1802.5	Scuttle	Less than one quarter extant	GD	Two pre-firing parallel incisions on the handle
P 12382	D2 1802.5	jar	Less than one quarter extant	SM	Two pre-firing diagonal incisions on the side of the handle
P 12850	D2 1802.5	Flared-rim bowl	Less than one quarter extant	SM	One horizontal pre-firing incision below rim interior
P 13108	D2 1813.2	closed vessel (handle)	Less than one quarter extant	PP	Two pre-firing diagonal incisions
P 12383	D2 1813.4	Scuttle	More than one quarter extant	GD	two horizontal symmetric parallel pre-firing incisions on the top of the handle
P 12965	D2 1804.4	Basin	Less than one quarter extant	SM	two thin pre-firing diagonal incisions
P 12942	D2 1804.4	Conical tumbler	Less than one quarter extant	PP/White meta	Two short diagonal pre-firing parallel incisions above base, on the low wall exterior
P 12949	D2 1804.4	Closed Vessel	Less than one quarter extant	SM	Two long symmetric pre-firing diagonal parallel incisions
P 12381	D2 811.1	Scuttle with	Less than a quarter extant	SM	Diagonal pre-firing incision on the handle above the rim
P 12510	D4 2823.3	Miscellaneous close vessel	Less than one quarter extant	PP	Two symmetric diagonal parallel incisions on the side of the handle
P 12592	D4 2823.2	Miscellaneous closed vessel	Less than one quarter extant	PP	Two symmetric parallel pre-firing diagonal incisions
P 12758	D4 2823.2	Miscellaneous closed vessel	Less than one quarter extant	PP	One deep diagonal pre-firing incision (Possibly two)
P 12500	D4 2823.1	Miscellaneous closed vessel	Less than one quarter extant	PP	Two diagonal deep pre-firing incisions, with pointy edges
P 12591	D4 2823.1	Miscellaneous cup	Less than one quarter extant	PP	Two symmetric pre-firing parallel diagonal incisions.
P 12507	D4 2823.2	Conical tumbler	Less than one quarter extant	FFO/SM	One diagonal and one horizontal pre-firing incision

Table 4. MM IIB Potter's marks

[59] P 12965 (Table 4).

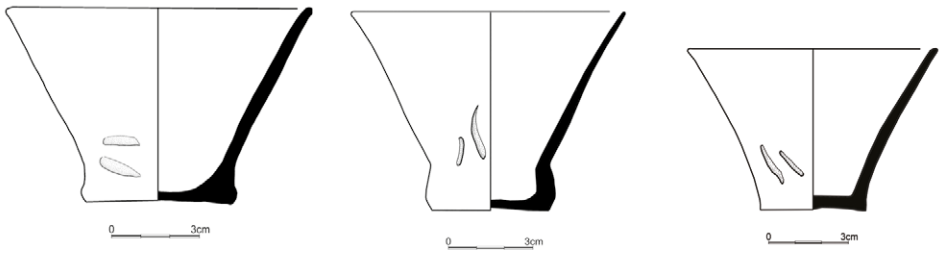


Fig. 8. P 1872; P 4412; P 6385 : Conical tumblers. Drawing by Georgios Doudalis



Fig. 9. P 4312: Flared rim bowl. Photo by Chronis Papanikolopoulos



Fig. 10. P 13252: Miscellaneous cup. Photo, by Georgios Doudalis

Closed vessels are also marked with potters' marks. The closed vessels are divided into the categories of miscellaneous, jars with horizontal handles, and pitchers. They are all made with local coarse fabrics. The majority of the marked vessels are made with purple phyllitic clay (Fig. 11)[60] while fewer are made of a combination of purple phyllite, silver mica, and white metamorphic rocks[61], and two examples are made with silver mica[62].

All the closed vessels are marked on the handle, either on its top or on the side with variations of the two diagonal incisions, with the exception perhaps of one vessel[63] which preserves at its break one diagonal pre-firing incision. Sometimes the incisions are deeper, longer, shorter, or have pointed edges, all of which possibly represent different graphic characters of various members of the workshop.

The final shape that bears a potter's mark is the scuttle. Three scuttles have been identified in the Mochlos' MM IIB deposits. These examples are interesting because they show differences in fabrics. P 12829 (Fig. 12) and P 12383 (Fig. 12) both preserve two thin, long, parallel incisions on top of the handle, and they are made with the granodioritic

[60] P 13270, P 13108, P 12510, P 12592, P 12500 (Table 4).
[61] P 9519 (Table 4).
[62] P 12382 and P 12949 (Table 4).
[63] P 12758 (Table 4).

fabric, a clay that appears near Gournia and Kalo Chorio. The third example, P 12381, is made of silver micaceous clay and marked with two pre-firing diagonal incisions.

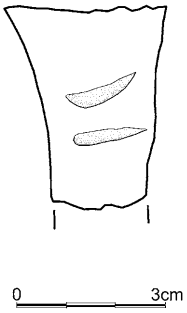


Fig. 11. P12500: Miscellaneous closed vessel. Drawing by Georgios Doudalis



Fig. 12. P 12829; P 12383: Scuttles. Photos by Chronis Papanikolopoulos

Summary and Evaluation

Most of the potters' marks appear in semi-fine and coarse ware vessels, and the most frequent mark is that of the two diagonal incisions. The direction of the mark seems quite important because the examples from the workshops that were active in the area of Kalo Chorio and Gournia, among others[64], present two parallel, horizontal incisions and the examples of the Mochlos potter's marks (PP, SM, PP/White meta, or medium-fine fabrics) are single or two parallel, diagonal pre-firing incisions. The variations of each potter's mark may simply be a result of different members of the same workshop incising the same mark differently, with the mark itself possibly representing the brand of the workshop.

Interestingly, on an early Neopalatial cup (Fig. 13)[65] made with medium-fine local fabric tempered with low-grade metamorphic rocks, the same diagonal parallel lines appear on the exterior above the base, but this time it is painted, perhaps after the firing. This may be interpreted as a continuation of the same Protopalatial workshop into the early Neopalatial, with the method of application shifting from incised to painted.

Concerning the closed vessels, the majority have the mark on the handle, and this shows a common practice. The same habit is found at other sites of East Crete, such as at Petras[66] and the Syme Vianou Sanctuary[67].

However, Petras, Malia, and Gournia are the most relevant sites for comparison with the Mochlos material and in the exploration of territoriality, because Gournia, Petras, and Malia seem to be the sites that most influenced Mochlos in the production and consumption of pottery during the Protopalatial period.

[64] Christakis 2014: 115; Doudalis 2022.
[65] P 13622 (Fig.13).
[66] Tsipopoulou 1990; 2016; 1995.
[67] Christakis 2014.

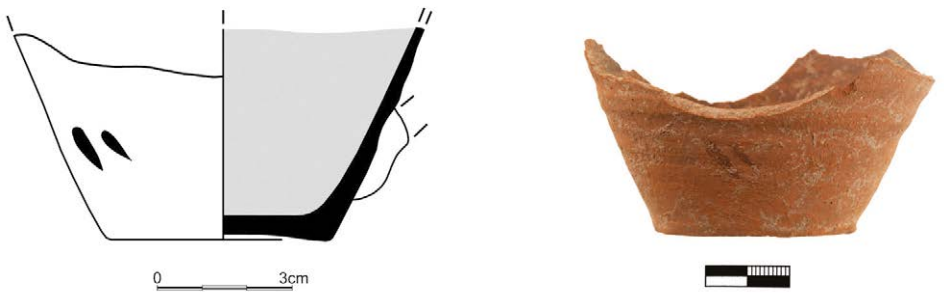


Fig. 13. P 13622, MM III Convex cup. Drawing by Douglas Faullman, Photo by Chronis Papanikolopoulos

As Tsipopoulou writes, the potters' marks have various meanings[68], in which the marking does not only function to distinguish the vessels of different workshops when they are fired in the same kilns[69]. A consideration of territorial relations could supplement the multifunctional nature of the potters' marks as stated by Beller and Bikaki[70]. This multifunctionality is considered in the work of other scholars like Christakis[71], in which the potters' marks have been used as an ornament, production marks, in administration, or as trademarks. In the analysis of the potters' marks from Syme Viannou, Christakis concluded that the different marks were not used for administrative purposes but instead were connected to the relationships between ruling elites and the different potters who were attached to them[72]. Even though according to Christakis' perspective, the potters' marks are related to the distribution of the vessel in the kiln, this idea does not negate that the mark might have acted as a signature that relates the potter with the vessel as the variations of the same markexhibit it, similarly to the relief marks of the central-south Crete[73], but also as a mark of the potting group as an entity[74]. Thus, it can certainly act as a production mark, but also as a distribution sign or trademark.

There are also connections between the practices of marking and the part of the vessel that is marked. The handles in open vessels like cups and closed vessels like amphorae, jugs, pitchers, and jars, when they bear the mark in both MM IIA and MM IIB, have it either on the side or on the top, but the mark is always visible. When a vessel does not have a handle and belongs to the open vessel category, it is marked in a highly visible place. For example, the flared-rim bowls were marked below the rim interior. Cups are marked on the underside of the base, which would have been visible to a second party when tilted toward the mouth, or above the base, low on the exterior wall, visible even in stasis.

The number of marked vessels, the limited variety of the mark, and the idea that the marks are indicators of workshops suggest that Mochlos did not have a large variety of workshop units that settled in its periphery. The existing workshops used the clay sources

[68] Tsipopoulou 2016: 138.
[69] Poursat *et al.* 1978: 99.
[70] Beller 2014; Halepa-Bikaki 1984.
[71] Christakis 2014: 155-156.
[72] Christakis 2014: 159; Lindblom 2001: 132.
[73] Baldacci 2018: 68.
[74] Christakis 2016: 142-143.

that were located near the settlement from MM IIA onwards. Possibly one workshop was using one kind of mark – two lines – and another was using the second kind of mark – the single line incision. These potters were in contact with potters working at other sites in the eastern part of Crete, as we can see from the examples that come from Petras and Syme Viannou[75], and this familiarity is testified by the similarities in vessel shapes between Mochlos and the Palatial sites of Petras and Malia in MM IIA, and then between Mochlos and Malia in MM IIB, especially in tablewares. Marking with linear incisions was a common practice in Crete during this period and was transmitted through the movement of potters, especially in the MM IB period, which is a period of change[76]. The late development of potters' marks in Mochlos is a result of the intensification of production that accompanied the introduction of the wheel. Additionally, their appearance in the MM IIA period, and their continuation into MM IIB, is related to the beginning of an increase in local and regional populations, as evidenced by the material that comes from the surveys. However, these production strategies appear only on the local and the regional level since during this period, production and consumption followed localized patterns, albeit with regional variations.

The introduction of the potter's wheel and the intensification of local production are among the reasons that potters started marking their vessels in Middle Minoan IIA and continued doing so in MM IIB. This intensification is related to population increase and the exploitation of natural resources, including clay sources. These changes were probably a result of migrations within the island, resulting in the change of the political system from local chiefdoms to states that included social heterarchies[77]. Mochlos is an example of these transformative processes during all three phases of the Protopalatial period. These changes manifest in pottery production and consumption, as well as in the changes in vessel shapes and decoration patterns[78]. Thus, in MM IIA Mochlos, the variety of vessels and types shows an openness in the consumption of shapes introduced from the area of Gournia, Petras, and Malia and that Mochlos' heterarchies were participating in the same system of consumption as the consumers of these three sites. In the MM IIB period, with the establishment of the Palace at Malia as the major political center in the central and eastern part of the island, the observed standardization in the production and consumption of the Mochlos material signifies political and cultural attachment with this major site.

Statistically, in the Middle Minoan IIA and Middle Minoan IIB periods in Mochlos, there was a change in the production of coarse and semi-fine ware pottery, specifically a growing preference for local clay fabrics. Fewer vessels of granodioritic fabric appeared than in the preceding period, limited to some cooking and storage vessels. This trend demonstrates continued but constricted trade connections between Mochlos with the area of Mirabello and especially Gournia. In explaining why there was an increase in the production of local vessels in this period, one hypothesis is that during the Middle Minoan IIA period, the political landscape of settlements started to change with the establishment of centers that set the trend in production and consumption of ceramic wares. The various

[75] Christakis 2014, Tsipopoulou 1990.
[76] Doudalis 2018.
[77] Cadogan 2011, Haggis 1999, Schoep 2006.
[78] Doudalis 2022.

settlements seemed to establish their own territories of resources, and the increase in local production – particularly of pottery – would have required securing clay sources. The homogeneity in the production of pottery even with minute local variations led potters to mark their products not only to indicate ownership of vessels in the production process but also in order to be recognizable to consumers and to be distinguishable from other potters operating in the region who wanted to explore and participate in the same market, in this case, the workshops from the Mirabello region. The linear form of the potter's mark and its simplicity supports the argument for regional competition because the simplicity of the mark indicates that it was made to be recognized locally and within the territory of the Mirabello Bay. The example of the two scuttles with the parallel horizontal incisions made with granodioritic fabric on the contrary to Mochlos' local diagonal incisions shows that the competition was quite regional and probably only the consumers of the Mirabello region, including Mochlos, could identify the provenance of the different workshops that are marked with lined incisions. Unfortunately, the marks from the area of Gournia are not yet published but they differ in their orientation, different from single oblique or double diagonal incisions[79].

Apart from the continuity in the consumption of similar fabrics in the MM IIA and MM IIB periods, a second observation is the continuity of the marks themselves within categories of vessels, especially tablewares. However, local conical tumblers, which are the most commonly marked open vessels, represent a new addition to the repertoire of shapes in Middle Minoan IIB, even though a rare example appeared in the earlier MM IIA stratum. It seems that this cup type is a standardized local vessel that appears in each of the Middle Minoan IIB layers, and the mark is always that of two diagonal incisions, with some minute variations. Considered together with the other marked vessels, the standardization in production shows workshop activities that use certain local clay sources and which mark the products in order to distinguish themselves as local. In doing so they may have made themselves more marketable within their perceived territory.

To conclude, the Protopalatial period in the Mirabello area saw a drastic increase in population, which coincides with the first examples of wheel-made wares that are similar to those of Malia in shape and decoration. Thus, it seems that some of these migrants were artisans leading to an increase in the number of potters, who form workshops in the region. The influx would have driven demand for new wares, and this need would have forced intensified production. If some of the migrants were potters in trade, then they may have joined workshops or, depending on determinants such as kinship, they might have been forced to form new workshops. At any rate, more people and potters would equate to a perceived decrease in natural resources, and potters would have felt the need to keep their sources secret or stake their claims. At the very least, intensified production would have led to intensified competition and a need to «brand» or «trademark» wares to capture reputability and a market share.

The mobility of wares would have provided additional incentive to signify their place of origin. Territoriality and workshop practices are open fields, ripe for study, and this research provides just a glimpse into how workshops were operating at the local and regional levels. Further research will enrich and build upon the conclusions here, particularly those that publish potters' marks from sites across the island, as these

[79] J. Younger, *personal communication.*

will form the foundations for more comparative studies between and among sites in the Mirabello region and beyond.

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Late Bronze Age

Some reflections on seal use and seal users in Late Minoan I Crete (ca. 1600-1450 BC)

Ilse Schoep

Abstract: This paper explores some aspects of seal-ownership in MM III-LM I society on Crete, which is not well-known but crucial for understanding sealing deposits and the people doing the sealing. The question whether one seal equals one person or whether a person owned multiple seals is surprisingly difficult to answer. Minoan sealing deposits are generally characterized by, on the one hand, a high number of *different* seal-types (too high to all signify «administrators») and on the other, the use of *look-alike* and *alike* seal-types (too similar to signify different individuals). This paper offers some thoughts on who the seal-owners may have been and how wide-spread seal ownership may have been on MM III-LM I Crete. Contemporary funerary evidence could in theory provide some indications, but is rather patchy. If, however, the extant evidence is trustworthy it could suggests that seal ownership was limited to a couple of seal devices, which contrasts to the contemporary funerary evidence from the Greek Mainland.

«the absence of writing does not mean the absence of communication, for the sealings have a communicative power, both for their contemporaries and for us, in the messages of their seal impressions» (Palaima 1994: 357).

Introduction

When thinking about communication in ancient societies, one thinks in the first place of the written and spoken word. There are, however, other media of communication[1], such as, for example, seals and sealings[2]. The importance of seals and their impressions in LM I society cannot be underestimated. They were small and mobile artefacts, literally prêt-à-porter, miniature depictions that must have played a crucial role in disseminating beliefs, practices and ideology over a large area which is why they have been likened to Bronze Age mass media[3]. Their iconography links them to an extraordinary, pervasive and coherent visual communication system consisting of wall-paintings, plaster reliefs, relief vases, inlays for wooden furniture, three-dimensional terracotta models, figurines,

[1] Hill Boone and Mignolo 1994.

[2] The term sealing is here used as a generic term for all types of stamped documents, including those that did not physically seal anything such as roundels and noduli.

[3] Cf. Otto 2019: 419; Wengrow 2019.

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pictorial textiles, gold appliques that were attached to clothing[4], jewelry, maces, staffs but also pottery motifs (ivy, papyrus, lily, reed, double axes, etc.), etc. Furthermore, they probably also refer to immaterial culture, such as myths, beliefs, prayers etc.

As personal possessions seals (and their impressions) are widely accepted to bring us closer to the Bronze Age individual than is usually possible and thus to provide a direct link back to the society in which they were produced, circulated and consumed[5]. Unlike in the Ancient Near East, where inscriptions on seals (and their impressions) generally clarify the identity of seal owners, the absence of inscriptions on Neopalatial seals means that ownership, or in more neutral terms, the people or groups signified on a semiotic level by the seal-type, must have been conveyed in a different way. Although amongst the best studied artefacts in the Aegean, many questions remain about the role of seals (and their impressions) in Minoan society: were seals items of adornment or talismanic, amuletic or sphragistic devices? How widespread was seal ownership and who were the people behind the seals? How did the materiality of the seal (form, material and iconography) signify people? Did a seal-type signify an individual or not? Our main purpose in this paper is to revisit some old questions, raise some new ones and point out potential new avenues for future research into the communication system that was the world of seal devices and their impressions. The main focus of this paper will be LM I seals, because the main deposits of sealings date to LM IB and because, unlike previous periods, the iconographic repertoire of Neopalatial seals constitutes an island-wide language.

«Magical», Talismanic or «Sphragistic» Seals?

In discussions about seal use there is a tendency to differentiate between different types of use. Thus, while it is widely accepted that Prepalatial seals had an amuletic, talismanic and apotropaic («magical») function[6], Protopalatial and Neopalatial seal devices are mostly considered to be sphragistic and thus non-magical devices[7]. This assumed shift in function can, at least partly, be explained by the so-called Emergence of the First Palaces in MM IB[8], which is thought to have necessitated the creation of an elaborate administrative system and a means to distinguish between different people. Sealings, and by extension the seals that stamped them, are viewed as administrative tools, deployed by a centralized palatial authority to monitor the mobilization and allocation of goods. Their main role was to identify the people involved in monitoring incoming and outgoing goods[9]. With the exception of the MM III-LM I talismanic seals[10], which form a highly distinctive stylistic group to which Evans already attributed a magical function, non-administrative functions of seal devices have received little attention[11]. The labels

[4] Cf. Schoep 2017. The gold appliques from the Shaft Graves at Mycenae, for example, display an astonishing variety, comprising birds, griffins, butterflies, stags, female figures, deer, felines, palm tree, octopus, etc., which are all motifs that occur on seal devices.

[5] Krzyszkowska 2011: 437.

[6] Sakellarakis and Sakellaraki 1997: 631; Karytinos 2000: 37; Sbonias 1999: 35; Krzyszkowska 2005: 21, 76; Anderson 2016: 75-78.

[7] Cf. Krzyszkowska 2011: 440.

[8] The term Palace is used here as a conventional term rather than the residence of a ruler (see Schoep 2006).

[9] E.g. Palaima 1990; Weingarten 1987; Hallager 1996; Schoep 2002a; Montecchi 2019, etc.

[10] Evans 1935: 446; Onassoglou 1985; Stram 2017; Krzyszkowska 2005: 133-137.

[11] But see Krzyszkowska 2016.

«magical» and «administrative» and their implicit dichotomy between the religious and the economic is, however, typical of western rationalism and probably anachronistic. In other geographical regions where seals were used (Egypt, Mesopotamia and Anatolia), they are widely accepted to have been multivalent artifacts that functioned as amulets and talismans, markers of social status and badges of authority[12]. Therefore Minoan seals and signet rings are also likely to have combined «magical» and «sphragistic» purposes. In fact, the «sympathetic» or «contagious magic» Evans attributed to the talismanic seals, implying the transferal of magic from the stone to the wearer, may equally be applicable to other seals[13]. Knappett recently suggested that their close connection to the body may point towards an amuletic rather than sphragistic function[14]. The links between the iconography of LM I seal devices and the extraordinary and pervasive LM I visual communication network of other artefacts (see *supra*) strongly suggests that seals were not just sphragistic tools[15]. This is also suggested by the fact that some of them were discovered with beads and formed part of neck-laces or bracelets[16], which would have made their sphragistic use clumsy and impractical (though not impossible).

Thus, not all seals may have been used for sphragistic purposes but even those that were may also have had «magical» properties. By stamping a seal, not only the identity of a seal owner, but also the «magical» properties of the seal, and the agencies evoked by its iconography were transferred onto the object sealed and onto the transaction (event) the sealing was produced for[17]. According to Wengrow sealings are far more than a way of physically protecting on object or a space and their effectiveness «*derives from a subtle combination of material, social, and psychological processes*»[18]. The act of sealing is therefore a highly symbolical act, evoking different agencies and taking place in a particular context and for a particular reason and seal devices are therefore best regarded as multivalent objects that do not fit the modern categories «magical» or «sphragistic».

Individuals or dividuals[19]?

The question whether one seal-type[20] denotes one individual is important for understanding seal ownership in society and getting a grip on the number of people involved in stamping sealings in deposit. The general rule of one seal-type = 1 persons is widely sometimes explicitly, sometimes implicitly accepted as a general rule. Hallager, for example, accepts this but in his study of sealing reflexes he notes some exceptions[21]. Palaima also follows this reasoning, suggesting that «*by counting the number of different seal-types, we can arrive at an approximate number of the individuals using seals who impressed the surviving sealings*», without completely ruling out that a seal-type can also stand for an

[12] Ameri *et al.* 2018: 6; Wegner 2018: 257.
[13] Evans 1935; Stark 2017: 66; Krzyszkowska 2016; Knappett 2020: 68-70.
[14] Knappett 2020: 77.
[15] See also Krzyszkowska 2011: 440.
[16] E.g. Dimopoulou 1999: 29; Kilian-Dirlmeier 1988: 164.
[17] Wengrow 2008: 13.
[18] Wengrow 2008: 13.
[19] For these terms, see Strathern 1988.
[20] The term seal-type refers to «*a distinct seal motif belonging to a single seal identifiable from its impression on a sealing*» (Palaima 1987: 256) or «*an individual seal face or its ancient impression*» (Krzyszkowska 2005: 356).
[21] Hallager 1996: 92. See also Finlayson *et al.* 2021.

administrative or economic unit, such as a scribal department, storeroom or workshop[22].

The suggestion that seal-types may not denote an individual but a collectivity is based on the phenomenon of look-alikes, first identified by Weingarten in her study of the Zakro sealings[23]. Weingarten identifies look-alikes as seals «*that must have been made similar intentionally, in order to assert similar authority within some closed group*»[24]. She later refines the definition by adding that look-alikes «must be used in a similar way and preferably in a way that is virtually interchangeable»[25]. She argues that such close similarity in seal-type either means that there was no need to distinguish one person's message from another, or that seal devices were intentionally made to look similar and did not signify individuals but (membership of) a group (officials, families, clans)[26]. The possibility that seal-types were associated with a corporate group has recently also been explored by Finlayson[27].

Besides *look-alikes*, as defined by Weingarten (see *supra*), which undoubtedly signified a person as a part of a group, there is also the phenomenon of *alike* seal types, i.e. seal-types that display the same iconographic theme or motif but can clearly be distinguished from one another by the bare eye and were not necessarily used in the same way. This phenomenon is very common in and across all major assemblages of sealings on Crete (Chania, Ayia Triada and Zakro).

Within the sealing assemblage from the Villa at Ayia Triada, there are numerous examples: shells (CMS II,6 nr.140, nr. 141), a seated female with an agrimi (CMS II6, nr. 30, nr. 31) (Fig. 1), quadrupeds (CMS II,6 nr. 62, nr. 63), birds (CMS II,6 nr. 113, 114), lions (CMS II,6 nr. 85, nr. 88), etc.

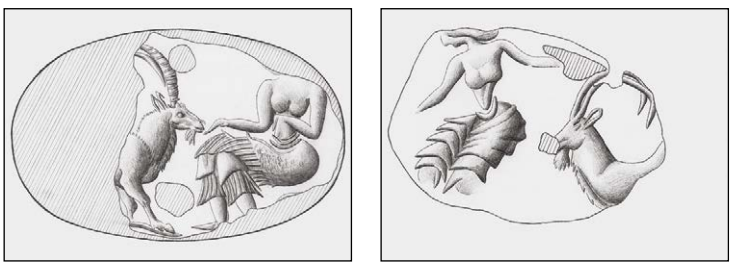


Fig. 1. Seal impressions from Ayia Triada by similar, *alike* seal-types (CMS II,6 nr. 30 left and CMS II,6 nr. 31 right) (Images courtesy of the CMS Heidelberg)

Within the same deposit there are also six different seal-types depicting bull-leaping scenes (II,6, nr. 39-44). These are easily distinguished by the different positions of the leaper, which may have been meaningful to past actors, but it is still difficult to see how such *alike* seal-types could denote distinct individuals. Although this motif is since

[22] Palaima 1987: 256.

[23] Weingarten 1983. See also recent discussion in Karnava 2018: 190-192.

[24] Weingarten 1986: 290.

[25] Weingarten in discussion following Militello 2000: 247.

[26] Weingarten 1992: 28, 34; Weingarten 2018: 330; Weingarten 2010: 405. Palaima (1987: 256, n. 34) hypothetically suggests a scribal department, storeroom or workshop.

[27] Finlayson 2020.

Betts's seminal study associated with Knossian administrators[28], other interpretations are possible, the more so because there is no proof that the bull-leaping rings were produced in a Knossian workshop, or connected to the n Palace at Knossos[29]. Furthermore, considering the ritual nature of bull-leaping, the group signified by these rings may equally well have been ritual practitioners, athletes[30], or people involved in the organization of this activity. At Zakro, the use of *look-alike* and *alike* seal-types is not only common amongst seals from the hand of the Zakro Master but also amongst other seal-types[31], such as, for example, the two rings depicting a procession scene (Fig. 2). Although the latter display small differences, it is still hard to see how these rings could signified different individuals rather than membership of a group or collectivity.

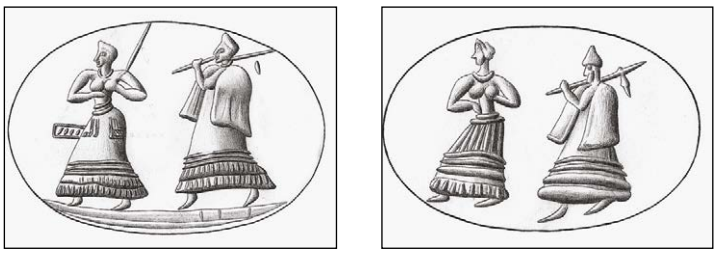


Fig. 2. Sealings from Zakro impressed by similar, *alike* rings (CMS II,7 nr. 16 left and CMS II,7 nr. 17 right) (Images courtesy of the CMS Heidelberg)

Alike seals can also be recognized amongst the sealings from Chania where the wounded quadruped (CMS VS1A nr. 154, nr. 156), the talismanic seal with papyrus motif (CMS VS1A nr. 181, nr. 182) (Fig. 3), the butterfly (CMS VS1A nr. 169, nr. 170) and perhaps the couchant lions (CMS VS1A nr. 161, nr. 163) are so similar as to be not easily distinguishable if not all variants are present. It is interesting to note that, besides two seals attested amongst the impressions from the Odos Katré 10 deposit, a third talismanic seal with papyrus motif was found in an LM IB house on the Ayia Aikaterini Square (House IV, room C) (CMS VS1A nr. 116) (Fig. 3), suggesting that at least three alike seals were being used in LM IB Chania.

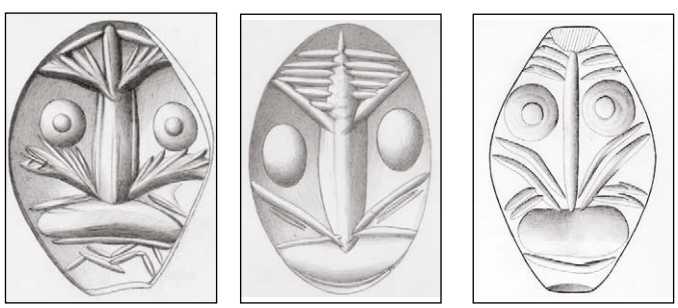


Fig. 3. Seal impressions from Chania (from left to right CMS VS1A nr. 161, CMS VS1A nr. 163) and seal from House IV, Plateia Ayia Aikaterina (CMS VS1A nr. 116) (Images courtesy of the CMS Heidelberg)

[28] E.g. Betts 1967; Hallager 1996.

[29] Schoep 1999; Krzyszkowska 2005.

[30] In this respect, it is interesting to note that one of the bull-leapers on the Tell el-Dab'a fresco is wearing a seal around his arm (Younger 1992).

[31] See Weingarten 1983 for discussion.

There are also some intriguing examples from the Peloponnese[32]. The presence of two alike carnelian lentoids (CMS I, nr. 144-145) in the LH II chamber tomb 515 at Mycenae (Kalkani S Bank)[33] could endorse the suggestion that the motif refers to membership of a group (family?), rather than individuals. Variants of the seal-type depicting a «priestly figure» with a fenestrated axe on the shoulder were found in the LH I/II tombs at Vapheio, Routsi and Pylos, in association with important persons[34]. Their presence has been connected to the functions of these individuals, in particular their religious functions (see also *infra*). A variant of this seal-type was found at Vatheia near Knossos (CMS II,3 nr. 198), but unfortunately the seal lacks a context[35].

Besides the meaning and role of *alike* seal-types within the same deposit, an additional question is raised by their reoccurrence at different sites (see also *infra*). The already mentioned bull-leaping rings belong to this category and two of these (the so-called Knossos replica rings) were responsible for seal impressions at the multiple sites[36]. Some other rings are so similar that the differences in their impressions could only be established by microscopic magnification. A gold ring showing a woman leaning on a baetyl while turning backwards towards a sacred knot (CMS II,6 nr. 4) on a flat-based nodule from Ayia Triada is almost a mirror image of the ring (CMS II,7 nr.6) used to impress a nodulus from Zakro Palace (Fig. 4)[37]. Another example is the LM IA lentoid found on the floor of a house at Petras (Pateropoulos-Liondakis property) which depicts a female figure carrying a quadruped on her shoulder, for which there are 19 comparanda from other sites (i.a. Knossos, Vapheio, Ayia Triada, Malia, Gournia, Kato Zakro, etc.) (see *infra*)[38]. The recurrence of motifs involves talismanic motifs, animals (suckling, wounded, looking back quadrupeds), water birds (flying, walking or sitting), griffins, butterfly, composite creatures, monkeys, dogs etc.) and the above mentioned cult scenes. The consistency of the renditions strongly that they were based on a common source, perhaps in another medium[39]. The question is whether the iconographic motifs had the same meaning and denoted people in the same way across sites.

It is impossible that in the case of very similar seal-types attested at different sites (Fig. 4) the seal-types refer to the same individual and unlikely that they refer to members of the same family or clan. Therefore the most likely interpretation, if seal-types are not random, is that seal-types, or at least some seal-types, refer to the aspects of the identity of a seal owner (gender, age, occupational title, social role)[40]. If this line of reasoning is correct, it would suggest a common understanding of social and occupational roles in Neopalatial society.

[32] Regarding the Minoan seals found on the Greek Mainland, we can of course not be certain that they were used in the same way as on Crete.

[33] See also Weingarten 2018 on these seals. Besides these, 4 agate seals depicting animals (cattle, goat, lion) were found.

[34] Rehak 1994: 80; Hitchcock and Banou 2011. For seal from Pylos, see J. Davis Michael Ventris Memorial Lecture 16/05/2021.

[35] See discussion following Militello 1996: 246 and Stocker and Davis 2017.

[36] For additional discussion of these Knossos replica rings, see Hallager 1996; Schoep 1999; Krzyszkowska 2005: 188-192; Karnava 2018: 192-194.

[37] Weingarten 2010: 405.

[38] Rupp and Tsipopoulou 2012.

[39] Blakolmer 2010; Rupp and Tsipopoulou 2012: 309.

[40] For the possible variety of occupational terms in Linear B, see Nakassis 2013.

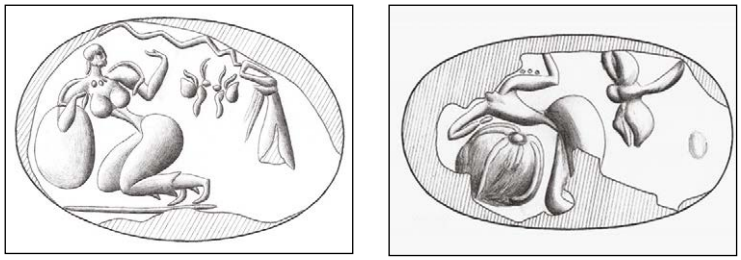


Fig. 4. CMS II,6 nr. 4 (Ayia Triada) and Zakro II,7 nr. 6 (Zakro) (Images courtesy of the CMS Heidelberg)

Summarizing, it seems that the practice of producing and using very similar (or *alike*) seal-types – though not always look-alikes *sensu stricto* – was common not only at the local but also at the regional (see *infra*) level. Distinguishing between different individuals on the basis of the impressions of these seal-types would only have been possible when the other variants were present at the same time and would, even then, not have been straightforward[41]. Past actors did not dispose of the excellent, detailed, and enlarged images that we have at our disposal, which provide us with a sort of God's perspective that is fundamentally different from the experience of past actors. This, in combination with often sloppy stamping in the clay[42], makes it unlikely that impressions by *look-alike* and even by *alike* seal-types could be told apart and makes it more likely that such seal-types signified membership of a collective entity rather than an individual, suggesting that they denoted dividuals rather than individuals[43]. These collective entities may have been very diverse, including families, clans, fraternities, occupational groups, participants in specific events or rituals (e.g. bull-leaping), and perhaps also age-and gender groups. However, whether such a scenario applies to all seals or only some is not clear, and this needs an in-depth analysis of unique seal-types[44].

One individual, multiple seals?

Besides the possibility that seal devices may not have signified individuals but (membership of) a collective entity, it is also possible that an individual owned multiple seal devices. Hallager, by examining sealing reflexes, which happen automatically without thinking, found evidence for individuals simultaneously using two seals and *vice versa*, two individuals impressing the same seal[45]. Hallager is very careful in drawing conclusions from this observation, pointing out that when (the impression of) a particular seal can be identified with (the sealing reflex) of one individual, this does not exclude the possibility that latter may have owned multiple seals and, conversely, that a person using two different seals does not necessarily imply he also *owned* them[46].

[41] Weingarten 1992; Relaki 2012: 312.

[42] For sloppy stamping see Pini 1999: xxiv-v; Krzyszkowska 2005: 155; Relaki 2012: 301; Knappett 2020: 76-77 and recently Finlayson *et al.* 2021.

[43] For terms see Strathern 1988.

[44] Karnava 2019 suggests that this may be the case for the charioteer ring.

[45] Hallager 1996: 205.

[46] Hallager 1996: 115, note 439, 205.

Comparisons with contemporary cultures further East suggests that ownership of multiple seal devices is a strong possibility. In the Hittite world, for example, a man and wife could jointly hold a seal in addition to each having multiple, individual seals[47]. In a deposit from the Upper City of Hattuša, there is evidence that in the course of his career the «Great Scribe», Matu, used 4 different seals[48]. Similarly, the most prominent woman in the Nişantepe Complex Archive at the same site used a total of 11 seals[49]. Hittite seals have the advantage over Minoan seals that the seal owners can easily be identified by the presence of inscriptions[50]. The possibility that persons in Minoan society held multiple seal devices acquired in the course of their lives, and/or denoting to different aspects of their personhood, cannot be dismissed out of hand. To explore this possibility, we will look at the deposition of seals and rings in funerary contexts.

Funerary evidence

Unfortunately, the mortuary evidence from Crete is ambiguous and does not lend itself to a proper and much needed contextualization of seals[51]. Neopalatial tombs are few in number, used for multiple burials over long periods of time, and demographic data (minimum number of individuals, age, sex) are either lacking or unpublished. The cemetery at Poros contained at least 15 chamber tombs, which revealed a minimum of 4 gold rings and an approximate total of at least 36 seals[52]. Unfortunately, the tombs were heavily looted in ancient as well as modern times. One gold signet ring (the «Sacred Conversation» ring) was found in association with a LM IB burial in a chamber tomb on Leoforo Ikarou, which contained «many tens of burials», and yielded at least 6 high quality seals made of semi-precious stones[53]. The «Sacred Mansion» ring was found in another tomb (Demotiko Scholeio[54]) in close contact with the upper part of the body of an undisturbed burial, which had been placed close to the entrance of a side-chamber and was perhaps one of the last ones to be placed in this tomb. Two more gold signet rings («Divine Couple» and «Epiphany of Male God») and a haematite Syro-Minoan cylinder seal came from a looted tomb on Parodo Lagonikou[55]. The chamber tomb on Odos Poseidonos yielded as many as 14 seals[56] and the in 1967 excavated chamber tomb Π 1967 contained 6 LM IA-LM IB seals – one of which was associated with the latest, LM IB burial (Bier I) –, as well as a silver ring with geometric design, and the bezel of another ring[57].

[47] Herbordt 2010: 221.

[48] It is interesting to note that these display older and newer styles (Herbordt 2006: 105).

[49] Herbordt 2010: 220.

[50] Non-royal seals bear Hieroglyphic writing but the Hittite king, queen, crown prince and powerful vassal kings used bigraphic seals combining cuneiform and Hieroglyphic writing (Herbordt 2010: 217-218).

[51] Cf. Drakaki 2005-2006.

[52] This estimate is based on Muhly 1992 and on the excavation reports of the post-1967 excavations. One of the seals, a gold seal, was found in a MM IIIA level in a pit in the floor of a looted tomb (Dimopolou 2010).

[53] Dimopoulou 1994: 709; Dimopoulou and Rethemiotakis 2000: 44. See Müller 2012 for a discussion of (semi)-precious stones.

[54] Rethemiotakis 2003: 1-2.

[55] Rethemiotakis 2016-2017.

[56] Dimopoulou 1994: 708.

[57] Muhly 1992: 140-142, 183, 190, Pls. 32-33.

A LM IB-II «warrior» burial in a chamber tomb at Ayios Ioannis, Knossos («Gold Cup Tomb») revealed two seals (CMS II,3 nr. 60 and nr. 61) at the height of the skeleton's hands[58], and an LM II burial from the New Hospital site (Tomb III) was accompanied by three seals[59]. The 21 tombs from the Mavrospelio cemetery (Knossos) yielded 26 seals and an exceptional gold ring with Linear A inscription[60]. Although many of the seals are Neopalatial in date, with a propensity for the talismanic type, few were found in association with Neopalatial burials[61]. Unfortunately, there are no demographic data and the ratio of seals to individuals is unknown[62]. Of the 150 pithos burials at Sphoungaras (Gournia), only 15 contained grave goods amongst which 12 seals, all excepting one of the talismanic type[63]. The house tombs at Mochlos that were reused in the Neopalatial period yielded ca. 5 seals and a gold ring (CMS II,3 nr. 252), but only some can be attributed to specific tombs[64]. The more than 200 pithos burials at Pachyammos yielded no seals, despite the fact that the quality of the burial containers exceeds that of Sphoungaras[65]. Although not strictly speaking an example from the mortuary realm and earlier in date (MM IIIA), it may be relevant to mention here the male from the Anemospilia sanctuary who was wearing a ring of iron and silver on his left hand, while an agate cushion depicting a rowing man was found near his left wrist[66]. This suggests that this man had at least two seal devices in life.

Burial evidence from the LH I/II Peloponnese provides unambiguous evidence that certain individuals were buried with several tens of seals. The cist under the floor of the Vapheio tholos tomb contained a single male who was buried with 29 seals and 2 gold rings[67]. Around his wrist he wore an amygdaloid depicting a man in a long garment carrying a fenestrated axe on his shoulder. The presence among the grave goods of a bronze axe of exactly this type makes it difficult *not* to connect this seal with the identity of the man. Another seal from this context depicting a similarly clad figure wearing a sealstone around his left wrist and leading a griffin, could also refer to the deceased. For other seals, such as, e.g. the amygdaloid depicting a dancing woman (CMS I, nr. 226), however, the connection is not clear. The number of seal devices in the Vapheio tomb was recently trumped by the Grave of the Griffin Warrior at Pylos, in which a male was buried with more than 50 seals near his right arm, one of which depicting a «priest» with a fenestrated axe, and 4 gold rings to the right of his ribcage. Like at Vapheio, the excavators suggest that there is a link between the iconography of the seal devices and the actual grave goods, in particular the bronze mirror, horned staff, necklace and the sun disc[68]. The publication of the other seal devices will make clear whether they also

[58] Preston 2007: 257-314 dates this tomb to LM II. An LM II burial from the New Hospital site (Tomb III) was accompanied by three seals.

[59] Hood and de Jong 1952: 249.

[60] Alberti 2013: 53.

[61] Forsythe 1927 and Alberti 2013.

[62] There are very few demographic data for the Knossos tombs but Hood 2010 notes that in one MM IIB-III chamber tomb at Ailias more than 50 people had been buried.

[63] The exact provenance of most seals is unknown. One jar contained a lead ring and a rock crystal seal set in a ring, while in another jar a talismanic seal and a bronze hairpin were found (Hall 1921: 68-69).

[64] The number of seals is based upon those published in CMS. For the Mochlos cemetery, see Soles 1992.

[65] Seager 1916: 9. Of the 213 jars, some are EM or MM in date.

[66] Sakellarakis and Sakellaraki 1997: 650-651, fig. 717.

[67] Killian-Dirlmeier 1987: 197-212; Rehak 1994; Krzyszkowska 2005: 121; Hitchcock and Banou 2011.

[68] Davis and Stocker 2016; Stocker and Davis 2017; 2020. The other seal devices have not been published yet.

refer to items buried with the deceased in some way.

Based on the total of preserved seal devices and the variety in styles, shapes, materials and technical quality, scholars have previously suggested that seal ownership was relatively widespread in the Neopalatial period[69]. Krzyszkowska estimated a total of about 1800 Neopalatial seals to which we must add the ca. 500 different seal-types of which impressions are preserved[70]. Given the low recovery rate of Neopalatial tombs, this total of 2300 seal-types presumably only forms a small part of the original number. Widespread seal ownership does not seem to be confirmed by the current, admittedly limited, funerary data. The number of sealstones recovered from burials at Pachymammos, Sphoungaras (Gournia) and Mochlos may even suggest that seal ownership was far from common, at least at these sites. At Sphoungaras, only 1 in 10 was buried with a seal and at Pachyammos none out of ca. 200 burials[71]. The chamber tombs at Poros are generally richer, but the number of seals (minimum 30) seals and signet rings (minimum 4) cannot be related to the number of people interred[72]. There is no evidence that individuals in LM I Crete were buried with more than two seal devices, in contrast to the LH I/II evidence from the Peloponnese. Whether or not this is a real pattern remains to be confirmed by future discoveries.

Who were the Seal Users?

Who were the seal owners who left impressions on sealings? Ever since Betts' seminal study of ring impressions that were made by identical rings (the so-called replica rings[73]) at several sites, it is implicitly understood that the latter belonged to Knossian administrative officials[74]. The lack of evidence for a Knossian workshop (see *supra*)[75], has done little to discredit the belief that the rings belonged to Knossian administrators[76]. Not just the impressions made by the so-called Knossos replica rings but also those made by other rings and seals are – often implicitly – assumed to have been made by people at different bureaucratic levels of a central administration[77]. This assumption results at least partly from the theoretical framework within which administrative documents (sealings and tablets) are studied, which is heavily influenced by early 21st century principles of administration. This theoretical framework sees regular and efficient recording of collection and (re)allocation («management») of animate and inanimate things by specialized officials as the main purpose of administrators[78] and comes with a specific terminology: specialized officials, centralized administration, administrative

[69] Krzyszkowska 2005; Murock Hussein 2018: 388.

[70] Krzyszkowska 2005: 120-121, note 4.

[71] Hatzaki 2018.

[72] Dimopoulou 1994: 707, 709 and Eadem 1999. The original number may have been much higher considering that the tombs were looted.

[73] For a critique of this term see Krzyszkowska 2005: 189-192.

[74] Betts' main argument was the high quality of the rings.

[75] E.g. Schoep 1999: 213-217; Krzyszkowska 2005: 189-192.

[76] Weingarten 1990: 110-112; Hallager 1996: 104, 201-213, 238; Goren and Panagiotopoulos 2009; Panagiotopoulos 2015: 282.

[77] Weingarten 1987: 21-22; Hallager 1996: 104, 220; Schoep 2002a; Palaima 1994; Militello 2000. But see Krzyszkowska 2011: 440.

[78] Peperaki 2016: 4, 10-11.

elite, taxation, mobilization and appropriation of resources, etc. and it creates a perception of powerful administrators (insiders) and passive outsiders that are usually cast in a subservient role (tax payers, workers, farmers, craftsmen, religious personnel).

The intensity with which a seal/ring was used in a sealing deposit is taken to reflect different bureaucratic levels, with the most active seal owners representing the administrative elite[79]. The latter is considered to be resident at the administrative centre, while the less active members are located elsewhere. Out of 158 different seal-types at Ayia Triada, Weingarten locates 57 seal owners at the Villa in Ayia Triada and the remainder elsewhere, suggesting that the latter might have been more self-sufficient but still part of the same internal administrative system[80]. Hallager also accepts that seal owners were administrators at different levels, with the possible exception of those that impressed two-hole hanging nodules[81].

However, were all these seal owners administrators? Just as Relaki noted for the high number of seal-types at MM IIB Phaistos, it is very unlikely that Weingarten's 57 seal owners (see *supra*) were indeed resident administrators. While it is likely that amongst the most active seal-types some were indeed resident administrators, the majority of seal owners must have been located elsewhere; their seal-impression testify to the fact that they had dealings with the Villa at Ayia Triada but this does not imply that they were actively participating in the management and control of the site's economy[82].

A similar debate exists about the parties involved in stamping Linear B nodules, whether palatial officials (administrators) or external parties[83]. Nakassis' prosopographical study of the people recorded in the Pylian Linear B tablets, breaks down the rigid and hierarchical divide between high officials of the Mycenaean Palace («insiders») on the one hand and the rest of the population («outsiders») on the other (e.g. farmers, herders, smiths, potters, slaves, religious practitioners, carpenters, etc.). He shifts the focus from a model of total centralization towards «*articulating the complex socioeconomic relationships between the palace, other institutions, groups, and individuals*»[84]. His study reveals there was a large group of people that varied greatly in importance and status, had differential access to resources and entertained various relationships to the palace. I believe that this range is also what we see in the seal impressions from Ayia Triada.

Ayia Triada was a very small site (1,5 ha) and the Villa a ritual building, which was undoubtedly run by a number of resident people and served as a place to which non-residents from the immediate and wider region came for rituals and feasting[85]. The impressions on the sealings are likely to reflect people/groups that varied in importance, status and occupational activities and entertained various relationships with this

[79] Weingarten 1987: 2; Hallager 1996: 104. Palaima (1994: 314) suggests to drop the term «*administrative* elite» because it implies an active participation in the management and control of the site's economic life.

[80] Weingarten 1987: 21-22.

[81] Hallager 1996: 198-199, 223. For the two-hole nodules he leaves open the possibility that the many seal users were people in the vicinity of the centre.

[82] Cf. Krzyskowska 2011: 440; Palaima 1994: 314. See also Relaki 2012 for interpretation of sealing pattern at MM IIB Phaistos.

[83] Panagiotopoulos 2010, for example, believes they were administrators, whereas Flouda 2010 argues they were external parties. See also Palaima 2004: 220-221 for possibility of external parties.

[84] Nakassis 2013: 3.

[85] Puglisi 2004.

ceremonial centre[86]. Besides the people involved in the daily running of the building, seal-types may denote people organising, provisioning for and participating in rituals and feasting at the Villa[87].

When taking on board the possibility that not all seal owners stamping sealings were necessarily administrators or officials, then the high number of seal-types (158) in the Villa becomes more palpable[88]. I will give a couple of hypothetical examples of who these people may have been and the types of activities they may have been involved in. In the SW Quarter of the Villa, 45 noduli, all impressed by the same ring, depicting a boat with a stylized rower (male or female?), (Fig. 5), were found in close proximity to a Linear A tablet (HT 24) recording ca. 45 units of wool and it is widely accepted that there was a connection between both[89]. The presence of loom weights in the SW and the NW Quarter of the Villa and the «Casa della Sfere Fittili» suggests that special fabrics were produced on site but there is no evidence for spinning activities, suggesting that the yarn came from elsewhere[90]. It is tempting to suggest that the ring belonged to the party delivering the yarn, or the person involved in the transformation of yarn into textile[91].

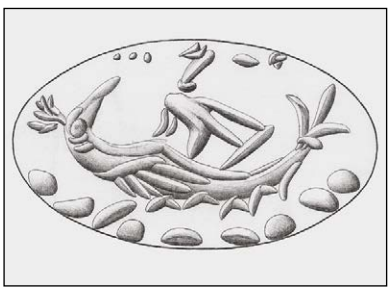


Fig. 5. CMS II,6 nr. 20 (Image courtesy of the CMS Heidelberg)

Other seal-types may belong to suppliers or providers of other commodities that were not produced on site either, such as, for example, wine and olive oil[92]. There is no evidence for metallurgical activities either, although metal objects were recovered from the Villa. This could suggest that the ingots stored in the Villa were intended to be allocated to a metallurgy workshop outside Ayia Triada. Weingarten recently suggested that a seal owner at Chania who made 46 impressions on roundels dealing with tripods may been a

[86] A study of representations of people wearing seals also points towards a variety of seal owners: the Cup Bearer from Knossos was a participant in a procession, the bull-leaper on the Tell el-Dab'a fresco a «priest» leading a griffin on CMS I, nr. 223 (see *supra*) as well as female terracotta figurines (Younger 1992; Rehak 1994).

[87] Palaima 2004: 220-221. See Montecchi 2019: 95-196, 313-327 for a thorough discussion of the administration at the Villa and the wider region. For the numerous parties involved in the organization a Mycenaean feast, see Weilhärtner 2017.

[88] These people may also have been mentioned in the Linear A tablets, under their personal names or under collective names (toponyms or occupational names), see Schoep 2002: 113-116). Depending on their importance, these people (and their seal device/s) must have been to the people running the Villa.

[89] For a full discussion see Palaima 1994: 317; Hallager 2002: 107-108; Montecchi 2019: 196-201 and Del Freo 2021.

[90] Militello 2007; 2014: 277.

[91] It has been suggested that the uniformity of the noduli suggests that they has been prepared on the spot by one person (Krzyszkowska 2005: 162, note 24). A ring with a boat scene from Mochlos shows a boat with a seated woman heading towards (or leaving?) a stylized building (shrine?) (CMS II,3 nr. 253). See Sourvinou-Inwood 1973 for discussion of this ring.

[92] For an interesting perspective on contributors of goods to an administrative centre, see Palaima 2004: 221, 223.

metal-smith[93].

The scarcity of sealstones from the settlement of Ayia Triada stands in sharp contrast to the abundance of other finds[94]. Only one seal was found in the Villa (CMS II,3 nr. 117) (Fig. 6) , three more in later burials (CMS II,3 nr. 116, 118, CMS II,4 nr. 153) and two were stray finds (CMS II,4 nr. 153, CMS XI nr. 287). The seal from the Villa (CMS II, 3 nr. 117) is decorated with the topos of the female figure carrying a quadruped on her shoulder (Fig. 6), which is well known from other sites (see *supra*). Interestingly, a haematite seal from Area 17 – identified as a sanctuary –in the central building at Archanes (Tourkogeitonia) displays the same motif[95] and it is tempting to interpret the seal-type as signifying a (female) ritual practitioner (see also *supra*)[96].

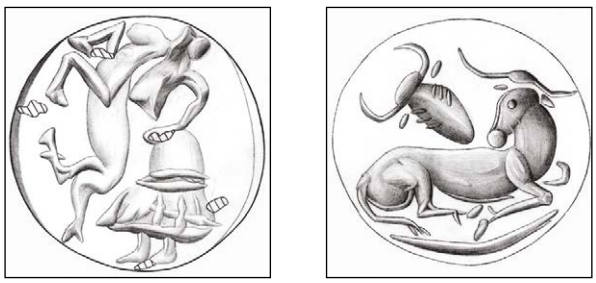


Fig. 6. Lentoid CMS II,3 nr.117 from the Villa at Ayia Triada (left) and stray find from Ayia Triada CMS II,3 nr. 119 (right)(Images courtesy of the CMS Heidelberg)

A contextualization of such well-established topoi and other seals in residential contexts may also go some way towards elucidating who the people behind the seal(s) impressions were. At Gournia, a link between the presence of seals/sealings[97] and «industrial» activities (pottery production, metallurgy, stone vase production) has been posited[98]. At Zakro, the number of seals is surprisingly low, despite the fact that there is considerable evidence for industrial activities in the houses on the Ayios Antonios Hill and the discovery of an archive of more than 500 sealings in Hogarth's House A[99]. The distribution of seals in residential contexts obviously warrants an in-depth study which exceeds the scope of this paper[100].

[93] Weingarten 2017: 103.

[94] This could be explained by the fact that seals and rings were worn on the body and disappeared with the people when settlements were abandoned. For the rich finds from the Villa, see Halbherr *et al.* 1977.

[95] Sakellarakis and Sakellaraki 1997: 696, fig. 797.

[96] See Rupp and Tsipopoulou 2012 for a full discussion.

[97] Seals were found in Houses Eg, Ba, Co, Da, Hb and the Palace, noduli in Eg, Fg, Fh and the Palace, roundels in Cf and the Palace; Metal rings were found in Ec and Dd (Watrous and Heimroth 2011).

[98] Watrous and Heimroth 2011: 208-209.

[99] This is surprising considering the evidence for industrial activities taking place in the houses on the Ayios Antonios Hill at Zakro (Salichou 2011-2012).

[100] See Krzyszkowska 2022; 2022a for sealstones and a sealing from Mochlos from the settlement.

The production and circulation of seal devices and iconographic motifs

Although questions such as where were seals and rings were produced, how they were acquired and whether there was any control over the production and circulation of the devices (type, style, material) and/or their iconography are very relevant but they cannot be answered on the basis of the current data[101].

Considering that the production of metal rings requires very different techniques and raw materials than seals, it is likely that they were produced in other workshops[102], none have been located.

The published evidence for Neopalatial seal-carvers' workshops is very limited and the best evidence comes from the wealthy harbour town of Poros-Katsambas. Here, inside a well-built LM IA two-storied house (Sanoudakis plot), a two-room workshop containing more than 50 unfinished sealstones[103] (mostly lentoid, some amygdaloid) in soft (chlorite and serpentine) and semi-precious stone (agate, red jasper, sard, cornelian, rock-crystal and amethyst) was found[104]. In addition to this, rough-outs and blanks, damaged items, flakes and chips were also recovered[105]. Dimopoulou argues that the house belonged to a wealthy person, no other than the craftsman himself and sees no reason to assume palatial control[106]. In the central building at Archanes (Tourkogeitonia), the excavators postulate the existence of a seal carver's workshop in association with a shrine on the upper floor, (Area 17) on the basis of the presence of raw materials (i.a. large lump of jasper) and an unfinished steatite sealstone[107]. Production in a building that was clearly aimed at staging ceremonies implies a different production context than at Poros, and production was perhaps aimed at residents of this building or people with ties to the latter, which could suggest a degree of control over the material, shape, style and motif of the seals perhaps through attached specialists.

A, non-located, workshop, specializing in lentoids of a soft, unidentified material and an iconography of fantastic creatures is assumed to have existed at Zakro but surprisingly, not a single sealstone in this style has been found on the site[108]. On the basis of a couple of seal-types that hint at a local style (CMS II,6 nr. 73 and nr. 117), a workshop is assumed to have existed at Ayia Triada[109]. Although at present there is not much to go on, it seems likely that the production of seals (and rings) was taking in local workshops but that some may have been acquired from non-local workshops, unless the recurrence of look-alike and very similar seal-types happened locally on the basis of actual seals acquired from elsewhere or picture books.

Control over the production and circulation of seal devices could, in theory, have been exercised through the use of rare and imported materials, complex techniques and/or shapes but also through attached specialists. More exclusive raw materials and

[101] See also Krzyszkowska 2011.

[102] For this issue see Becker 2015.

[103] See Dimopoulou 2000: 35-36.

[104] Dimopoulou 2000: 27-38; Dimopoulou-Rethemiotaki 2004: 376, note 30. Interestingly, a small piece of gold sheet and a sketch engraved on a chlorite flake were also found in the house on the Sanoudakis plot.

[105] Krzyszkowska 2005: 122.

[106] Dimopoulou 1997: 437.

[107] Sakellarakis and Sakellaraki 1997: 696-697.

[108] Krzyszkowska 2005: 151-152.

[109] Krzyszkowska 2005: 176. See also Weingarten 1987.

higher skilled craftsmen using special techniques could suggest that access was perhaps dependent on economic status (wealth) but it is not clear how the latter related to social status. Weingarten noted that the most active seal devices at Ayia Triada were not necessarily of the highest quality or of the most exclusive material[110]. This could mean either that the people most active in stamping the sealings were not the economic elite, or that status was not directly connected to the quality of seal device[111], which seems less likely[112].

Because we tend to think of seals as administrative tools, we are inclined to think that there was control by an authority over the distribution of seal-types[113], but there is no evidence that motifs and scenes were restricted to particular shapes or materials[114], and seal engravers of soft stones drew on the same iconographic repertoire as those of hard and exotic stones and metal rings[115]. I have no knowledge of motifs that are restricted to a particular type, material or quality of seal devices[116]. Although proportionally signet rings have more bull-leaping, combat, hunting, worship and procession scenes than seals, these topoi are not exclusive to the former and also occur on seals in soft local and hard semi-precious stones; *vice versa*, the most common theme on seals, i.e. animals[117], is also attested on signet rings, albeit proportionally less frequent than on seal stones. Although we usually consider signet rings as indicative of higher status than seals, the distinction between signet rings and high quality seals may be artificial and guided by modern values[118]. The recently discovered «Pylos Combat Agate»[119] from the Grave of the Griffin Warrior (cf. *supra*) with its exquisite engraving, challenges the modern distinction between signet rings and seals[120]. Seals that were mounted in gold and set into metal rings further blur the line between seals and rings as separate categories[121].What remains baffling from our perspective is how people in the past could make sense of a deposit of sealings and know who was responsible for what impressions? Or was this of lesser importance than the act of sealing itself? During the act of sealing, there would have been no doubt about the identity of the individual or group stamping a sealing and the purpose of the act of sealing. Since the act of sealing was transient, and the sealings were the only tangible remains of such performances, one wonders if this was the reason they were preserved and curated on the upper floors together with ritual paraphernalia[122] and if sealings formed, as Wengrow suggests, a mnemonic record and symbolic capital[123]?

[110] Weingarten 1987: 107; ; Krzyszkowska 2005: 17; Relaki 2012: 311 fig. 10.10. However, one has to be careful with interpreting sealing intensity because this only works when all sealings in a deposit are contemporary (Cf. Palaima 1987: 256, note 34).

[111] Weingarten 1987: 107.

[112] Cf. Younger 1990: 240; Younger 2000: 240 suggests that size, material, artistic quality, and time expended in manufacture were indicative.

[113] Krzyszkowska 2011: 440-441.

[114] E.g. Hallager 1996: 209-213 for discussion of «local replica» rings.

[115] Krzyszkowska 2005: 124.

[116] See also Krzyszkowska 2011: 440 note 2.

[117] See Blakolmer 2016.

[118] Some seals were covered with gold foil and thus created the illusion of gold rings (Krzyszkowska 2005: 124).

[119] Stocker and Davis 2017.

[120] Anastasiadou 2016: Neopalatial cushion seals must have represented objects of high status and may not have less prestigious.

[121] Müller 2012: 466; see Pini 2010 for a wide variety of non-sphragistic rings.

[122] Cf. Schoep 2017. See also Montecchi 2019: 77.

[123] Wengrow 2008: 16.

Conclusions

Neopalatial seal devices and their impressions formed part of an extensive and integrated communication system in Neopalatial society on Crete. However, our understanding of this communication system is plagued by uncertainties. It is far from certain that one seal-type equated one individual and the existence of *look-alikes* and similar seal-types within the same sealing deposits strongly suggests that there were seal-types that did not signify individuals but dividuals, emphasizing membership of collective entities (family, clan, occupational title, workshop, office, etc.). A person may furthermore have possessed multiple seal devices, acquired over the course of a life-time, as attested in the Hittite archives; different seal-types may have expressed different aspects of someone's personhood, such as the family or clan to which he/she belonged, occupational activities, participation in rituals, age, gender, social class etc. Although on the LH I/II Greek Mainland there is evidence for the burial of individuals with several dozens of (Minoan) seal devices, no such evidence is available for Crete but of course, the Neopalatial burial record is restricted and plagued by problems (long period of use, multiple burials, disturbed, looted). The evidence that is available suggests that ownership of seals was not common and that no more than 2 to 3 seal devices were deposited with a person. As to the identity of the seal owners that impressed sealings, I suggested that they are best seen as representing a heterogeneous group that ranged in importance, status, occupational activities and that were involved in a variety of activities. There is no evidence that access to seal devices and seal-types was controlled in any way other than access to exclusive raw materials and highly-skilled artisans. Iconographic themes and motifs are not restricted to particular types of seal devices or to particular materials and occur equally on seal stones made of soft, local stone as on hard, semi-precious stone and metal rings. The main difference seems to lie in the quality of the engraving and the skills of the engraver. The sealing pattern at Ayia Triada suggests that there is no clear-cut relationship between administrative activity – as documented by the most frequently attested seal-types – and economic status, as it is not necessarily the highest-quality seal devices that are most active. Overall, it remains baffling to us how people in the past were able to make sense of a deposit of sealings and know who was responsible for what impressions and what transactions. We can only hope that the publication of unpublished material and future discoveries will allow for a better contextualization of seal devices in mortuary but also in residential contexts and thus lead to a better understanding of seal ownership and seal use in Minoan Crete.

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Communication breakdown: marks on weights and their role in metrological identification

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Abstract: In the present contribution the role played by incised and stamped features on weights in metrological studies is addressed. Metrological studies and metrological identifications are currently based primarily on statistical analyses of the mass value of weights found in archaeological contexts. Often these are strengthened by deductions based on the interpretation of features incised or stamped on the surface of the weights. Despite the fact, however, that the interpretation of these signs has often played an essential role in metrological identifications, the methodological approach used in their interpretation presents issues which need to be addressed. In the present paper I first provide a critical review of some of the most relevant cases in the eastern Mediterranean and then propose a method which will allow these features to be more accurately used in the metrological interpretation of weights. The method is tested on two sets of weights from Ayia Irini and Enkomi in Cyprus.

Introduction

Metrological studies and metrological identifications are currently based primarily on statistical analyses of the mass value of weights found in archaeological contexts. Often these are strengthened by deductions based on the interpretation of features incised or stamped on the surface of the weights. Despite the fact, however, that the interpretation of these signs has often played an essential role in metrological identifications, the methodological approach used in their interpretation presents issues which need to be addressed. In the present paper I first provide a critical review of some of the most relevant cases in the eastern Mediterranean and then propose a method which will allow these features to be more accurately used in the metrological interpretation of weights. The method is tested on two sets of weights from Ayia Irini and Enkomi in Cyprus.

The issue in metrological studies

This sensitive issue was already recognized by Evans and Petrie at the dawn of metrological studies. Evans, in his analysis of a corpus of weights from the Aegean, explicitly assumed that the marks on the weights represent the unit of a given standard[1]. He did not, however, provide any background or justification for this interpretation. Petrie, in his study of

[1] Evans 1906.

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weights found in Egyptian contexts[2], criticized interpretations based only on a limited number of the available marked weights, and proposed instead that marks, which he considered often to be secondary additions, were applied in order to show the equivalent value in another standard. He also noted that some marks had been altered. Finally, he suggested that when marks are simple numbers and refer to the original purpose of the weight, they often refer to multiples of the standard. Importantly, Petrie also distinguished between generic and specific marks. He defined generic marks as «names for a weight» and specific marks used to distinguish a standard[3].

Signs and marks were also straightforwardly viewed as representing values of a given system during the fifties of the twentieth century[4]. In the sixties Bass[5], in his analysis of the weights found in the Cape Gelidonya shipwreck, noted that none of them have marks and, importantly, the existence elsewhere of weights with the same identification marks but different weight values, an observation he defined as «frustrating»[6]. As a possible explanation for this situation, he suggested that sites excavated on land were likely to contain a mixed array of weights from different localities and of different dates, which were often difficult to separate.

In the seventies inscriptions and stamped and incised marks also played an essential role in metrological studies. Inscriptions were central to the metrological identification of a weight found at Tell Sweyhat[7], and, more importantly, in Parise's identification of a common mina between the Ugaritic, Karkemish and Hittite shekels[8]. In the metrological studies of the weights found at Ayia Irini in Cyprus by Parise incised marks did not play a significant role[9]. In this period, also, Petruso[10] analyzed a set of data composed of marked weights found in the Aegean. He argued that the marks could be interpreted as indicators of values within a common system. What was new was his broad acknowledgement that many of these marks represent something other than value or denominations in a system or set. Specifically, he considered the possibility that they could be maker's, owner's or sealer's marks. He also recognized what could be defined as a fuzziness variable in the identification of these marks as denominations of values of a weight system: «[…] *the isolation of value marks is not at all difficult, as will be evident, if the symbols are approached with healthy measures of imagination and common sense*»[11].

Petruso also studied inscribed weights from the site of Uronarti in Egypt, dated to the Middle Kingdom (probably to Sesostris III, ca. 1878-1842 B.C.)[12]. They bear two types of inscriptions. One is the hieroglyphic sign for gold; the other is a series of short strokes believed by Petruso to designate what each weight was worth. Even if the author assumed

[2] Petrie 1926.
[3] Petrie 1926: 2-3.
[4] Berriman 1955; Breglia 1958: 160 note 38.
[5] Bass *et al.* 1967.
[6] Bass *et al.* 1967: 142.
[7] Holland 1975: 75.
[8] Parise 2009.
[9] Parise 1977.
[10] Petruso 1978.
[11] Petruso 1978: 27.
[12] Petruso 1981: 45-46.

their function[13], it appears confirmed[14]. These marks were interpreted as representative of the beqa standard.

Among the marked weights from Ebla[15], a weight of 467.5 grams bears a groove in the curved upper part, that, according to Archi, «*certainly represents the unit value of the mina*» in the light of the identification of the mina unit weight from Ugarit proposed by Schaeffer and another inscribed weight found in Tell Sweyhat[16].

Before proceeding to a statistical analysis of the weights found in the Uluburun shipwreck, Pulak briefly addressed the issue of the marked weights. Importantly, he distinguished marked weights as weights carrying «*denomination marks*»[17]. Within this group, he defined a category of weights bearing «*simple incisions*» and one of «*bronze*» examples with «*impressed marks that appear to have been made with a hammer and narrow-bladed chisel*». He then made a further distinction between weights carrying primary marks, made just after the specimen was crafted, and those carrying secondary marks, without providing a description of the latter category. Reviewing the corpus, he argued that no marks stand out as obviously indicating the denomination represented by the mass of the weight in question, except in the case of three weights[18]. Two of these, made of copper-based metal and reported as underweight and weighing 2.71 and 2.27 grams, bear the same «I» mark, which Pulak proposed was made with a chisel after casting[19]. The third, which weighs 4.82 grams, is reported to have a «|» sign[20]. Pulak concluded that it was not possible to determine with an acceptable level of certainty the intended mass of these three weights and therefore the meaning of these marks was not clear. Despite these limitations, he proposed a metrological interpretation for these signs: the weight with the «|» mark (4.82 grams) could represent a unit while the two with the «I» incision represent ½ of the previous. He further suggested that, based on the estimated weight of these objects, the «I» weights could represent 1/3 of one unit of the Ugaritic or qedet standard and the «|» piece could represent 2/3 of a 9.4 grams unit. Alternatively, he proposed that the «I» and the «|» weights could represent, respectively, ½ and 1 unit of a 7.4 grams standard. He then mentioned a weight inscribed with a possible composite sign representing 𐄁 of the Cypro-Minoan script[21], which does not correspond to or represent a numerical denomination. Two other weights (of 275.79 and 456.48 grams) have the same «|_» incision, which is considered unlikely to represent a mass denomination and more likely to be an owner's mark or intended to distinguish this particular set within a set[22].

More recently Michailidou, addressing this issue in both Egyptian and Near Eastern contexts[23], has proposed that signs reported on weights could denote, variously, the weight, the name of a king, the name of a deity, the name of the owner and so on. She

[13] Petruso 1981: 45-46.
[14] Imhausen 2016: 19 table 1.
[15] No. 17, 19, 21, 22, 23, 24, 25, 27 in Archi 1987: 53.
[16] Archi 1987: 47-48.
[17] Pulak 1996: 84.
[18] Pulak 1996: 84.
[19] Pulak 1996: 327, 330.
[20] Pulak 1996: 347.
[21] Pulak 1996: 85, 418.
[22] Pulak 1996: 84-86.
[23] Michailidou 2001.

also noted that the number of weights bearing signs is small and that the signs are usually simple and consist of plain lines or geometric shapes[24]. Addressing the weights found in the Aegean, she observes that the most common signs are small circles (and to a lesser extent triangles). The number of circles has been interpreted as a multiple or, less probably, as a fraction of the basic unit of the Minoan or Aegean standards respectively by Petruso[25] and Parise[26].

If we consider, now, some further examples of metrological interpretations of marked weights in the eastern Mediterranean and surrounding areas, it will give us a better idea of the predominant methodological approach used. Two incised weights from Tell Beydar are reported by Milano[27]. Without any discussion he appears to accept that the incisions represent a value indicator of a given weight standard. If we consider, however, the metrological identification of weight no. 1, it is clear that any straightforward assumption about these signs is problematic. The weight value of no. 1 is 2.6 grams, and the six incised lines are described as «irregular». Milano's metrological interpretation is based on these incisions. His first step was to consider them as representative of fractions of a heavier unit (given the light mass of the weight in question), thus 2.6x6 = 15.6 grams. This hypothetical value, which does not make much sense by itself, then went through a second interpretive step following which (15.6÷2) the value of 7.8 grams was obtained, which was identified as the main unit of the Karkemiš standard as defined by Parise, who described it as «*the most widespread standard attested at Ebla, as well as in the Eastern Mediterranean from the Early Bronze to the Iron Age*»[28].

In another instance, marks and inscriptions are considered important features which allow an easy identification of weights. A good example is represented by Rahmstorf's study of weights in the eastern Mediterranean, Near and Middle East[29]. More recently, arguing against the identification of spool-shaped objects found at Dhaskalio as scale weights, Haas-Lebegye and Renfrew suggest that marks represent units of a weight standard and that their presence may be considered a determining factor in identifying objects as weights[30].

A similar interpretation has been used to provide a metrological interpretation of a marked weight from Kültepe by Müller-Karpe[31]. In this case a weight with four aligned circular depressions weighing 24.62 grams was interpreted by dividing 24.62 by 4, based on an assumption that the incisions are representative of a weight value, thus: 26.62÷4= 6.155 grams. It was then proposed that this value represents a native Anatolian standard, attested as «weight of the country», or possibly a Mycenaean-related weight unit. However, no preliminary analysis, in-depth description of these features or comparison with other weights with the same or similar features was carried out[32]. In the

[24] Michailidou 2001: 55-56.

[25] Petruso 1978; Petruso 1992 in Michailidou 2001: 56 note n. 29.

[26] Parise 1971 in Michailidou 2001: 56 note n. 29.

[27] Milano 2004: 3.

[28] Milano 2004: 4; regarding the statement concerning the Karkemiš standard, Ialongo, Hermann, Rahmstorf 2021 (Ialongo *et al.* 2021: 4) did not find proof of its presence in their data pool. Similarly, Pakkanen did not find this Karkemiš standard attested in the weights from Uluburun (Pakkanen 2011).

[29] Rahmstorf 2006: 9-10.

[30] Haas-Lebegye and Renfrew 2013: 502-503.

[31] Müller-Karpe 2015.

[32] Müller-Karpe 2015: 151-152.

case, also, of a weight found at Sarissa weighing 5.43 grams and bearing a «—|» incision, the incision has played an essential role in the metrological identification. It was first identified as a «simplified» cuneiform inscription meaning 1/2. It was then assumed that the main unit of the standard represented by the weight is 10.86 grams and identified as the «necef» standard[33]. Finally, Müller-Karpe wondered whether this unit could also be representative of the Mycenaean system[34].

In Cyprus, an interesting lead disk-shaped weight from Phlamoudi-Vounari weighs 255 grams and has two dots and two roughly incised groups of lines, one of four and one of two on one of its surfaces. For Smith, these incisions played an essential role in the metrological identification of the weight: with the two dots interpreted as 20 (10 each) and the group of four lines as 1 each for a total of 24. The conclusion was, therefore, that it represents 24 units of 10.63 grams[35]. This unit is considered by Smith to be common across the Levant, the Hittite kingdom and Cyprus and to have been introduced to Cyprus in LC I (1600-1450 B.C. approximately[36]). Reference is made to a similar disk-shaped weight of 252.5 grams bearing four incised dots from the Aegean[37].

Another peculiar object, in this case of stone, from Apliki-Karamallos in Cyprus has been tentatively identified as a weight[38]. With a recorded weight of 238.5 grams, it has a convex shape. On both sides there are what appear to be two cross-shaped incisions. In this case the incisions did not play a role in the metrological identification. The object was tentatively ascribed by Kassianidou to the Syro-Egyptian metric system, representing 25.53 times a base unit value of 9.34 grams[39]. Nine short grooves located at a more or less equal distance from each other on the edge of the object.

This habit of assuming numeric values for incised features on weights appears to be still widespread nowadays. For example, we can quote a study about objects interpreted as weights found in Spina, Italy[40]: «*More numerous, at least eight, in Spina are pebble stones with numeral inscriptions on one face, interpreted as standard weights (Fig. 5.1-5)*»[41].

Discussion

Following this brief overview of how incisions, grooves, marks and other features have been used in the context of metrological identification in the eastern Mediterranean, it is important to make some preliminary observations. It is clear from the examples reported above that they have played a significant role in metrological studies. At the same time, it is evident that there has been little methodological discussion of how they should be considered. In the first instance, it appears that little attempt has been made to differentiate between different types of features and many authors have taken their function and meaning for granted. The second concern is that, in the majority of cases,

[33] Müller-Karpe 2015: 152.
[34] Müller-Karpe 2015: 251-252.
[35] Smith 2005: 64.
[36] Karageorghis 2003: xiii.
[37] Horowitz 2007: 175-176.
[38] Kassianidou 2007.
[39] Kassianidou 2007: 281, A5:11c at p. 305.
[40] Zamboni 2020.
[41] Zamboni 2020: 8.

these features have been straightforwardly interpreted as representing units of account of a given standard. This situation highlights the need to address the nature of individual grooves, incisions and similar features before proceeding to use them as «pivot» data to propose metrological identifications. Indeed, in many cases these features were the only element used to attribute a weight to a given standard. In other cases, they have been used to definitively confirm the attribution of a weight to a given standard. This practice is entirely legitimate when we are analyzing weights with indisputable and straightforward features of these types, for example in the case of those bearing cuneiform and hieroglyphic inscriptions informing us about the metrological unit represented by the weight[42]. When the features are not so clear, it is necessary to examine them rigorously before assuming that they are indicative of a specific unit of a weight system and utilizing this information to perform metrological identifications.

The problem is exemplified by the lack of accurate descriptions of these features. Without a detailed description and relevant photographic documentation, it can be difficult to assess their nature. This is especially relevant if we consider how incisions, scratches and grooves can be the result of production processes, dynamics related to the formation of the archaeological record or damage during excavation. A good example is the object considered to be a weight from Apliki, noted above[43]. It has a peculiar shape which finds no parallels either in Cyprus or nearby areas. It presents two groove-like incisions on both of its surfaces, as well as nine short grooves located at a more or less equal distance from each other on the edge of the object. They may be described as variously shallow and relatively wide grooves[44]. They may be compared with two stone objects found in Tomb 21 at Ayia Irini in Cyprus[45]. They seem to be produced through attrition and not through the action of a sharp cutting-edge and find no parallels on other weights from Cyprus. Similar grooved stones found beyond Cyprus have been interpreted as «raddrizzatori»[46], leather or bead-related production tools[47]. Thus, it seems unlikely that this object was a weight. The metrological datum also appears to argue against this interpretation. It weighs 238.38 grams and does not match either the Mesopotamian or the Syrian standard. It is also inconsistent with the absolute values we can extrapolate from the metrological texts RS.014 and NBC 2513[48]. The closest values are shown in Table 1. These data allow us to suggest that this object was not a weight on both metrological and morphological grounds.

Weight standard	Closest Unit	Closest Unit Absolute value	+3.4% error margin	-3.4% error margin	Text
Mesopotamian	1/2 mina	249.99996	258.4999586	241.4999614	NBC 2513
Syrian	1/2 mina	279	288.486	269.514	NBC 2513

Table 1

[42] For example, Holland 1975 and Petruso 1981: 44-47.

[43] Kassianidou 2007: 305, see A5:11c.

[44] Kassianidou 2007: 305 n. A5:11c.

[45] Inv. n. 138 and 155. Both interpreted as arrow straightener and made of sandstone/limestone. See Pecorella 1977: 177, 181.

[46] Tools used to straight up arrow shafts.

[47] Moroni Lanfredini and Benvenuti 2010: 10-11, fig. 9 n. 3, 4, 5.

[48] For details about the metrological identification, see De Benedictis: forthcoming.

Another relevant example comes from Enkomi, Cyprus. Here, in Room 35 of Area III attributed to Level IIB, a weight with a straight groove near the center of the upper surface was found[49] (Fig. 3). Both the excavator, Dikaios[50], and Courtois[51] described the groove as an incised line. It was then interpreted as representing one unit of the standard represented by the weight without any further description, comparanda or explanation and identified as representative of the «Syro-Egyptian» standard[52]. So, in this case also, an incised feature was decisive in contributing to a metrological identification. If, however, we look closely at this object it is clear that the interior of the groove is bright and clean, while the rest of the object is covered in soil (Fig. 1). This suggests that the groove is the result of a more recent episode, which perhaps occurred during excavation. These two examples show that an accurate and critical description of such features (with adequate photographic documentation) is needed before proceeding to ask if they might indicate a given unit of a given system.



Fig. 1. Stone eight from Enkomi Area III, Level IIB, Inv. No. 1552 (Photo Enrico De Benedictis. Courtesy of the Department of Antiquities of the Republic of Cyprus)

Following this first analytical stage, if the incised feature (or features) appears to be original and deliberate, they could be considered as mark or marks. Then, the next step is to consider all possible reasons for their presence before interpreting them as indicative of metrological denominations. Firstly, we must consider the materials which were used to produce balance weights. They were made of different types of stones, copper-based metal and lead. Marks on pottery or other clay objects cannot be used directly as *comparanda* because these materials are more fragile, and no scale weights of clay are attested in the Late Bronze Age Eastern Mediterranean and Near East. As for

[49] Inv. no. 1552 in Dikaios 1971: 642.
[50] Dikaios 1971: 642.
[51] Courtois 1984: 113.
[52] Courtois 1984: 116-117.

the marks on metal weights, the first relevant comparison comes from metal ingots. There are many examples these types of features on the ingots which are variously classified as primary and secondary[53]. The first category includes marks which were made by the foundry and are believed to identify the production site and/or the metal properties[54]. They could have been made by producing a relief in the mold or by stamping the upper surface when the metal was still soft. The secondary marks, on the contrary, could have been added anywhere at any time after casting by producers, traders, handlers or owners. They were produced with a chisel or by cold stamping[55]. It is, then, important to understand if the marks on metal weights are primary or secondary, and the implications relevant in each case (i.e. whether they were related to production, distribution, ownership or use), and to compare them with marks found on other supports from the same site. In the case of weights made of stone this distinction does not apply for obvious reasons.

Once it is clarified that the features on a given weight were deliberate and not an accident of production or other activities, it is possible to narrow the interpretative range. The first step in assessing whether a mark indicates a given unit of a given weight system is to perform a metrological analysis of the weight and, if found together with other weights, of the entire set. It is important to remember, however, that even if the analysis provides a meaningful interpretation, this is not enough to confirm that the mark is indicative of a given unit of a given weight system. This is because the correspondence between the weight value of the object and a unit of a given weight system and the presence of one or more marks can be casual and the meaning of such marks could be different. For this reason, if the metrological analysis provides a positive outcome, it is necessary to extend the analyses to the rest of the set (if present); it is also crucial to find other examples where the same feature is attested on a weight with the same weight value. In the absence of convincing parallels, the metrological interpretation of the mark is only one possibility among others. Finally, in cases where at least two weights have the same weight value and the same clearly original and deliberate feature or features (incisions, marks, grooves), they may be interpreted with a fair degree of certainty as weights representing a certain number of units of the system identified by the metrological analysis.

First test case: Ayia Irini Tomb 21

This methodology can be tested by an analysis of a weight found in Tomb 21 at Ayia Irini in Cyprus[56]. Other finds in the tomb suggest a relationship with metalworking[57]. It was part of a set (Fig. 2) and was found in the earliest burial stratum (stratum 6), which was undisturbed, although subsequent burials may have partially modified the disposition of the grave-goods[58]. It can be dated to the Late Cypriot IA period[59] (1600-1450 B.C. approximately[60]).

[53] Pulak 2011: 297.
[54] Galili *et al.* 2013: 8-9.
[55] Galili *et al.* 2013: 8-9; Bass *et al.* 1967: 72-73.
[56] Pecorella 1977: 7-14.
[57] Webb 2022: 28-29.
[58] Pecorella 1977: 139-140, 197.
[59] Webb 2022: 28.
[60] Karageorghis 2003: xiii.



Fig. 2. Iron-stone weights set from Stratum 6 of Tomb 21 at Ayia Irini-Paleokastro. From left to right: Inv. Nos. 210, 197, 195, 211, 214, 212, 213 (Photo Enrico De Benedictis. Courtesy of the Department of Antiquities of the Republic of Cyprus)

The set of weights is associated in the burial stratum with some objects that may be hypothetically related to weighing activity and/or be part of what we may define as «weighing equipment»[61]. Among these is a metal object which was interpreted by the excavator as a stylus[62]. One terminal is cylindrical in section with a pointed end and the other is square in section with a flattish end resembling a chisel. On the basis of the identification of this object as a stylus, two copper-based metal hinges have recently been interpreted as the remains of a diptych[63]. On the contrary, they may be related to another object in the assemblage (inv. no. 216), which has recently been identified by Dr. Alison South as a small bolt lock of a type found on Egyptian senet game boxes[64]. This type of lock is also attested on kohl tubes[65]. However, no other objects compatible with a game box or a kohl tube were found in the context. Both hinges and lock might, alternatively, have been part of a wooden box containing the weighing tools found with the burial. A good comparison comes from Thera, from near the Xeste Building 2, where a scale pan and balance weights were found together with traces of wood and two hinges, the latter interpreted as the remains of a box measuring 20x10 cm[66]. Similar examples are attested from Western Europe[67].

Other possible «weighing equipment» in the Tomb 21 assemblage includes evidence of a scale. Only one scale pan was initially identified[68]. My own examination of the fragments, however, has identified not only the two fragments with holes used to fasten the suspension rope or chain originally recognized, but another three fragments with similar holes. This makes in total five fragments with holes. Even if each scale pan was provided with three holes, this shows that these fragments belong to two, not one scale pan. Another

[61] De Benedictis: forthcoming.
[62] Pecorella 1977: 185 n. 163 ter; Webb 2022: 29.
[63] Webb 2022: 29-30.
[64] Personal communication from South A., for example see Hayes 1959: 25.
[65] For example, see Hayes 1959: 64.
[66] Michailidou 2008: 55-58.
[67] Roscio *et al.* 2011 and maybe also in Uhlig *et al.* 2019.
[68] Pecorella 1977: 195.

copper-based metal object that may have been part of a scale was originally identified as a nail[69]. It may be compared with objects from tombs of similar date at Morphou *Toumba tou Skourou* in Cyprus[70], which were interpreted as rivets. Analysis of two Egyptian wall paintings showing weighing scenes suggests an interesting possibility. These scenes depict an individual operating a scale while weighing goods (often gold) and another person in front of the scale recording the measurements on a tablet. While the scale is usually of the type attested, for example, in the tomb of Rekhmire[71], the reliefs from Unas' staircase[72] and the Mereruka[73] and Kaemrehu[74] tombs show a different type of scale (Fig. 3). These scales are suspended from a rope that is not directly connected to the scale beam but to a vertical rectangular element. The beam must have been secured to this vertical element, which implies the presence of a pivot-like object that held together the vertical element and the beam in such a way as to keep the latter functional. Notably, only a single 'rivet' was found in Tomb 21. Accordingly, we may suggest that it was the pivot of a scale composed of two wooden or bone/ivory elements, a beam and another structural element similar to those attested in the Egyptian paintings. We should, however, be cautious about this hypothesis because scale beams are very rarely attested in the archaeological record in the Eastern Mediterranean and have so far not been found in Cyprus.

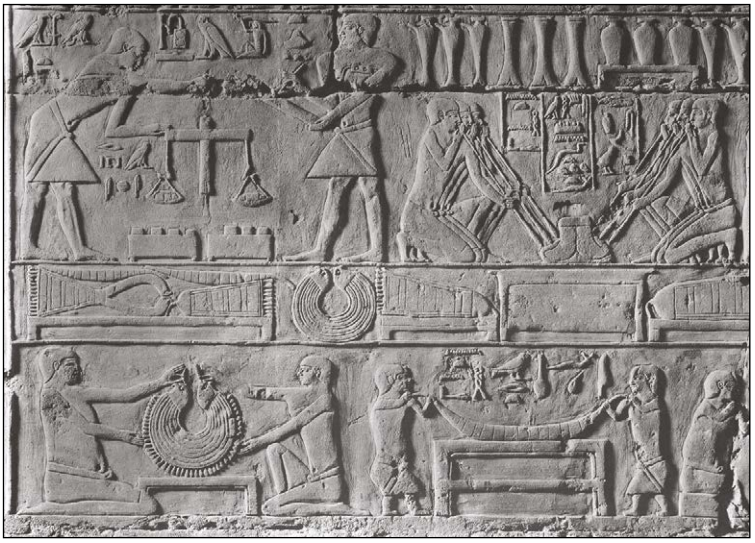


Fig. 3. Weighing scene from Mereruka tomb (Duell 1938: pl. 32)

Seven weights were found in Tomb 21 (Fig. 2, Table 2). All are made of an iron-rich stone previously identified as hematite. pXRF analysis of the weights could suggest that they were made of stone from the same «batch», except for No. 213 which shows distinctive lower iron and higher silicone values (Fig. 4). Six of the weights are sphendonoid, a shape

[69] Pecorella 1997: 195 n. 218.
[70] Vermule and Wolsky 1990: 224 T 1.46.
[71] De Garis Davies 1943: pl. LV.
[72] Gouda *et al.* 2007: 16.
[73] Gouda *et al.* 2007: 16, 19.
[74] Borchardt 1937: 235 and pl. 1534 B.

well documented in Mesopotamia and Syria. Two of these bear a mark on their flat base (Nos. 213 and 212, Fig. 5). No. 213 has a «+» shape, composed of two incisions which appear to have been made with a sharp tool (perhaps of metal?). The incisions are straight and fairly deep and were probably each made in one stroke. They appear to have been carved from the point of greatest length and width and do not extrude from the base. No. 212 has an X-shaped mark composed of two incisions probably also made with a sharp metal tool. They are straight and somewhat deep, were probably each made in one stroke and also do not extrude from the base.

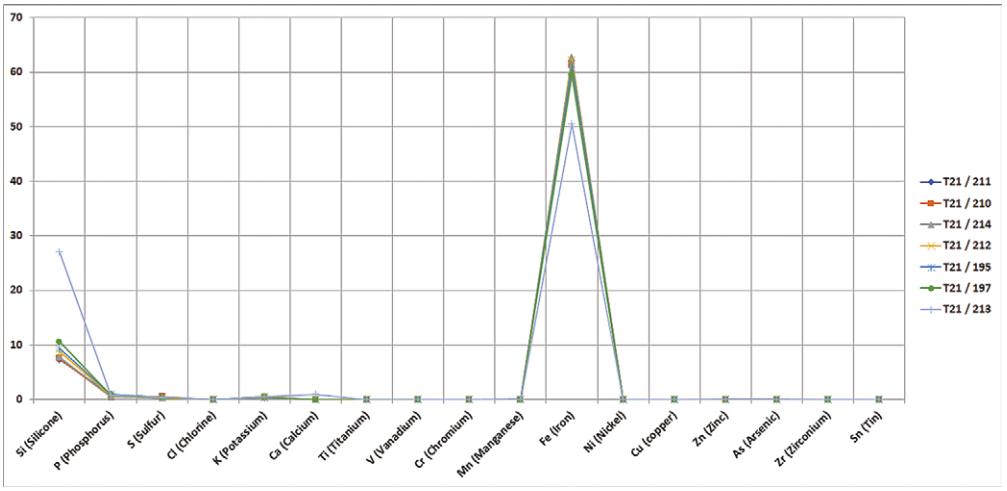


Fig. 4. Results of pXRF analyses of the weights found in Tomb 21 at Ayia Irini. Analyses performed by Andreas Charalambous (University of Cyprus)

Inv. No.	Integrity	Shape	Features	Weight
No. 213	complete	Sphendonoid	+ shape	5.36
No. 212	complete	Sphendonoid	X shape	8.34
No. 214	complete	Trapezioidal	-	17.2
No. 211	complete	Sphendonoid	-	18.9
No. 195	complete	Sphendonoid	-	28.84
No. 197	complete	Sphendonoid	-	44.97
No. 210	complete	Sphendonoid	-	92.94

Table 2



Fig. 5. Iron-stone weights with incised features from the set found in Tomb 21 at Ayia Irini-Paleokastro, Nos. 212, 213 (Photo Enrico De Benedictis. Courtesy of the Department of Antiquities of the Republic of Cyprus)

The following metrological identifications are based on two units: the Mesopotamian and Syrian standards. The framework provided by Parise[75] is not adopted because it presents a number of issues which need to be clarified[76]. The Mesopotamian standard will be examined using a framework based on the absolute value of the main unit (1 shekel) as 8.333332 grams as hypothesized by Powell[77]. The absolute values used for the identification are provided by the reconstruction of the metrological text found in Ugarit[78] and calculated based on the absolute value for 1 shekel as 8.333332 grams and by the subdivision of this unit into 180 smaller units (še or grains), while 60 shekels makes 1 mina and 60 mina form 1 talent[79]. For the Syrian standard identifications are based on a unit of 9.3 grams which has been proven to be statistically consistent[80].

Mesopotamian standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
No. 213	5.36	2/3 of shekel	5.555554667	5.744443525	5.366665808	-0.006665808
No. 212	8.34	1 shekel	8.3333322	8.616665288	8.049998712	-
No. 214	17.2	2 shekel	16.6666644	17.23333058	16.09999742	-
No. 211	18.9	2 shekel	16.6666644	17.23333058	16.09999742	1.66666942
No. 195	28.84	4 shekel	33.333328	34.46666115	32.19999485	-3.35999485
No. 197	44.97	5 shekel	41.666661	43.08332644	40.24999356	1.88667356
No. 210	92.94	11 shekel	91.6666542	94.78331817	88.54998583	-

Table 3

From this first interpretative stage (Table 3) it is possible to hypothesize that Inv. Nos. 213, 212, 214 and 210 are weights representing the Mesopotamian standard. In the case of No. 213, the weight does not perfectly fit within the 3.4% error margin but considering

[75] Parise 1970-1971.
[76] De Benedictis forthcoming.
[77] Powell 1987-1990: 510.
[78] Nougayrol *et al.* 1968: 254-256; De Benedictis forthcoming.
[79] Marti and Chambon 2019: 53.
[80] Ialongo *et al.* 2021: 4.

that this offset is less than a tenth of gram it may be explained as due to the lack of precision instruments used to produce weights in ancient times.

Syrian standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
No. 213	5.36	½ of shekel?	4.65	4.8081	4.4919	0.5519
No. 212	8.34	1 shekel	9.3	9.6162	8.9838	-0.6438
No. 214	17.2	1+5/6 shekel	17.05	17.6297	16.4703	-
No. 211	18.9	2 shekel	18.6	19.2324	17.9676	-
No. 195	28.84	3 shekel	27.9	28.8486	26.9514	-
No. 197	44.97	5 shekel	46.5	48.081	44.919	-
No. 210	92.94	10 shekel	93	96.162	89.838	-

Table 4

The metrological interpretations made on the basis of the Syrian standard provide interesting results (Table 4). Inv. Nos. 213 and 212, which appear to be consistent with the Mesopotamian standard, show a consistent offset of different tenths of a gram. This appears to confirm the previous interpretation and rules out their possible interpretation with the Syrian standard. Inv. Nos. 211, 195, 197 and 210 appear to be compatible with the Syrian standard. Inv. No. 214 appears to be consistent with 1+5/6 shekel unit of the Syrian standard.

Based on these analyses (Table 3 and 4) we can propose that the weights found in Tomb 21 represent two sets which belong to the Mesopotamian and Syrian standards. This appears to be in line with the general interpretation of this set made by Alberti[81]. We may propose that Inv. Nos. 213, 212 and 214 are representative of the Mesopotamian standard and Inv. Nos. 211, 195 and 197 are in line with values of the Syrian standard. However, two weights are more challenging. Inv. No. 214 indeed appears to be compatible with both standards. However, its mass is very close that of Inv. No. 211, which appears to be relevant to the Syrian standard only. While not impossible, having two weights of similar mass might raise questions about their functionality. If, however, these sets were used to weigh precious metals, even this fine-scale difference, 1/6 of a shekel, between Inv. Nos. 214 and 211 might make sense. At the same time, it is important not to forget that following the Mesopotamian standard interpretation, Inv. No. 214 fits the standard, while Inv. No. 211 presents an important offset in mass from the closest value. Based on these arguments, it is possible to propose a metrological interpretation for Inv. No. 214 as 2 Mesopotamian shekels. The second case is Inv. No. 210. Considering the above, it is not possible to attribute this weight to one of these two sets because its mass value is compatible with both standards and its interpretation must be left open to both options.

The two incised weights appear to represent values of the Mesopotamian standard because they match the 3.4% error margin or show a minimal offset from these values (Table 5).

[81] Alberti 2006: 325.

Inv. No.	Weight	Feature	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
No. 213	5.36	Yes: + shape	2/3 of shekel	5.555554667	5.744443525	5.366665808	-0.006665808
No. 212	8.34	Yes: X shape	1 shekel	8.3333322	8.616665288	8.049998712	-

Table 5

Second test case: Enkomi Area III

The second test case involves a number of weights from Enkomi in Cyprus (Fig. 6 and Table 6). It is composed of four sphendonoid weights reportedly found as part of a hoard, together with a roughly elliptical-shaped black stone or pebble, a round white stone and a perforated bird-shaped object made of green stone[82]. All but two of these objects were recently located at the Cyprus Museum: a sphendonoid weight and the bird-shape object (Inv. Nos. 1631/7 and 1631/9[83]). The hoard was found in Area III in a large courtyard (Γ-E 46-48 E.) and ascribed to Level IIA (dated to the beginning of LC IIA, 1425/1400-1375 B.C.[84]). The contextual data are not very helpful for interpretation. In the west of the courtyard, traces of metalworking are attested (copper slags, possible fragments of a copper ingot). The possibly communicating Room 5 produced three stone beads, a terracotta loom weight, a pestle, two stone grinders, an ivory comb, a paste bead, a pebble, a terracotta bead and a bracket[85]. Four of the weights have interesting features. The first sphendonoid weight (Inv. No. 1631/1) has an X-shape on the flat base (Fig. 7 top), composed of two incisions which could have been made with a sharp tool (perhaps of metal). They are straight, appear to be fairly deep and were probably each made in one stroke. They do not extend from the base profile with the possible exception of the ends of one incised stroke. Here, a very small flake of the surface is missing; possibly the result of a first attempt to make the first incision. The second and the third examples (Inv. Nos. 1631/4 and 1631/9, Fig 7 center) have a similar feature: a shallow line made by multiple short shallow incisions which run across the base of the objects from each long end.

Unfortunately, Inv. No. 1631/9 was not located, so that the only basis for interpretation is the photograph in the publication[86]. The fourth relevant object, the pebble Inv. No. 1631/5 (Fig. 7 bottom) has an irregular feature which runs longitudinally at about 90° around the elliptical section of the object near one of its ends. It is very shallow and greyish in color, and potentially a deliberate feature. Only microscope analysis, however, could clarify this. Inv. No. 1631/3 is a sphendonoid weight of iron stone which appears to have been intentionally cut in order to obtain a specific weight. The cut area has a uniform, flat surface which suggests an intentional act. It appears to follow a diagonal direction from an area slightly above the original flat base to the opposite side on the curved upper surface.

[82] Dikaios 1971: 630.

[83] Interestingly, this weight is not reported among the finds listed from this hoard, but it is shown on the plates. See Dikaios 1970: 630 and Pl. 127.

[84] Dikaios 1971: 483, 496.

[85] Inv. Nos. 1751, 1756, 1757, 1758, 1763/1, 1763/2, 1765, 1772, 2797/6, 2798/9, 2798/10, 2801/2, 3649/5 in Dikaios 1971: 631-632, 634-635.

[86] Dikaios 1971: 127.



Fig. 6. Iron-stone weight set from Enkomi Area III, Level IIB. From left to right: Inv. Nos 1631/1, 1631/2, 1631/3, 1631/4, 1631/5, 1631 (Photo Enrico De Benedictis. Courtesy of the Department of Antiquities of the Republic of Cyprus)



Fig. 7. Iron-stone weights with incised marks from Enkomi Area III. From top to bottom Inv. Nos. 1631/1, 1631/4, 1631/5 (Photo Enrico De Benedictis. Courtesy of the Department of Antiquities of the Republic of Cyprus)

The results of pXRF analysis of four of the objects composing the set are presented in Fig. 8.

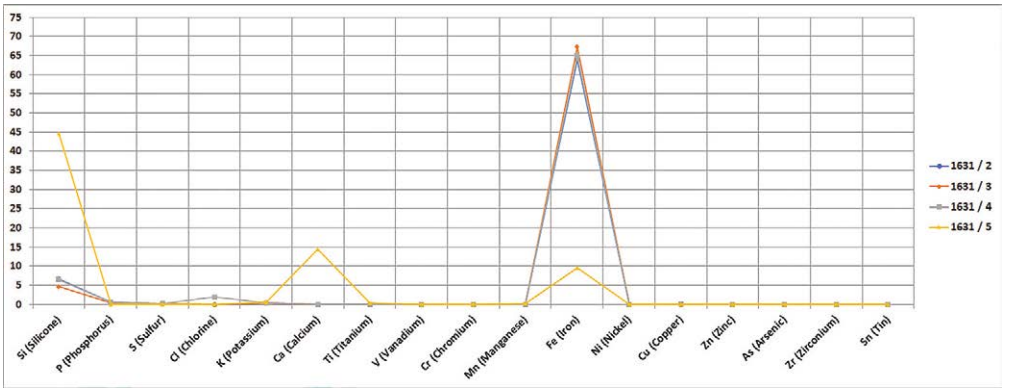


Fig. 8.Results of pXRF analyses on the weights from Enkomi Area III. Analyses performed by Andreas Charalambous (University of Cyprus)

All but one are made of an iron-rich stone which cannot be further identified at this time. The readings of Inv. Nos. 1631/2, 1631/3 and 1631/4 suggest that they could have made of stone from the same «batch». This, however, needs to be confirmed by further analyses. The material of Inv. No. 1631/5, with its high silicone, higher calcium and low iron content, appears to have been different.

Inv. No.	Integrity	Shape	Features	Weight
1631/6	Complete	spherical	-	1.14
1631/5	Complete	pebble	-	2.09
1631/3	Cut	sphendonoid	-	2.89
1631/4	Complete	sphendonoid	Yes: | shape	3.43
1631/2	Complete	sphendonoid	-	4.89
1631/1	Complete	sphendonoid	Yes: **X** shape	8.41
1631/7	-	Zoomorphic?	-	-
1631/9	-	sphendonoid	Yes: | shape	-

Table 6

Following the same methodology adopted for the weight set from Tomb 21 at Ayia Irini, we may propose the following metrological interpretations (see Table 7 and 8).

Mesopotamian standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/6	1.14	24 še	1.111110933	1.148888705	1.073333162	-
		25 še	1.157407222	1.196759068	1.118055377	-
1631/5	2.09	¼ of shekel	2.083333	2.154166322	2.012499678	-
1631/3	2.89	1/3 of shekel	2.777777333	2.872221763	2.683332904	0.017778237
1631/4	3.43	-	-	-	-	-
1631/2	4.89	½ of shekel	4.166666	4.308332644	4.024999356	0.581667356
1631/1	8.41	1 shekel	8.333332	8.616665288	8.049998712	-

Table 7

Four of the objects could be consistent with the Mesopotamian standard (Inv. Nos. 1631/6, 1631/5, 1631/3, 1631/1). Inv. No. 1631/2 shows an offset too high to be identified as ½ a Mesopotamian shekel and Inv. No. 1631/3 shows an offset from the 3.4% error margin below a tenth of a gram, making its interpretation as 1/3 of a shekel possible.

Syrian standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/6	1.14	22 še	1.136666667	1.175313333	1.09802	-
		22 ½ še	1.1625	1.202025	1.122975	-
		23 še	1.188333333	1.228736667	1.14793	-
1631/5	2.09	1/6 shekel 10 še	2.066666667	2.136933333	1.9964	-
1631/3	2.89	1/4 shekel 10 še	2.841666667	2.938283333	2.74505	-
1631/4	3.43	-	-	-	-	-
1631/2	4.89	½ shekel	4.65	4.8081	4.4919	0.0819
1631/1	8.41	-	-	-	-	-

Table 8

As far as the Syrian standard is concerned, we have an interesting picture. The metrological interpretations of Inv. No. 1631/6 fluctuate between 22 and 23 še. However, if we consider the interpretations of Inv. Nos. 1631/5 and 1631/3, which are consistent with fractions of a shekel, it is possible to suggest that this object was also targeting a fraction which is 1/8 of shekel (22 ½ še). Inv. Nos. 1631/5 and 1631/3 appear to be compatible with 1/6 shekel 10 še and 1/4 shekel 10 še. 1631/1 does not appear to be compatible with this standard.

However, before proceeding, it is important to assess the nature of some of these finds. Not all the objects in this assemblage can be safely interpreted as weights. Some of them are certainly so, given their sphendonoid shape. But Inv. Nos. 1631/6 and 1631/5 are more problematic. Indeed, these two are pebble-shaped and, although their mass value appears to be metrologically relevant, it cannot be taken as the only parameter in identifying an object as a weight. In order to ground the interpretation, a comparative analysis is indispensable. In the case of these two objects, I have not found any relevant comparanda from the Eastern Mediterranean. Therefore, these objects cannot for the moment be considered as weights. Their metrological profile, as proposed here, may however be useful should relevant comparisons be published in the future.

What appears evident from the mass value of the objects which can be reliably identified as weights from this context is that it is possible that they were used for precision weighing. From a metrological perspective, the most problematic specimen is Inv. No. 1631/4. This weight apparently does not match the values attested in the metrological text RS 20.014 and RS 21.010 from Ugarit[87]. However, its mass value does appear to be attested in the MS 3888 text, which is considered to be identical with a small section of the larger tablet text MS 2186[88]. Based on the calculations extrapolated from this text, the metrological profile is set out in Table 9.

[87] Bordreuil 2006: 216-230.
[88] Friberg 2007: 112.

Mesopotamian Standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/4	3.43	1/3 shekel 15 še	3.472221667	3.590277203	3.35416613	-
Syrian standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/4	3.43	1/3 shekel 5 še	3.358333333	3.472516667	3.24415	-

Table 9

Another problematic specimen from this context is Inv. No. 1631/2. Metrological interpretations based on both the Mesopotamian and the Syrian standard are affected by the offset. In the case of the Mesopotamian standard this offset is fairly consistent (0.581667356 gram), while for the Syrian standard it appears marginal, being below one tenth of a gram (0.0819 gram). However, it is possible to suggest that the mass of this weight fits the profile of a unit reported in another metrological text, MS 2186[89] (see Table 10).

Mesopotamian Standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/2	4.89	½ shekel 15 še	4.861110333	4.895110333	4.695832582	-
Syrian Standard						
Inv. No.	Weight	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/2	4.89	½ shekel 15 še	5.425	5.60945	5.24055	-0.35055

Table 10

In conclusion, the metrological interpretation of this set appears to be problematic. No metrological identifications have previously been proposed, probably because these are mostly light specimens and only Inv. No. 1631/1 was identified by Courtois as representing a Mesopotamian shekel[90]. The Mesopotamian standard indeed appears to be unequivocally attested by Inv. No. 1631/1, but it is not possible to determine if the other weights belong to this or to the Syrian standard. It is possible that here we are in presence of a set representative of the Syrian standard except for Inv. No. 1631/1. This raises the following question: if all the other weights belong to the Syrian standard, why did the user of this set feel the need to have a single weight representative of the Mesopotamian standard? The answer may lie in trade practices which are still poorly understood, or these weights may in fact be representative of the two systems but at the moment it is impossible to tell what weight belongs to which standard.

The context of the hoard which contained the weights, as already noted, does not allow a reliable interpretation of their function, although given the location nearby of evidence related to metalworking activities, it can be tentatively suggested that they were used in connection with metallurgical activity or the metals trade. A closer look at the weights with incised features suggests the following picture (see Table 11).

[89] Friberg 2007: 111.
[90] Courtois 1984: 131.

Inv. No.	Weight	Feature	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin
1631/4	3.43	| shape	1/3 shekel 15 še Mesopotamian Standard	3.472221667	3.590277203	3.35416613	-
			1/3 shekel 5 še Syrian Standard	3.358333333	3.472516667	3.24415	-
1631/1	8.41	X shape	1 shekel Mesopotamian standard	8.333332	8.616665288	8.049998712	-
1631/9	-	| shape	Not found	-	-	-	-

Table 11

For Inv. No. 1631/4 an interpretation may be offered which needs, however, to be considered speculative, as only two weights with the same incised feature have been found to date. Given that the incised feature appears to represent a deliberate action, and that no other weights with a similar feature are attested in Cyprus or nearby areas (for example on the Uluburun shipwreck and at Ugarit[91]), it may be proposed that it was not incised to represent a given unit of a given weight standard. If we accept that, in this set, we may have weights representative of different standards, it is possible that this mark was incised to distinguish this weight from the others during the weighing procedure.

Inv. No.	Weight	Feature	Unit Value	Unit Ab. Value	+3.4% error margin	-3.4% error margin	Offset weight from Error margin	Chronology
1631/1	8.41	X shape	1 Mesopotamian shekel	8.333332	8.616665288	8.049998712	-	LC IIA
N. 212	8.34	X shape	1 Mesopotamian shekel	8.333332	8.616665288	8.049998712	-	LC I

Table 12

More interesting is the case of Inv. No. 1631/1. It has the same mark and the same metrological profile as Inv. No. 212 from Ayia Irini (Figs. 4 left and 7 top), with Inv. No. 1631/1 very slightly overweight compared to the absolute value of one Mesopotamian shekel, while Inv. No. 212 basically perfectly represents that value (Table 12). The chronological horizon of the two finds also appears to be coherent. On this basis two hypotheses can be proposed. The first is that, since in both sets we have weights of different weight value and only a few of them are marked, these marks were meant to help the user to quickly distinguish specific weights during the weighing process. In the case of the set from Tomb 21 at Ayia Irini it is possible that the marks helped in a quick identification of the lightest weights in the set, although they are also visually distinguishable by shape. If so, these features helped to distinguish weights used for what we may loosely define as «precision» weighing (Inv. No. 213), considering the relatively heavier value of the other weights in the set. The mark on Inv. No. 212 may have been intended to allow an easy identification of the weight representing 1 Mesopotamian shekel among the other sphendonoid weights. Inv. No. 214, given its different shape, would have been easy to identify. Perhaps the mark in this instance was meant to facilitate the identification of this weight from similar weights representative of the Syrian standard. This hypothesis may be strengthened by the fact that the only weight which can be ascribed to the Ugaritic standard does not bear a mark, and thus it is unlikely that such features were meant to distinguish weights belonging to different standards in this set. As far as the weight set from Enkomi is concerned, this is a set composed of under-unit weights (probably fractions of a unit). It is possible, as in the case of the set from Ayia Irini Tomb 21, that the features on the weights were meant to allow an easy and fast visual identification of the weight values during the weighing procedure. However, if we

[91] Pulak 1996: 323-501; Bordreuil 2008.

accept the metrological identifications proposed above, it is also possible that marks were used to distinguish weights belonging to different standards.

The data presented here allow a further suggestion for weights Inv. No. 212 from Ayia Irini and Inv. No. 1631/1 from Enkomi. They come from a similar chronological horizon and, if the metrological interpretations presented in this study are accepted, both represent a Mesopotamian shekel. Thus, the cross-shaped incision on the flat base of both objects could represent one unit of the Mesopotamian standard at least in the Cypriot environment. At present this hypothesis is based on only two examples, surely too small a sample. If, however, in future a third weight with a mass compatible with one Mesopotamian shekel and the same incised X-shaped mark is found, it could be fully accepted.

Conclusions

In the past features deliberately incised or stamped on the surface of weights have played a key role in their metrological identification. This, however, has not always been based on a sound methodology and has not always led to reliable metrological interpretations. On the contrary, this type of interpretation has often suffered from a lack of accurate descriptions of the objects and the features, inadequate contextualization of the finds, an absence of good photographic documentation and a lack of comparative analyses. This study has shown that it is indispensable to approach these features in the context of metrological studies very carefully because they may have meanings other than as indications of the unit represented by the weights on which they appear. An accurate assessment of these features must be based on a meticulous descriptive study and comparative and contextual analysis. This is required in the first instance to securely distinguish intentional, purposefully made marks from accidental ones. The terminology used is also of great importance. Indeed, it is necessary to distinguish between metrological identifications and interpretations. «Identification» must be reserved for those specimens which bear univocal incisions or marks which clearly state the amount and the unit represented[92]. When facing more cryptic features, such as simple strokes and grooves, if these are used to provide a metrological identity for weights, it would be advisable to use the word «interpretation».

The results of the two case studies examined here show that this approach allows for more reasoned and inclusive interpretations. The most interesting outcome concerns weights Inv. No. 1631/1 from Enkomi and Inv. No. 212 from Ayia Irini. The X-shape incised on the flat base of both objects could represent one unit of the Mesopotamian standard. However, caution is needed because two positive comparative cases do not allow a high degree of certainty. A further example would confirm this hypothesis.

In conclusion, we may note how in metrology the interpretation of these features is made extremely difficult by what we might call a «communication breakdown» between the meaning that they had for their users and our interpretations, which are based on a very partial knowledge of this background. The methodology suggested here attempts to address this issue and provide hypotheses grounded as much as possible in the archaeological context.

[92] For example, Holland 1975 and Petruso 1981: 44-47 together with Imhausen 2016: 19 table 1.

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Manufacturing Late Bronze Age pictorial kraters according to shape proportions and capacities? The case of Rude Style bell kraters

Laetitia Phialon

Abstract: A series of Rude Style bell kraters thoroughly studied by Dimitri Anson in 1980 provide a very interesting case study and insights into the production of a specific pictorial krater shape in Cyprus. The statistical methods employed by this author to classify variations in the shape proportions of RS bell kraters are tested in this article. However, the relevance of using cluster analyses for a quite limited number of vases in order to obtain a new shape classification is here challenged. In addition, this article aims to compare dimensions and capacities of RS bell kraters with other Late Bronze Age pictorial kraters. Nevertheless, it is impossible to confirm that potters referred to any standard measurements in the manufacturing process of pictorial kraters. By contrast, they may have worked with models or shape templates, visually and tactilely ensuring that the proportions of vases such as the RS bell kraters were respected.

Introduction[1]

Late Bronze Age pictorial pottery was found in mainland Greece, on the Aegean islands like Rhodes, as well as in Cyprus and in the Levant. Studies on this ceramic class mostly focus on iconography and style of pictorial compositions, such as chariot or bull fighting scenes[2]. The «Rude» or «Pastoral Style» is characterized by depictions of animals like bulls, wild goats (agrimi) and birds on vases found in Cyprus (LC II), most frequently on bell (ring-based) kraters[3]. Pictorial kraters are illustrated in exhibition catalogues and in scholarly literature, but accurate profile drawings are rarely provided. Moreover, their dimensions are not systematically measured. Little is known about the capacities of pictorial kraters. On the other hand, the geographical production origins of pictorial pottery are more regularly investigated[4]. Results of chemical analyses suggest that a large number of Mycenaean pictorial pottery found in Cyprus and the Levant come from

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[2] Vermeule and Karageorghis 1982; Åkerström 1987; Morris 1989; Sakellarakis 1992; Recht and Morris 2021.

[3] Vermeule and Karageorghis 1982: 3, 59-68, 207-209. Only a single fragment decorated with a chariot scene is catalogued by Vermeule and Karageorghis 1982: 66-67, 208, VI.52 (amphoroid? krater, late pastoral). Also, a LH IIIC1 fragment decorated with a warrior: Vermeule and Karageorghis 1982: 68, 208, VI.59. Also Mountjoy 2018: 71-82, with additional motifs (the sphinx, lion, tree/bush), and the running spiral, which is a non-pictorial motif of the Rude/Pastoral Style. On previous research on the Pastoral style, see Kostopoulou 2021: 234-236.

[4] Catling *et al.* 1963; and recently, see Demakopoulou *et al.* 2017.

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the Argolid[5]. Chemical analyses also confirm that Pastoral or Rude Style pottery was produced in Cyprus[6].

Mycenaean pictorial kraters come from settlement and funerary contexts in mainland Greece as well as in Cyprus, but their most frequent find-contexts may vary from a region to another, as in the case of chariot kraters[7]. In Cyprus, Mycenaean pictorial kraters were mainly found in tombs[8]. However, it is assumed that pictorial kraters do not only represent symbolic grave goods accompanying the dead and referring to elite lifestyles[9], but that they were also used before being placed in the tombs, most likely in feasting that took place in settlements, due to the traces of use wear observed on their rims, bases and handles, or remains of old repair[10]. It is thus generally agreed that pictorial kraters, like the non-pictorial ones, functioned as central vases in feasting, «in the display and consumption of liquids»[11], most likely for mixing wine and water[12]. In some rare cases, however, in a sacral find-context[13], or because of a hole pierced through the base[14], pictorial kraters may have been used in cultic activities.

The organisation of a feast or banquet may have required to be aware of how much beverage a krater could have held, regardless of the number of times this vase was filled during the same event. The shape, dimensions and capacity of a krater may have played a significant role in the organisation of a feast. The potters were undoubtedly aware of the function of the krater. They were responsible for the fashioning of three main shapes in the Mycenaean pictorial pottery production: the stemmed (or open) krater (FS 7-9), in LH IIIA2, the amphoroid krater (FS 53-55), in LH IIIA2-IIIB, and the ring-based (or bell, loop handled) krater (FS 281, 282), in LH IIIB-IIIC[15].

However, it is uncertain as to whether the dimensions and shape proportions of kraters, as well as their capacities, were controlled during the manufacturing process. Which features were the most significant in a krater shape? Were the height and width of a krater measured by the potter? Was the potter able to tell the purchaser of a krater about the

[5] Catling and Milett 1965: 219; Asaro and Perlman 1972: 223; Yellin and Maeir 1992: 35; Mommsen and Maran 2000-2001: 104. For bibliographical references, see South 2006: 131, n. 1; Crouwel and Morris 2015: 152, note 13; Anson 2017: 1; Recht and Morris 2021: 99.

[6] Catling and Millet 1965; Asaro and Perlman 1972: 221; Anson 1974: 120-140; Anson 1980a. For a discussion about the locally produced pictorial pottery found in Cyprus, see Kling 1989: 91-94.

[7] Recht and Morris 2021: 100-101, fig. 6.

[8] Van Wijngaarden 2002: 194-196.

[9] Steele 2004: 293, the krater as «a prerequiste element for inclusion in high-status burials in coastal urban centers». Also Recht and Morris 2021: 101, «perhaps as part of the funerary display and activities related to the identity of the deceased and as a status symbol». For the pictorial krater as a medium for social groups to distinguish themselves, see van Wijngaarden 2002: 194. According to Sherratt (1999: 185-188; cited by van Wijngaarden), pictorial kraters may be associated to sub elites in Cypriot society, which might have not afforded metallic kraters nor owned a real chariot. However, some tombs that provided pictorial kraters, notably at Enkomi, were richly furnished, see Tatton-Brown 2003: esp. 37, T. 67.

[10] Keswani 1989: 562, «abrasion and chipping of the rim, handles, and base which result from long-term repeated handling rather than from catastrophic post-depositional breakage and smashing in the mortuary context»; Keswani 2004: 138; cited by Steel 2004: 293; Crouwel and Morris 2015: 169, Recht and Morris 2021: 118. However, such evidence of use is not always available, see South 2006: 133.

[11] Crouwel and Morris: 172.

[12] See *Odyssey* I, 110. For a discussion about the beverage held in Late Bronze Age kraters, with bibliographical references, see Phialon 2020: 196.

[13] For a White painted wheel-made pictorial style krater («Creature krater») found in a room having a sacral function, see Fischer and Bürge 2018: 61, «since it stood on the square stone which served as a house altar», see p. 63, fig. 2.42.

[14] Crouwel 2006: 22.

[15] Recht and Morris 2021: 98. Also Steel 2004: 293.

capacities of his vessels? The quantity of beverage held in a pictorial krater may have been as significant for the consumer as the krater shape or the scene that decorated it. A series of kraters that would have similar dimensions and capacities, especially when they were found in various regions, may lead us to believe that standard measurements were applied in different workshops, and that these measures may have been part of a communication system between potters[16]. In cases of kraters having similar proportions, there is also the possibility that models or shape templates were employed and shared between different workshops. However, the question is whether such assumptions relate to the production of RS bell kraters.

In order to shed light on this issue, this article focuses on two papers of Dimitri Anson[17], who applies statistical methods to classify variations in the shape of RS bell kraters and pictorial amphoroid kraters. In his opinion, when correlated with the results of stylistic studies and chemical composition analyses, the presence of distinct shape groups obtained using cluster analyses may reveal the existence of distinct workshops[18]. Statistical methods have been applied systematically and for decades in the field of archaeometry, notably to classify variations in chemical composition patterns of sampled pottery[19]. It is only recently that such methods have developed for the computed typological classification of vessel profiles, especially in the case of pottery from the Levant[20].

My article aims to test the shape proportions selected by Anson in his study of RS bell kraters. It also explores the possibility that shape templates and standard measurements were shared by various workshops or transmitted from a generation of craftspeople to the next one, comparing dimensions, shape proportions and capacities of RS bell kraters with Mycenaean pictorial ring-based kraters.

Some preliminary remarks on drawings and dimensions of pictorial kraters

The seminal study of Arne Furumark on Mycenaean pottery, first published in 1941, defined the pictorial class and its four main groups[21]. The amphoroid and ring-based kraters include pictorial examples in his catalogue[22], which are then illustrated in the volume of plates[23]. The minimum and maximum heights of the krater shapes are indicated in the catalogue, whereas the heights of the illustrated vases are noted in the volume of plates. Noteworthy is that Furumark shapes (FS) are represented by line drawings, without internal profiles, but with scales represented in the figures (1:20 or 1:10)[24]. In Furumark's typology, three ring-based kraters serve as template drawings, one

[16] See Alberti 2017: 17, «communicating through a network of measures».

[17] Anson 1980b; Anson 2017.

[18] Anson 2017: 3, 10.

[19] On statistical methods, the choice of the method, the validity of the groupings, see Hoffmann *et al.* 2013: 8-9; on correlation effects and corrections, see Hoffmann *et al.* 2013: 17-22.

[20] E.g. Karasik and Smilansky 2011; Sergi *et al.* 2012; Roux and Karasik 2018; Harush *et al.* 2019; Harush and Grosman 2021.

[21] Furumark 1972: 430-470. This includes some famous pictorial kraters (e.g. Warrior Vase, Mouliana krater in the «Hellado-Mycenaean style», see Furumark 1972: 448-454).

[22] Furumark 1972: 583-643. The pictorial pottery is, however, not specifically indicated in the catalogue.

[23] Furumark *et al.* 1992: pl. 34-36 (amphoroid), and pl. 155 (ring-based). The bell kraters are also termed «ring-based», see Mountjoy 1986: 219-221, Krater, ring-based FS 281-82.

[24] For kraters, see Fururmark 1972: 22-23, fig. 3-4, and 48-49, fig. 13-14, and 65, fig. 18. Also Mountjoy 1986: fig. 271-272, and fig. 281.

corresponding to FS 281 and the other two to FS 282[25].

Pictorial kraters are unequally documented in other catalogues of Mycenaean pottery. The first *corpora* of Mycenaean pottery include pictorial kraters from Cyprus and the Greek mainland next to Mycenaean decorated pottery[26]: vases are illustrated with photographs, but not with profile drawings; their heights are systematically indicated. By contrast, in her major study of Mycenaean decorated pottery, which also includes Mycenaean pictorial vases, Penelope Mountjoy indicates systematically the heights and diameters of the examined vases together with drawings of their profile and decoration[27]. However, her catalogue presents only a few pictorial ring-based kraters with complete profiles from the Greek mainland[28]. Nevertheless, many pictorial vases from Cyprus, including RS ring-based (bell) kraters, are illustrated with profile drawings in another study of Mountjoy on decorated pottery from Cyprus and Philistia[29].

By comparison, among the large number of pictorial amphoroid kraters studied by Christine Morris in her PhD[30], just a few of them are documented by profile drawings[31]. The heights and diameters of the complete (and nearly complete) vases provided in her catalogue are data essential for this research, since they can be compared to width measurements extracted from the photographs using a computer program, as I will explain below. Noteworthy are also three pictorial kraters with complete profiles (stemmed, ring-based and amphoroid) illustrated in the catalogue of Mycenaean pictorial pottery from the National archaeological museum of Athens[32], where the dimensions of the vases and fragments are systematically noted.

Nevertheless, most studies focusing on iconography and style of Mycenaean pictorial pottery do not provide profile drawings. This last remark applies to the seminal study of Emily Vermeule and Vassos Karageorghis[33], where motifs and styles are thoroughly described and pictorial vases illustrated by photographs. The ceramic shapes are noted in the catalogue[34], but not the dimensions of the vases[35]. Likewise, the study of Barbara Kling[36] on Mycenaean pottery and related pottery found in Cyprus focuses on contexts and decoration. Many pictorial vases are included in her catalogues, but the dimensions of the vases do not attract much attention[37]. The same remark applies to the study of

[25] Furumark 1972: 48-49, fig. 13-14; see Anson 2017: 3.

[26] Furtwaengler and Loeschcke 1886: 24-31. *Corpus Vasorum Antiquorum* series, notably the British Museum for Mycenaean pottery of Cyprus, first fascicule, see Smith 1925, II c b: 6-9, pl. 6-11. Also *CVA* online, https://www.cvaonline.org/cva/CountryList.

[27] Mountjoy 1999.

[28] Mountjoy 1999: 233-234, no. 190 and 192, fig. 76, and p. 355-356, no. 128, fig. 122, and p. 359-360, no. 139, fig. 124.

[29] Mountjoy 2018: 71-82 (Rude/Pastoral Style), fig. 29-34; the same vessels are then described under each site; on examples of the CypIIIC pictorial krater at Enkomi, see Mountjoy 2018: 993, fig. 513.

[30] Morris 1989.

[31] Morris 1989: no. 25, fig. 59.a, no. 30, fig. 64, no. 57, fig. 84, no. 69, fig. 95, no. 85, fig. 109, no. 202, fig. 183.

[32] Sakellarakis 1992: 120, no. 1, p. 124, no. 32, and p. 126, no. 61, which is illustrated in Pliatsika 2021: 61, fig. 2.

[33] Vermeule and Karageorghis 1982.

[34] Without references to Furumark Shapes nonetheless, except in the case of a krater, see Vermeule and Karageorghis 1982: 60, n. 14: this krater (VI.1) of Rude/Pastoral style, listed by Furumark under the FS 281 form, has a conical profile and a straight vertical upper body, which fits better with the FS 282 form.

[35] Vermeule and Karageorghis 1982: 195-230. On chariot scenes depicted on the three main shapes of Mycenaean pictorial kraters (stemmed, amphoroid, ring-based), see Recht and Morris 2021: 97, fig. 2.

[36] Kling 1989.

[37] See the 21 catalogues in Kling 1989. For pictorial motifs on bell kraters, see Kling 1989: 118-124; and on amphoroid kraters, see Kling 1989: 130.

chariot kraters published by Laerke Recht and Christine Morris[38].

In addition to the above-mentioned catalogues of pottery, it is worth noting the publication of pictorial pottery from Berbati, mainly documented by photographs, together with profiles of fragments, but does not include pictorial kraters with complete profiles[39]. It must be stressed that pictorial kraters with complete restored profiles are rarely found in settlements. The Argive *corpora* of Mycenaean pictorial pottery illustrate this point. The *corpus* of Mycenaean pictorial pottery from Tiryns includes only three complete (or nearly complete) profiles of ring-based kraters[40], and that from the Citadel House Area on the acropolis of Mycenae only fragments of such shape[41]. Two pictorial kraters with complete profiles from Midea can be added to them[42].

As regards Cyprus and the Levant, the earliest publications of pottery do not always include profiles of complete pictorial vases[43]. However, some profiles of pictorial kraters are published by Vassos Karageorghis, in a study where the heights and diameters of RS bell kraters are also provided[44]. Moreover, some RS bell kraters from Hala Sultan Tekke (Cyprus)[45], Minet-el-Beida (Syria)[46], as well as a chariot bell krater from Pyla-*Kokkinokremos* (Cyprus)[47], supplement the series of RS bell kraters studied and drawn by Dimitri Anson[48]. Anson is also the author of another article, which focuses on the proportions of Mycenaean pictorial amphoroid kraters, using various computer programs to measure their dimensions and classify variations in their shape proportions[49].

It should also be noted that most Mycenaean pictorial amphoroid kraters with complete (or nearly complete) profiles from Cyprus and the Levant are included in the catalogue of Morris' PhD thesis[50], in addition to amphoroid kraters from Enkomi[51] and Hala Sultan Tekke[52]. Furthermore, pictorial kraters from Cyprus may belong to other pictorial styles, such as Minoan pictorial amphoroid kraters[53], for instance from Pyla-*Kokkinokremos*[54], or White Painted Wheel-made Pictorial Style kraters (rounded bodies and low stemmed

[38] Recht and Morris 2021, with the catalogue in Appendix.

[39] For the catalogue, see Åkerström 1987: 26-44; the drawing of a complete pictorial krater, on pl. 24.1d, is reconstructed from the non-joining fragments, see in catalogue krater no. 136 on p. 34.

[40] Güntner 2000: Pl. 24.1a, 28.1a, and 82.1. By contrast, there is no profile drawing published in Slenczka 1974.

[41] Crouwel 1991: 7.

[42] Demakopoulou 2020: 115, fig. 3.a-c, and 119, fig. 6; see Fisher 2007: 109, no. 1373, fig. 123.

[43] For instance, internal lines are not rendered on drawings of complete pictorial vases from Ugarit, see Schaeffer 1949: 156, fig. 60, no. 22 and 23; but for fragments, see Schaeffer 1978: 346, fig. 54.1 on p. 347.

[44] The dimensions provided by Karageorghis 1965 may be used in parallel with the publication of the finds from Enkomi by the Swedish Cyprus Expedition (SCE), see Gjerstad *et al.* 1934.

[45] Åström, Bailey and Karageorghis 1976: 75, no. 86, pl. L, LXVI. The lower part of a RS bell krater decorated with bulls is missing, see Åström, Bailey and Karageorghis 1976: 73, no. 22, pl. L, LXVI.

[46] Schaeffer 1949: 156, fig. 60, no. 22 and 23. The internal profile is however not illustrated.

[47] Karageorghis and Demas 1984: 33, no. 12, pl. XXXIII. On the Mycenaean Pictorial and Pastoral bell kraters discovered in the recent excavations of this settlement, see Kostopoulou 2021: 280-281 (catalogue).

[48] Anson 1980b.

[49] Anson 2017.

[50] Morris 1989.

[51] 1) Dikaios 1969-71, vol. I: 375, no. 200, and vol. IIIa: pl. 223/12 (200); see vol. II: 855; also Vermeule and Karageorghis 1982: 31, 199, IV.40. 2) Karageorghis 1983: 164-166, no. 4790, fig. 2 on p. 165, pl. XXV.2,3.

[52] Fischer and Bürge 2017a: 207, fig. 38 top and bottom; for the first one, see Fischer and Bürge 2017b: 65, fig. 14.

[53] Crouwel and Morris 2015.

[54] 1) Dikaios 1969-71, vol. II: 899, pl. 297, no. 1 (Inv. 1953/III-9/1), cf. Catling and Karageorghis 1960: 116, no. 18, fig. 5; 2) Karageorghis and Demas 1984: 34, no. 20, pl. XVIII, pl. XXXIV; 3) Karageorghis and Kanta 2014: 165-167, no. 75, pl. II-III.

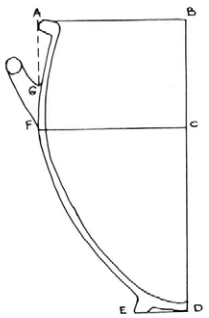
bases), notably from Hala Sultan Tekke[55].

Although the aim here is not to provide an exhaustive review of the publications on Late Bronze Age pictorial pottery, it is worth mentioning three papers on figurative painting on Mycenaean and Geometric pottery, which include profiles of previously published ring-based and amphoroid pictorial kraters from mainland Greece and Cyprus[56]. The dimensions and capacities of eight complete Mycenaean pictorial kraters from four tombs at Kalavasos-*Ayios Dhimitrios* are of special interest[57]. It is now time to get into the substance of the issue and to test the methods applied by Anson to classify variations in the shape of RS bell kraters and Mycenaean pictorial amphoroid kraters.

The Rude Style bell krater and the shape groups of Anson (1980)

Four variables and a multivariate analysis

In his 1980 article, Anson explores the possible relations between the decoration and shape types of a series of Rude Style bell kraters[58]. RS bell kraters with complete profiles and fragmentary kraters are first classified in seven stylistic groups («RS decoration type groups», from Group A to Group G). In order to obtain new shape groups, Anson calculates the proportions of fifteen kraters with complete profiles, i.e. the ratio height to the base diameter (*height/base diameter)*, the ratio height to the maximum diameter (*height/maximum diameter*), the so-called «centre of gravity» (*height/distance from rim to maximum diameter*), and the «handle height» (*height/distance from rim to handle start*)[59]. The «handle height» is the ratio that shows the widest disparity (Fig. 1).



HEIGHT/BASE BD/EDX2		HEIGHT/MAX D BD/FCX2		CENTRE OF GRAVITY BD/BC		HANDLE HEIGHT BD/AG	
2.8	1	1.05		2.8	34	7.0	1, 6, 8
2.7	7,34			2.7	9	6.3	
2.6	6, 9,26,39		7	2.6	6,41,44	6.0	7, 9
2.5	8,41	1.00		2.5	1,26,40	5.5	
2.4	18,21,40,41,53		1, 8, 9 34,44,53	2.4	8,19,21	5.0	21,39
2.3		.95		2.3	7,18,39,53	4.5	19,26,34,40
2.2			6			4.0	18,41
2.1	19		39			3.5	44
		.90	19,41			3.0	53
			18,40				
			21,26				
		.85					

Fig. 1. RS bell krater shape: points measured and proportions calculated by Anson (1980b: 7-8, fig. 4, Table I)

[55] Low stemmed kraters: 1) the «Creature Krater» (N33): Fischer and Bürge 2018: 63, fig. 2.42, and p. 239-240, fig. 3.19b, also fig. 3.49b. 2) the «Bird Krater» (L258-2), upper body preserved: Fischer and Bürge 2018: 56, fig. 2.31, and p. 240-241, fig. 3.50:1; 3) the «Horned God Krater» (N121), upper body preserved: Fischer and Bürge 2018: 241-242, fig. 3.102b. For an almost complete Proto-White painted bell krater, see Courtois 1971: 262, 270, 272, fig. 106 on p. 269; the scale on the top of the figure is uncertain, and the scale on the bottom is problematic, since the «zone à décor et historié […] mesure 20 cm de haut», see p. 270, inv. 16.107.

[56] Crouwel 2006; South 2006; Iacovou 2006.

[57] South 2006: 142-143, fig. 11-12.

[58] Anson 1980b: 2. Cited in Mountjoy 2018: 73.

[59] Anson 1980b: 8, table I. That is the ratio *height/distance from rim to handle start*; the top of the handles appears to be lower than the rim.

obtain new shape groups, Anson uses two computer programs (MULCLAS, a clustering program, and GROUPER, for producing attribute means) to generate a cluster dendrogram of RS shapes presenting two main branches and four sub-branches (Fig. 2)[60]. Group B kraters all appear in a different sub-branch from other kraters. However, this sub-branch also includes krater no. 1 in Group A, and is related to the same branch as krater no. 34 in Group C. According to Anson, RS bell kraters in Groups A and B correspond to a shape characterized by a high centre of gravity and high handles, the kraters in Groups C and D to a shape with a wider base and lower centre of gravity, and the kraters in Groups E and G to a shape with an elongated shape and very low handles[61].

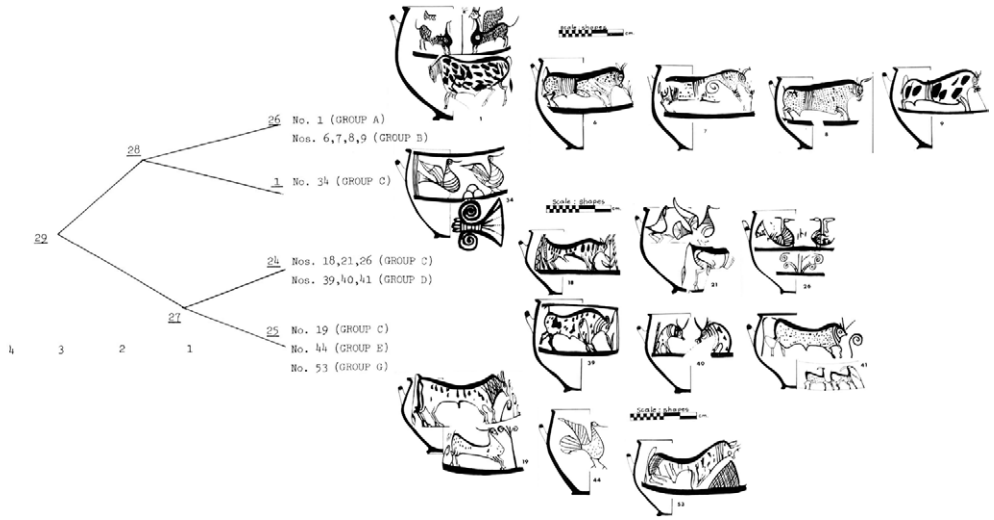


Fig. 2. RS bell kraters: Anson's cluster tree and drawings of RS shapes (after Anson 1980b: 9, fig. 5, and p. 3-6, fig. 1-3)

In the light of the above, Anson concludes that the RS shape groups in his analysis are compatible with his decoration types (i.e. style groups)[62]. Nevertheless, it is worth stressing that Anson's stylistic grouping matches even better with the sequence of kraters provided for the «handle height» (i.e. the ratio *height/distance from rim to handle start*) alone (Fig. 3)[63]. For instance, four of the five kraters with the higher ratios («handle height»), i.e. kraters no. 6, 8 and 7, 9, belong to Group B (style). This may suggest the existence of distinct workshops. By contrast, regarding the «centre of gravity», the sequence of kraters appears to be completely different (see above Fig. 1, also below Fig. 10). Moreover, one may note that the ratio *height/rim diameter* is not part of the selected variables, and may wonder whether an analysis involving this ratio would generate similar shape groups[64].

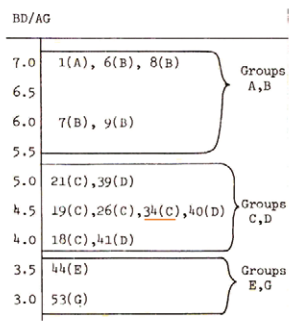
[60] Anson 1980b: 9, fig. 5. Three of these sub-branches include most of the bell kraters, while one branch is represented by just one example.

[61] Anson 1980b: 9. It must be noted, however, that Group E is represented by only a single complete krater. The same remark applies to Group G and Group A.

[62] Anson 1980b: 9.

[63] See Anson 1980b: 10, Table II. This table also shows the ratio *rim diameter/distance from rim to handle start,* whose values are mostly similar or close to the ratios *height/distance from rim to handle start* (i.e. «handle height»), aside from kraters no. 21 (Group C) and no. 7 (Group B).

[64] Anson 1980b: 9, fig. 5. The ratio *height/rim* is included in the multivariate analysis, see Anson 1980b: 3 («the ratios of

Anson's "handle height" (BD/AG = ratio *height / distance from rim to handle start*)	Sites and styles: catalogue numbers in Vermeule and Karageorghis 1982, corresponding to Anson's sequence of kraters
	1. Enkomi (VI.16), 6. Klavadhia (VI.11*), 8. Pyla-*Verghi* (VI.13*) 7. Pyla-*Verghi* (VI.14*), 9. Aradippo (VI.15*) 21. Enkomi (–), 39. Enkomi (VI.20) 19. Enkomi (VI.43), 26. Myrtou-*Pigadhes* (–), 34. Enkomi (VI.31), 40. Enkomi (VI.45) 18. Enkomi (VI.44), 41. Ankastina (cf. under VI.22) 44. Enkomi (VI.33) 53. Enkomi (VI.48)

* Painter 27 according to Vermeule and Karageorghis 1982: 177.
Early Pastoral (VI.1-VI.9), Middle Pastoral (VI.10-VI.41), Late Pastoral (VI.42-VI.58), LH IIIC1 (VI.59-VI.62), see Vermeule and Karageorghis 1982: 207-209.
RS bell krater with a more rounded body profile than the other kraters of Groups C and D.

Fig. 3. RS bell kraters: «handle height» calculated by Anson (1980b: 10, Table II), sites and style according to Vermeule and Karageorghis (1982)

The reason why a proportion such as the «handle height» may be used for identifying kraters made by individual potters is worth discussing further. This involves a comparison with the method employed to identify the work of individual painters in the production of pictorial pottery. According to Vermeule and Karageorghis, the painters of Mycenaean pictorial pottery used standard design forms in painting motifs like bulls, but the presence of characteristic details in the composition allows us to recognize the work of individual painters[65]. In terms of ceramic shapes, this would mean that the work of an individual potter might be identified on the basis of specific morphological features. Such features may include the position of the handle in relation to the rim, i.e. Anson's «handle height». RS bell kraters with a similar or close «handle height», for instance, kraters no. 1, 6, 8 and 7, 9, might thus be regarded as the work of the same potter. This idea is supported by the fact that kraters no. 6, 7, 8 and 9 are assigned to Painter 27 by Vermeule and Karageorghis[66], but should be corroborated by the analysis of other proportions such as, in the case of RS bell kraters, the width of the handle relative to the maximum diameter, or by the examination of the rim or base morphology. A comparison between the bases of the aforementioned kraters does not support this hypothesis well: the base of krater no. 9 in Group B is slightly raised concave[67], unlike the ring-based kraters no. 6, 7 and 8 in this group.

base, rim, and width to height, and the positioning of the largest diameter and handle placement on the vertical axis»).

[65] Vermeule and Karageorghis 1982: 174; also Recht and Morris 2021: 101. On the pictorial pottery painters influenced by the wall painting compositions, see Furumark 1972: 452-453; Immerwahr 1990: 149; Vermeule and Karageorghis 1982: 1-2, for identification of individual painters, 175-177. Also Papadopoulos 2018: 530-531, «From the vase to the wall to the vase?». On the Near East iconographic repertoire as a source of inspiration for Mycenaean pictorial art, especially regarding chariot scene and fighting bulls, see Åkerström 1987: 86. For the identification of painters among the pictorial vases from Tiryns, see Güntner 2006.

[66] Vermeule and Karageorghis 1982: 177, Painter 27, VI.11-VI.15 (bell kraters with bull motifs). Anson's krater no. 1 of Group A (= VI.16) is not assigned to an individual painter by Vermeule and Karageorghis.

[67] For the definition of features, see Mountjoy 1986: 201, fig. 270.

Another question is whether the statistical methods of Anson bring substantial new results or merely confirm previous shape classifications. Well before Anson's 1980 article, Furumark observed that the «deep rounded bowl with two horizontal handles» FS 281 («ring-based krater») have a «shape deep closing semiglobular, generally barrel-like or somewhat biconical», whereas the FS 282 form have a shape either the same as FS 281 or «sometimes more biconical» (or having somewhat a conical appearance)[68]. According to Furumark, FS 281 is also characterized by a «diameter equal to or (usually) somewhat greater than height», whereas FS 282 shows a «diameter greater than height».

Even though Anson's grouping is based on variations in shape proportions and not on the profile of the vases as described by Furumark (semi-globular, vs. barrel-like or biconical), a re-examination of the RS bell kraters drawn by Anson[69] allow us to confirm that kraters in Groups A and B, classified as a shape with a high centre of gravity and high handles, correspond mostly to the FS 281 form (semi-globular). Kraters in Groups C and D, with the exception of krater no. 34, as well as in Group E and G, fit well with Furumark's description of the FS 282 form (more biconical).

Nevertheless, a new result obtained by Anson is that kraters with «wider bases and lower centre of gravity» (Groups C and D) are distinct from kraters characterized by their «elongated shape and very low handles» (Groups E and G)[70]. It is true that, regarding the ratio *height/maximum diameter*, most kraters of Group E and G present numerical values higher than kraters in Groups C and D. However, all the RS bell kraters studied by Anson, except for krater no. 7 (with a ratio of 1.01), have a maximum diameter greater than the height (with ratios ranging between 0.86 to 0.98) (see Fig. 1). Finally, if a multivariate analysis is aimed at providing a more fine-grained typology than Furumark's shape classification, the new classification should also be relevant in terms of chronology.

Classification, chronology and geographical production origins

The main reason why Furumark has classified bell kraters into two different forms is a chronological one: FS 281 kraters are dated to LH IIIB and FS 282 kraters to LH III(B-)LH IIIC1[71]. By comparison, Vermeule and Karageorghis chronologically situate Mycenaean pictorial kraters between Late Helladic IIIA1 (Early Pictorial) and Late Helladic IIIC (Late Pictorial), and kraters of the Pastoral pictorial style (Cyprus and the East) in the second half of LH IIIB, which includes three stages of development (Early, Middle, Late stages) over a period of 30 years (1250-1220 B.C.)[72]. However, the Rude/Pastoral pictorial style continues in the initial phase of LH IIIC (1190-1175 B.C.)[73].

The complete kraters in Anson's Groups A and B are concentrated in the Middle stage of the Pastoral Style, but a fragmentary krater in Group B corresponds to the Early stage[74] (Fig. 4). Some kraters with wider bases and lower centres of gravity in Groups C and D are also assigned to the Middle stage of the Pastoral Style, and may thus be

[68] Furumark 1972: 633. See also the comment in Anson 2017: 2-3.

[69] Anson 1980b: fig. 1-3; on RS shape divided into three groups, see p. 9.

[70] Anson 1980b: 9.

[71] Furumark 1972: 633.

[72] Vermeule and Karageorghis 1982: 3. For kraters of the Pastoral pictorial style, see Vermeule and Karageorghis 1982: 59-67, 207-209. Also Mountjoy 2018: 71. Kostopoulou 2021: 233, 278-279.

[73] Mountjoy 2018: 81; see also Vermeule and Karageorghis 1982: 67, 208-209.

[74] Anson 1980b: no. 15; corresponding to Vermeule and Karageorghis 1982: VI.8.

contemporaneous with kraters in Groups A and B. Other kraters in Groups C and D are attributed to the Late stage of the Pastoral Style. Finally, kraters having an elongated shape and very low handles (Groups E and G) are respectively assigned to the Middle and the Late stages of the Pastoral Style. Thus, examples in Group E may potentially be contemporaneous from kraters in Groups A-D.

StG = Stylistic Group
ShG = Shape Group
ShCl = Shape Cluster
Date according to the find-context
MPVP = Vermeule and Karageorghis 1982
(non. ill.) = non illustrated
Stage = Stage of the Pastoral style
[?] = kraters of Group C included in a sub-cluster not related to other kraters of Group C

Anson 1980					MPVP		
No.	StG	ShG	ShCl	Date	No.	Stage	Painter
Kraters with complete profiles					Complete kraters		
1	A	1	1A		VI.16	Middle	
6	B	1	1A		VI.11	Middle	27
7	B	1	1A	LC IIC	VI.14	Middle	27
8	B	1	1A	LC IIC	VI.13	Middle	27
9	B	1	1A		VI.15	Middle	27
18	C	2	2A		VI.44 (non ill.)	Late	
19	C	[?]	2B		VI.43	Late	
21	C	2	2A				
26	C	2	2A				
34	C	[?]	1B		VI.31 (non ill.)	Middle	
39	D	2	2A		VI.20	Middle	
40	D	2	2A		VI.45	Late	
41	D	2	2A		Under VI.22	Middle	
44	E	3	2B		VI.33 (non ill.)	Middle	
53	G	3	2B		VI.48	Late	
Fragments and other kraters					Fragmentary or complete kraters		
15	B				VI.8	Early	
20	C				VI.17	Middle	
30	C				VI.37 (complete)	Middle	
46	E				VI.32 (complete)	Middle	

Fig. 4. RS bell kraters: classifications by Anson (1980b) and Vermeule and Karageorghis (1982)

In terms of chronological phases, Groups A and B can be dated to Late Cypriot IIC, which corresponds to LH IIIB (Fig. 5), as evidenced by the stratified find-context of a pictorial krater fragment from Enkomi and the discovery of two complete kraters in a tomb at Pyla-*Verghi*[75]. By comparison, according to the stratigraphic sequence in Enkomi[76], fragments in Groups C and D date to LC IIIA1. Some kraters in Groups A and B are

[75] Anson 1980b: 15, Table IV.

[76] Noteworthy is that three stratified pictorial krater fragments (29, 36, 43 in Group C) from Enkomi date to LC IIIA(1), see Anson 1980b: 15, Table IV. The Rude Style most likely continues to be manufactured in LC IIIA, see Kling 1989: 123. On pottery sequences and synchronisms (LH IIIC Early 1 in the Argolid or CypIIIC Early 1 in Cyprus, lasting from LC IIC Final to the beginning of LC IIIA), see Mountjoy 2018: 28, Table 4.

certainly earlier than kraters from Groups C-G, while others may be contemporaneous to them (Middle stage of Pastoral Style). The chronology of Group E seems to extend later in LH IIIC1, but the presence of a Groupe E fragment in the LC IIIA(2) level at Enkomi is likely accidental[77].

	CYPRUS	CRETE	GREEK MAINLAND
1400	Late Cypriot IIB	Late Minoan IIIA	Late Helladic IIIA
1350			
1300	Late Cypriot IIC	Late Minoan IIIB	Late Helladic IIIB
1250			
1200	Late Cypriot IIIA	Late Minoan IIIC	Late Helladic IIIC
1150			
1100	Late Cypriot IIIB		Submycenaean

Fig. 5. Chronological table (Iacovou 2012: 23)

According to Anson, a new typological analysis, when it is corroborated by a detailed examination of decoration and composition of clays, may be used to recognize «products of separate and sometimes contemporary workshops»[78]. In this line of reasoning, the variations in the shape proportions should be interpreted as evidence of distinct workshops, which would be both active in the years corresponding to the Middle and Late stages of the Pastoral pictorial style (i.e. at least two workshops corresponding to Groups C-D and Groups E-G). Moreover, a third workshop (compatible with Group A-B) would be then operative in the period of the Middle stage of the Pastoral pictorial style. The lack of chronological homogeneity related to a single group, except in the case of Group B, is thus in Anson's view not an issue. This can be explained by the relative short period covered by the production of RS bell kraters. Otherwise, this would mean that a generation of potters may have transmitted to the next one the shape proportions they used to produce these kraters.

A further argument supporting the view of different workshops manufacturing RS bell kraters in the years corresponding to the Middle stage of the Pastoral style would be that these kraters present different geographical production origins. Whereas the results of a spectrographic analysis confirm that most «RS vases found in eastern Cyprus and Ras Shamra are likely to be made in Enkomi»[79], the chemical analysis of the RS bell kraters studied by Anson presents subtle but significant variations in their composition patterns (elements of Fe, Mn, Ca and Na)[80]. Using a Discriminant Function Analysis (graph),

[77] Anson 1980b: 14-15, Table IV, no. 47 (E).

[78] Anson 1980b: 16.

[79] Anson 1980b: 10. For the earlier project: Anson 1974: 120-140; and results: Anson 1980a.

[80] Anson 1980b: 11-12. Samples were taken from two fragments in Group A, from four complete kraters and four fragments in Group B, from one complete krater and seven fragments from Group C, and three fragments from Group F, see Anson 1980b: 11, Table III.

Anson demonstrates that Group B samples differ in composition pattern from Group A, C and F samples, and that Group A samples also differ in composition pattern from Group F samples[81]. Consequently, Anson suggests that «the RS of Eastern Cyprus may therefore by subdivided into two groups. On the one hand, there is group (B), on the other, groups (A), (C) and (F) which appear to use the same clay», and that sampled pottery from the latter (Groups A, C, F) «conformed well with the Enkomi control group»[82]. Pottery in Group B, which was mostly found on sites other than Enkomi, may have been produced in another workshop, perhaps in Kition[83].

At this point, it is necessary to return to Anson's shape groups. It is worth emphasizing that the four complete kraters in Group B are clustered in a sub-branch distinct from most other kraters (Groups C-F) in the cluster tree of RS shapes. This matches with two different geographical production origins. The analysis of variations in the shape proportions of vases may thus appear as an interesting research tool for identifying possible workshops. However, the complete krater no. 1 in Group A is in the same shape group as the kraters of Group B (see Fig. 2). In other words, «despite similarities of shape, groups (A) and (B) now differ from each other not only in decoration but also in chemical composition»[84]. Nevertheless, the discussion should be based on a higher number of complete kraters analysed in terms of shape and fabric: only two Group A fragments were sampled, and the complete krater no. 1 in this group was not. Likewise, krater no. 34 in Group C, which is the only complete krater of this group related to the four aforementioned Group B kraters in Anson's cluster tree, was also not sampled. Eventually, the question arises as to whether RS bell kraters would be clustered in the same branches of the tree obtained in an analysis based on proportions other than the four used by Anson in 1980.

The Mycenaean pictorial amphoroid kraters and the new typology of Anson (2017)

From 3D measurements to a hierarchical cluster analysis

Anson's article[85] is an attempt to build a new typology of the Mycenaean pictorial amphoroid kraters (found in Cyprus mainly, in the Levant, and occasionally in Rhodes), «wherein quantitative measurements of vase proportions are used to classify the vases», that is to say a method of shape classification capable of reflecting «differences in chronology, decoration, or chemical fabric differences»[86]. As in the case of RS bell kraters, Anson suggests that new shape groups of amphoroid kraters, correlated with an examination of their decoration and chemical fabric, may also be interpreted as evidence of potential distinct workshops. In his opinion, this method may «provide new insights into the manufacture of the Mycenaean pictorial amphoroid kraters found in Cyprus and the Levant»[87]. Anson assumes that «a more fine-grained typology» than the series of

[81] Anson 1980b: 13-14, fig. 7 (graph).
[82] Anson 1980b: 14.
[83] Anson 1980b: 15. With a different numbering of the kraters: Anson 1980a: 115, 118, see fig. 2 on p. 122.
[84] Anson 1980b: 14.
[85] Anson 2017.
[86] Anson 2017: 4.
[87] Anson 2017: 4.

shapes defined by Furumark[88], among them the pictorial kraters attributed to the FS 53, FS 54 and FS 55 forms[89], may result from his new cluster analysis.

Anson's analysis includes 37 amphoroid kraters decorated with chariots and human figures, which are all described in the study of Vermeule and Karageorghis[90]. The majority are chariot kraters, but two amphoroid kraters are decorated respectively with boxers and men on shipboard[91]. To these 37 pictorial amphoroid kraters, Anson adds three Furumark template drawings (FS 53, FS 54, and FS 55) in his analysis[92].

This time, the variables used in the cluster analysis consist in the ratio of «the width of each vase at 10% along the vase's vertical axis» to the height of the vase. The series of widths are obtained by employing a specific software (Potometer computer program) that «can extract accurate 3D measurements from a single photograph»[93]. In other words, the proportions of the vase correspond to eleven width measurements (or radius) taken at 10% intervals from the basis to the rim, all of them divided by the height of the vase (Fig. 6). According to Anson, this series of proportions are registered in Columns 8-12 of his Table 1[94], next to data drawn from the study of Vermeule and Karageorghis[95] (catalogue numbers, stylistic sub-phases and individual painters), which, however, does not provide the heights and diameters of the pictorial vases.

By contrast, in many cases, the dimensions of the amphoroid kraters are indicated in the catalogue of Morris' PhD[96]. While most height measurements noted by Morris are identical or quite similar to those registered by Anson (Appendix 1), some significant differences should be pointed out[97]. In one case, the difference in rim diameters between the two authors exceeds 10 cm[98]. In order to verify the problematic cases, one can refer to the heights and diameters indicated in the first publications of the vases[99], the catalogues of museums, notably the CVA series, or the museum catalogues online[100]. In this respect, the dimensions provided by Morris appear to be the most accurate.

[88] Furumark 1972: 593, Form 8, amphoroid kraters (FS 52 to FS 57). Furumark notes that the kraters FS 54 have a neck usually higher than the previous ones, and that the kraters FS 55 have also a high neck (some having a more perked-up shoulder, others being a heavy piriform). The FS 52 form includes only one krater (from Qatna).

[89] See the catalogue of chariot kraters by Recht and Morris 2021.

[90] Vermeule and Karageorghis 1982; Anson 2017: 4, and Table 1 on p. 12. Most amphoroid kraters analysed by Anson (2017) are also included in the catalogue of Recht and Morris 2021, aside from the examples V.32 and V.38, which are not decorated with chariot scenes.

[91] Vermeule and Karageorghis 1982: 202, V.32 and V.38.

[92] Furumark 1972: 23, fig. 4; Anson 2017: 4, the cluster tree on p. 7, fig. 2, and Table 1 on p. 12.

[93] Anson 2017: 5, «The user fits ellipses on a computer image to features known to be circles in the original 3D space». For the software, see Wyvill and Anson 2004. However, to date, this software runs only with an old system (Mac OS 10.6.8 is the latest to supports Power PC apps, Geoff Wyvill, personal communication, 2021).

[94] See the table legend in Anson 2017: 11, Table 1 on p. 12.

[95] Vermeule and Karageorghis 1982.

[96] Morris 1989.

[97] Small differences in height of up to 1 cm are noted for many kraters, and larger differences of up to almost 3 cm in height for kraters no. 141, 143 and 171 by Morris (1989), i.e. kraters no. 20, 22 and 23 by Anson (2017), respectively. The height difference of 10 cm for kraters no. 124 and 146 by Morris, i.e. kraters no. 36 and 26 by Anson, cannot be explained.

[98] Krater no. 44 by Morris (1989), i.e. krater no. 8 by Anson (2017). Moreover, a difference of 10 cm is found for krater 141 by Morris, i.e. krater no. 20 by Anson.

[99] E.g. for krater no. 124 by Morris 1989, H. 33 cm, rim diam. 25.5 cm, see Maiuri 1923-1924: 152, no. 4. For krater no. 146 by Morris 1989, H. 46 cm, D. max. 37.5 cm, see Schaeffer 1936-1937: 212.

[100] E.g. for krater no. 141 by Morris 1989: H. 44.5, see krater no. 1951.204 at the MAG, https://magart.rochester.edu/objects-1/info/6020?query=mfs%20any%20%2251.204%22&sort=9&page=2.

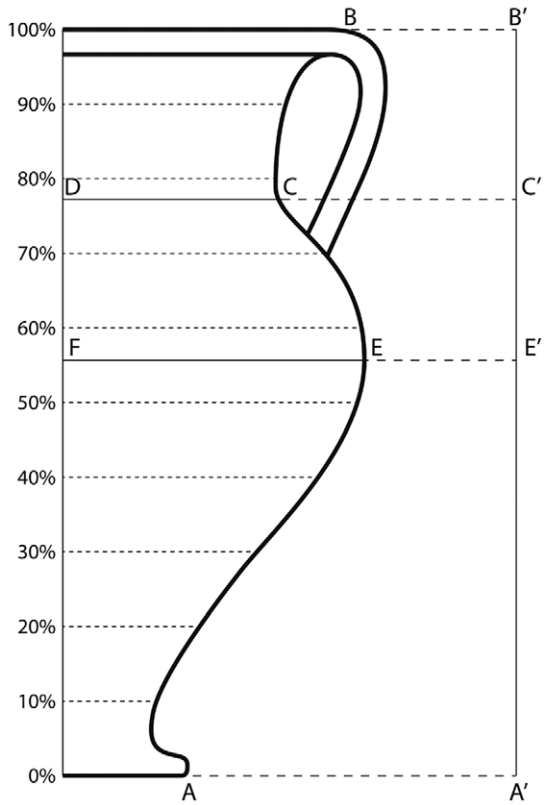


Fig. 6. Amphoroid krater shape: points measured by Anson (2017: 5, fig. 1)

Reading Anson's Table 1[101] raises four further issues: 1) the legend of the table indicates that «Columns 8-18 present vase radius to height ratios», but the numerical data in the table may correspond to diameter measurements, not ratios[102]; 2) the legend of the table indicates that «Column 22 [presents] ratios of vase radius to height at the point of vase's maximum width», but «Max D» is noted in the column heading of the table; 3) there is no legend for the abbreviations, and it must be guessed that «CG» is perhaps used for «Centre of Gravity»[103], and «STDV» for «Standard deviation»; 4) it is difficult to explain the numerical data recorded for the «Neck H» and «CG», which are higher than the krater heights.

Be that as it may, in the SSP hierarchical cluster analysis tree obtained by Anson, the pictorial amphoroid kraters are classified into two main (branch) groups and four (sub-branches) sub-groups (agglomerative clustering, Euclidian distance, Ward's method)[104].

[101] Anson 2017:12.

[102] By comparison, for the ratio *height/base* and the ratio *height/maximum diameter* calculated for RS bell kraters, see Anson 1980b: 8, Table 1.

[103] See Anson 1980b: 7-8, i.e. the distance between the rim and the point of intersection of this diameter and the vertical axis. Here, Anson 2017: 11, «Column 23 measures the position of the vase's maximum width as a ratio of the total height (cp. fig. 1: B'-E': A'-B')».

[104] Anson 2017: 6.

Anson states that the main results of his analysis are the following[105]: 1) «Group 2 encompasses FS 54 and FS 55. Group 1 encompasses FS 53»; 2) kraters in Group 1 are shorter than those in Group 2, and «proportionally wider at the shoulder and through having a shorter neck»; 3) Group 2B kraters are proportionally wider at the base and at the lower body than Group 2A kraters, whereas Group 1B kraters are proportionally wider at the 60% of their height than Group 1A kraters.

In Anson's article, the difference between Group 1 and Group 2 is illustrated by two visual models consisting of «bar-graphs of vase radius measurements at 10% intervals from the base to the rim»[106]. However, the horizontal bar-graphs range in width from 15 to nearly 45. This corresponds rather to diameter measurements (cm) than radii. Moreover, with the same scale, the height of the bar-graph models should be reduced, since all amphoroid kraters listed by Anson are shorter than 50 cm[107]. Finally, the shorter bar-graph model is not proportionally wider at the shoulder than the taller model. There are thus some serious issues about the visual presentation of the shape groups. Nevertheless, Anson's objective of proposing a new shape typology, fine-grained enough to reflect differences in chronology and geographical distribution, should be further tested.

The pictorial amphoroid kraters, their chronology and geographical production origins

In Furumark's classification, the LH IIIA2 late and LH IIIB amphoroid kraters (respectively FS 54, FS 55) are higher-necked and more pear-shaped than the LH IIIA1/2 and LH IIIA2 early amphoroid kraters (FS 52, FS 53)[108]. According to Anson, his own new classification of pictorial amphoroid kraters confirms Furumark's diachronic shape development: «with the passage of time the amphorae became progressively higher-necked and more pear-shaped»[109].

More precisely, the 37 pictorial amphoroid kraters studied by Anson range in date from LH IIIA1 to LH IIIB1, i.e. from LC IIB to LC IIC, which is a period covering the sequence going from Early Pictorial I to Ripe I style (1410-1270 B.C.), as defined by Vermeule and Karageorghis[110]. However, in Anson's shape classification, only one sub-branch shows kraters all dated to the same chronological phase, that is Shape Group 2A, which includes five kraters of the Rip Pictorial I sub-phase (LH IIIB1, 1300-1270/60)[111]. A similar homogeneity cannot be observed in the other groups: in Group 2B, kraters range from the Middle Pictorial II to Rip Pictorial I sub-phase (from LH IIIA2 late to LH IIIB1, 1345-1270/60); in Group 1A, kraters are assigned to the Middle Pictorial I-II and Ripe Pictorial I sub-phases (from LH IIIA2 early to LH IIIB1, 1365-1270/60); in Group 1B, kraters belong to the Early Pastoral I (LH IIIA1, 1410-1390) and the Middle Pastoral I-III sub-phases (LH IIIA2 early-LH IIIA2 late, 1365-1300). Although the kraters in Group 1B are all earlier than the kraters in Group 2A, matching thus with Furumark's

[105] Anson 2017: 6.

[106] Anson 2017: 8, fig. 3.

[107] See Anson 2017: 12, Table 1. See also the heights of the Mycenaean amphoroid kraters catalogued by Morris 1989: 344-510. For the heights of the Mycenaean amphoroid kraters in the British Museum: https://www.britishmuseum.org/collection.

[108] Furumark 1972: 593.

[109] Anson 2017: 4.

[110] Anson 2017: 3-4, 9; Vermeule and Karageorghis 1982: 3.

[111] Anson 2017: 9.

classification (see above, FS 53 preceding FS 54 and FS 55), the presence of a Ripe Pictorial I krater (LH IIIB1) in Group 1A is in contradiction with a relative elongation of the shape over time.

Another question is whether the classification of Anson may reflect different contemporary production environments[112], especially in the Middle Pictorial I-III and Ripe Pictorial I sub-phases (LH IIIA2 early-LH IIIB1, 1365-1270/60). Following Anson's reasoning, two distinct workshops were perhaps active during the Middle Pictorial I phase (LH IIIA2 early, 1365-1340), three during the Middle Pictorial II-III phase (LH IIIA2 late, 1345-1300), and three during the Rip Pictorial I sub-phase[113].

Here again, chemical composition analyses should bring light on this issue. In this purpose, Anson refers to the study of Catling and Millet[114], who have already demonstrated that the large majority of sampled Mycenaean pictorial pottery fall into the Peloponnese A Fabric Group[115]. The chemical analyses data from Catling and Millet's study are then used by Anson in a new cluster analysis[116]. First, it is worth noting the chronological heterogeneity of the pottery belonging to Fabric Group 1B (Early III, Middle II-III, c. 1375-1360, 1345-1300), as well as to Fabric Group 1A (Middle II-III, Ripe I, c. 1345-1270/60)[117]. This means that clays characterized by the same composition patterns were used over decades. Secondly, it must be stressed that only one single complete krater was sampled, which is krater IV.16 by Vermeule and Karageorghis[118]. One may wonder as to how fabric groups may be then compared with shape groups.

The individual painters identified by Vermeule and Karageorghis may be the key to better understand Anson's approach[119]. Painters 6, 10 and 12 are linked to pottery falling into the Fabric Group 1A as well as to kraters of Shape Group 2B (Fig. 7). By contrast, Painter 9 is associated to a fragment of Fabric Group 1B as well as to kraters of Shape Group 1B, whereas Painter 5 is that of krater IV.16, which is regarded chemically as an outlier and as belonging to Shape Group 1A. The fact that individual painters are exclusively linked to a single fabric or a single shape group, and not to two different fabric or shape groups, may be used as an argument in favour of the existence of different workshops[120], especially in the Middle Pictorial III phase (LH IIIA2 late, 1330-1300). Nevertheless, this does not help to reveal strong correlations between style groups, shape groups and fabric groups.

[112] Anson 2017: 10.

[113] See Anson 2017: 12, Table 1.

[114] Catling and Millet 1965.

[115] Catling and Millet 1965: 213-215, 221; see Anson 2017: 13. Also Morris 1989: 262-264.

[116] Anson 2017: 14-16. It is worth stressing that the classification (serial) numbers indicated in Anson's cluster tree and table related to the principal chemical [fabric] composition analysis (Anson 2017: 14, fig. 5, and 15, Table 2, no. 1-40) are *not* the classification numbers assigned to the complete kraters used in his analysis of variations in the shape of pictorial amphoroid kraters (Anson 2017: 7, fig. 2, and 12, Table 1, no. 1-14).

[117] Anson 2017: 16. To compare with Vermeule and Karageorghis 1982: 3, 20-44.

[118] Vermeule and Karageorghis 1982: 30, 198; corresponding to Catling and Millet 1965: 221, no. 3, pl. 58.3; corresponding to Anson 2017: classification no. 8 in fig. 2 and Table 1, i.e. classification no. 14 in fig. 5.

[119] Anson 2017: 16.

[120] Anson 2017: 17.

Anson 2017				MPVP		
No. (Shape)	Shape Group	No. (Fabric)	Fabric Group	No.	Stage	Painter
12	2B			IV.24 (Pyla-*Verghi*)	Middle II	6
15	2B			IV.48 (Kourion)	Middle III	10
26	2B			V.8 (Ugarit)	Ripe I	12
*3 or 16	1B			IV.49 (Tell Dan)	Middle III	9
8	1A	14	Outlier	IV.16 (Enkomi)	Middle II	5
		4	1A	IV.23 (Maroni)	Middle II	6
		5	1A	IV.52 (Enkomi)	Middle III	10
		10	1A	V.7 (Enkomi)	Ripe I	12
		7	1B	IV.63 (Maroni)	Middle III	9
		1	1B	III.21 (Enkomi)	Early III	2
		6	Outlier	IV.54 (Maroni)	Middle III	11
		13	Outlier	III.17 (Enkomi)	Early III	2

* In Anson's Table on p. 12, IV.49 corresponds to classification no. 3; *contra* in Anson's fig. 2, IV.49 corresponds to no. 16.

Fig. 7. Shape and fabric groups after Anson (2017), painters after Vemeule and Karageorghis (1982= MPVP)

Discussing shape proportions and ceramic profiles used in morphological classifications

Some issues regarding the visual representations of shape proportions

As regards the methods employed by Anson[121], the shape proportions selected as variables are the last point to discuss. It is a question whether a new shape classification of variations in the shape of RS bell kraters would be relevant by dividing vases into horizontal slices, i.e by using «the width of each vase at 10% along the vase's vertical axis»[122]. The profiles of the vases published in 1980, though rendered in reduced scales, are reliable enough to use them for this purpose, without having the original line drawings at one's disposal, by scanning the figures, measuring the vase radius using a software (e.g. Gimp or Photoshop)[123], and calculating the actual vase diameters according to the scale drawings[124] (Appendix 2). Compared to the height and diameters provided in publications or online by the British Museum, the differences are very small proving that Anson's drawings are accurate.

Logically, the numerical values obtained for the ratio *height/width at 0%* and the ratio *height/width of the maximum diameter* should be similar or very close to those noted by Anson in 1980 (*height/base* and *height/max D*)[125]. That is indeed the case, except for two ratios *height/base* (Anson's RS bell kraters no. 8 and 18), and two ratios *height/max D* (kraters no. 26 and 39). However, as later followed by Anson[126], diameters (or widths) should be divided by the height of the vase, instead of the height of the vase divided by the widths (in order to avoid a ratio *x/0*). In a computer program (e.g. Microsoft Excel), a

[121] Anson 1980 and 2017.

[122] Anson 2017: 5. For the «sliced» method, see Orton, Tyers and Vince 1993: 156.

[123] Measurements are obtained using the Guides and Measure or Ruler tool in these softwares. The vertical axis of a vase should be straightened, if necessary.

[124] I.e. using a cross-multiplication, i.e. multiplying the radius by 2, then by 20, and dividing the result by the length of the scale drawing, which vary very slightly from a figure to another. The height and rim diameter of krater no. 21 are those indicated in Anson's appendix, see Anson 1980b: 17, and fig. 2 on p. 5.

[125] Anson 1980b: 8, Table I.

[126] Anson 2017.

table including a series of ratio *radius at 10% intervals of vase height/height* may be used to generate a 2D column chart design, here stretched lengthwise (Fig. 8). From there, it is easy to understand why eleven proportions (*width at 10% of vase height/height*) were selected as variables by Anson, and probably lead to the idea of representing shapes by bar-graph groups.

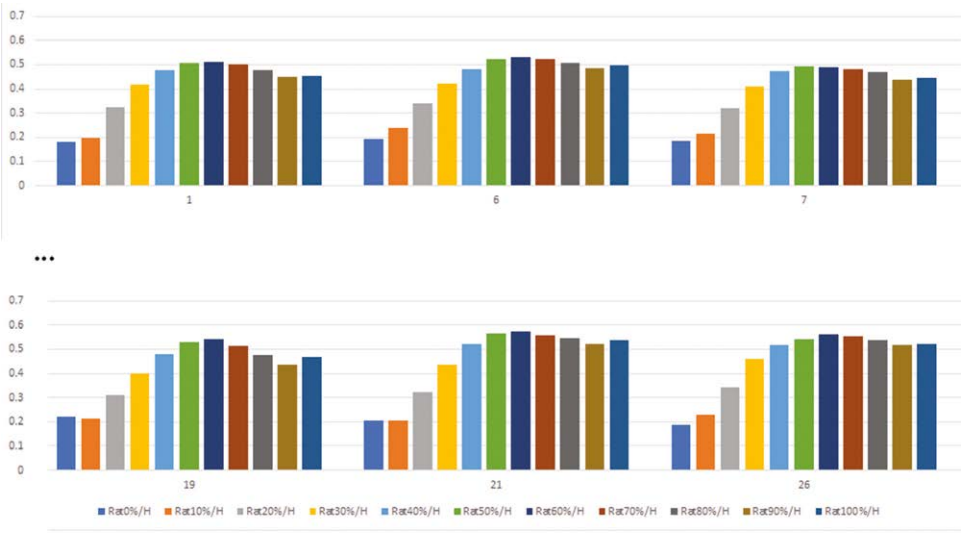


Fig. 8. 2D column chart design of RS bell krater proportions (ratio *radius at 10% intervals of vase height/height*, see krater shapes by Anson 1980b)

Nevertheless, this approach raises a certain number of issues. First, one may wonder why a vessel should not be divided into a higher number of slices, and how many slices would be the more efficient applying a statistical method[127]. Secondly, measurements and proportions are two different sets of variables. In a ratio *width/height*, a value of 1 (or 100%) is obtained when the width is equal to the height, whatever are the size or profile of the vase. In a ratio *height at the point of a given width/height of the vase* (h/H) converted into percentage, the height of the vase is of 100 (the ratio at the rim is thus of 1:1)[128]. A large vase having theoretically identical proportions than a small vase will be represented by the same bar-graph group. There is thus no reason to apply mean radius measurements to the bars of bar-graph groups.

Furthermore, a major issue is the risk of introducing a confusion between a shape visually represented by a bar-graph group and a geometric shape. The main points of a geometric shape are the ones that define it. On the profile, these points are located at the base, rim and at the maximum width, as well as at the base of the neck, in the case where the vase shape has one. The other points, which are complementary, may serve to better approximate the shape, or, in other words, to determine the curvatures at the M points[129].

[127] Regarding Anglo-Saxon burial urns (Richards 1987), it has been observed that 20 slices confirmed results obtained with 100 measures, with data subjected to the technique of principal component analysis (PCA), as mentioned in Orton, Tyers and Vince 1993: 156-158. Nevertheless, the three first components of the PCA are ratios related to the maximum diameter and the height of the maximum diameter.

[128] Orton, Tyers and Vince 1993: 157.

[129] On geometric shapes and mathematical curves, see Orton, Tyers and Vince 1993: 158-159.

Thus, in addition to the height, the maximum width (radius or diameter), the base width and rim width are essential measurements to learn about the dimensions of a vase.

New shape proportions of RS bell kraters and a test with five shapes

Employing ratios for classifying variations in the shape proportions of vases also means that two vases having distinct profiles can be more similar in proportions than two vases with similar profiles. In order to demonstrate it, I simplify the test by using only five simple individual shapes representing schematic vases (Fig. 9). I also limit the number of ratios to the widths at 0%, maximum, at 50% and at 100% of the vase height (width = radius of the vase), all relative to the height.

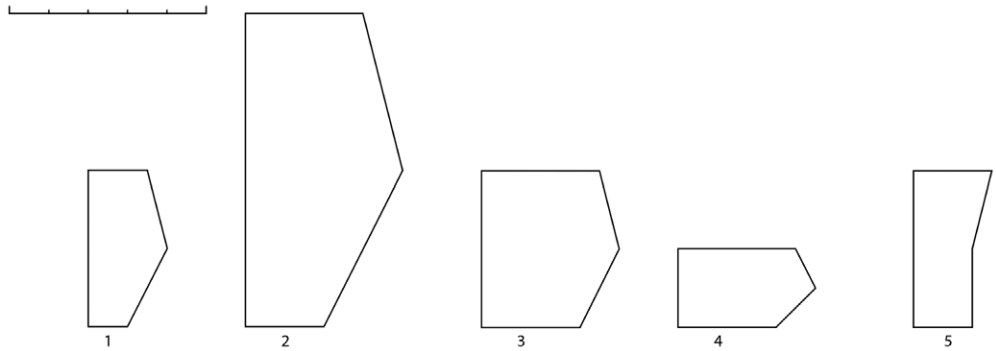


Fig. 9. Five simple individual shapes

It is true that the RS bell krater, just as the amphoroid krater, is a vase shape already well-defined, and that a vase with a profile different from the others, such as Shape 5 in my test, would not have been included in the analysis. This notwithstanding, in my test, Shape 5 is closer in proportions to Shape 1 and 2 than Shape 3, even if Shapes 1, 2 and 3 have similar profiles (Fig. 10).

Therefore, in a multivariate analysis, vases having distinct profiles but close shape proportions may be clustered in the same branches, since the closer two points to each other, the more similar the data sets are (i.e. with Euclidean distances, the smaller the distance, the more similar the cases). It must be stressed that the dataset will be processed equally in a multivariate analysis, unless greater weight is given to certain variables. However, a cluster analysis should concentrate on the most efficient metric variables related to the vase shape[130].

In order to better understand the profile of a vase, the variations between the maximum and minimum widths should be taken into account. In the case of the RS bell kraters studied by Anson[131], the maximum diameters are measured at the body height and the minimum diameters at the base. To determine whether the lower part of the vase strongly or weakly widens from the base to the maximum diameter, the ratio (*maximum diameter – base diameter)/height of the maximum diameter* should be considered. Inversely, the ratio (*maximum diameter – rim diameter)/*(*height – height of maximum diameter*), which

[130] For the variables used in the analysis of the Mycenaean pictorial amphoroid kraters, see Anson 2017: 5.
[131] Anson 1980b.

would «enclose»[132] the neck and the shoulder in the case of amphoroid kraters, indicates whether its upper body weakly or strongly narrows from the maximum diameter to the rim.

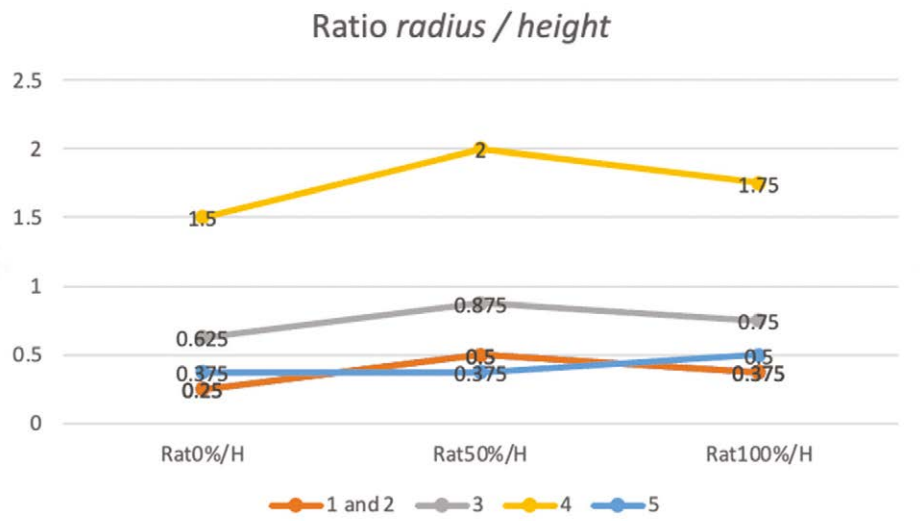


Fig. 10. A comparison of proportions for the five simple shapes in figure 9 (ratio *radius at 0%, 50% and 100% of vase height/height*)

In other terms, in a new hierarchical cluster analysis (agglomerative clustering, Euclidian distance, Ward's method[133]), I would use the ratio *maximum radius/height*, the ratio *height of the maximum radius/height*, the ratio *(maximum radius – [minus] base radius)/height of the maximum radius*, and the ratio *(maximum radius – rim radius)/(height – height of maximum radius)* as variables. However, the question is whether the clustering of the fifteen complete RS bell kraters studied by Anson will be then similar to the clustering obtained in 1980. Two Furumark template drawings (FS 281 and FS 282) may be used as control templates[134]. At least, it is hoped that the four complete RS bell kraters in stylistic Group B (no. 6-9) would be included in the same shape group, clustered in the same branch of the cluster tree, since they are all attributed to the Middle stage of the Pastoral style, and are all related to Painter 27, as identified by Vermeule and Karageorghis[135]. Moreover, Group B is characterized by a composition pattern that differs from Groups A, C and F. This question may be answered without employing a Hierarchical Cluster program[136].

[132] Orton, Tyers and Vince 1993: 158, referring to Richards 1987.

[133] As in the analysis of variations in the shape of pictorial amphoroid kraters, see Anson 2017: 6.

[134] Furumark 1972: 48-49, fig. 13-14. The LH IIIC1 early FS 282 template drawing is selected, but not the LH IIIC1 late, since its rim diameter is larger than the body diameter, by contrast to the RS bell kraters studied by Anson 1980b (body diameter larger than rim diameter). As regards the pictorial amphoroid kraters, Anson 2017 includes three Furumark template drawings (FS 53, FS 54, FS 55) in his analysis.

[135] Vermeule and Karageorghis 1982: 177, Group VI = Pastoral Pictorial. Vermeule and Karageorghis recognize the work of two distinct individual painters within this stylistic group (Painter 26, two fragmentary kraters, and Painter 27, four complete kraters, which are also included in Anson's catalogue, and a fragmentary one).

[136] For the treatment of analytical data using SPSS Version 8 for Windows, see Anson 2017: 6, 14.

Although the variations in the shape proportions of RS bell kraters are low (Fig. 11), the four sequences of kraters show that the four complete RS bell kraters of Group B (no. 6-9) are not particularly close to each other. These kraters would thus not all be clustered in the same branch of a cluster tree, unless special weights would be attributed to the first and last ratios. By contrast, kraters no. 9, 34 and 44, which are attributed to different stylistic groups, are close to each other in three sequences related to the ratio *maximum radius/height* and *(maximum radius – base radius)/height of maximum radius*, the ratio (*maximum radius – base radius)/height of maximum radius*, and in a lesser extent, to the ratio *height of maximum radius/height*. In addition, it is worth noting the similar shape proportions of kraters no. 21 and 40, which however are assigned to two different stylistic groups by Anson (respectively Group C and Group D). Finally, the two Furumark template drawings included in the analysis only really differ in terms of proportions in their lower part, with FS 281 widening more strongly from the base to the maximum diameter than FS 282.

In bold: kraters of Group B (see Anson 1980)

max R / H	No.	*h of max R / H*	No.	*(max R – base R) / h of max R*	No.	*(max R – rim R) / (H – h of max R)*	No.
0.49	**7**	0.51	**7**	0.47	**8**, 44, 34	0.01	34
0.50	**9**, 34, 44	0.52	18	0.48	**9**	0.02	
0.51	1, 53	0.53		0.49		0.03	
0.52	**6**, **8**, 39	0.54		0.50		0.04	
0.53		0.55	39, 53	0.51		0.05	FS 282
0.54	19, FS 282	0.56	**6**, 21	0.52	FS 282	0.06	39
0.55	41	0.57	1, 19, 40	0.53		0.07	**6**, **8**, FS 281
0.56	18, 26	0.58	FS 281	0.54		0.08	21, 40
0.57	21, 40, FS 281	0.59	FS 282	0.55	53	0.09	7, 53
		0.60	41	0.56	19	0.10	18, 26
		0.61	26	0.57	1	0.11	**9**
		0.62	44	0.58	**6**, 41	0.12	41
		0.63	**9**	0.59	**7**	0.13	44
		0.64		0.60	26, 39	0.14	1
		0.65		0.61		0.15	
		0.66	34	0.62	FS 281	0.16	
		0.67	**8**	0.63		0.17	19
				0.64	40		
				0.65	21		
				0.66	18		

Fig. 11. Ratios and sequences of RS bell kraters (R = radius, H = height, krater shapes drawn by Anson 1980b)

Analyses of ceramic profiles based on three mathematical functions

One may wonder whether shape proportions should be selected as the most indicative variables for exploring standardized ceramic shape types through computer-based analysis methods. In order to investigate the grouping of Levantine Bronze Age jars based on their morphology, Ortal Harush and Leore Grosman use three calculated mathematical functions to represent each vessel profile: the three chosen variables and weights are, in order, the radius, the tangent and the curvature; the distance measure in the cluster trees is the distance between these functions[137]. The radius is related to the size, the tangent to the general changes and trends of the shape, and the curvature to the minute changes throughout the profile[138]. Regarding the mathematical representations of the vessel profiles, it is worth stressing that, in each graph, the abscissa (X-axis) is the arc-

[137] Harush and Grosman 2021: 12. The same functions are selected in the frame of an experiment following a strict protocol, see Harush *et al.* 2019: 2. Also Smith *et al.* 2012: 21.

[138] Harush *et al.* 2019: 4; Harush and Grosman 2021: 6-7.

length, and not the vessel height[139]. Variations in the rim radius and rim-and neck-curve lengths are primordial in the studies focusing on ceramic profiles[140], though variations in the body profile are also an element of classification[141], since «these functions store the entire morphological information of the vessel's profile»[142]. An automatic classification of ceramic profiles therefore requires significant mathematical skills and computer resources.

In the case of standardized production, when the identity of the individual potters is known, the analytical approach, which is based on the weights mentioned above and focuses on the upper part of the vases, aims to detect individual morphological signatures[143]. Most of the vases produced by an individual potter may be clustered in the same branches or sub-branches of the computer-generated tree, without being restricted to a single (sub-)branch nonetheless, especially when the vases are of the same height or have the same capacity[144].

When the find-site or region (landscape unit) of standardized vases is known, the automatic morphological classification of ceramic profiles is used to provide information on geographical variations and to detect cultural markers (signatures) reflected in the final products[145]. Moreover, when the analysis focuses on the chronological horizon, the branches and sub-branches may cluster vases of the same type and same horizon[146]. Here, it is essential to note that the types obtained based on an automatic classification of a ceramic assemblage may include standardized vases varying in height and proportion[147]. Finally, the analysis of the ceramic profiles may lead to look for hints of social signatures, in which the types of jars would be representative of different social networks and group organizations[148]. It is however not the point to associate these types or sub-types with the products of single individual potters whose identity and number are unknown.

An additional comment on the variations in the shape of RS bell kraters

Consequently, in the light of above, I would challenge the idea of using shape proportions in a multivariate analysis to generate a new classification within an already well-defined small group of vases such as the RS bell kraters. The question arises whether the analysis

[139] On Levantine Iron Age jars, see Smith *et al.* 2012: 21-22, fig. 6.b-d. The same functions (radius, tangent, curvature) are used to analyze the profiles of modern white water jars made in India: Roux and Karasik 2018: 26, fig. 2-4. In this last case, the upper part of the external profile only, whose line is drawn horizontally to the vertical axis at the rim, is analyzed. On the curvature as a function of the normalized arc-length, see Karasik 2008: 113-114, fig. 1.B. On mathematical functions, see previously Orton, Tyers and Vince 1993: 159-163, fig. 12.6 (tangent), fig. 12.7 («two-curve» method).

[140] Harush and Grosman 2021: 7. See also Roux and Karasik 2018: 26; as stated by the authors, the upper part of the modern white water jars made in India holds the most significant information about them.

[141] Harush and Grosman 2021: 7, «Type 1 (with two subtypes), a jar with a spherical body and a rounded and short neck; and Type 2 (with two subtypes), a jar with a barrel body and a flaring and high neck».

[142] Harush and Grosman 2021: 12. Also Harush *et al.* 2019: 2. The average profiles of the sub-types may show a clear difference in height, see Harush and Grosman 2021: 8, fig. 4.

[143] Harush *et al.* 2019: 2, 5-7; Harush and Grosman 2021: 2. Also Roux and Karasik 2018: 21.

[144] Harush *et al.* 2019: 5, fig. 4. Also Roux and Karasik 2018: 31, fig. 2-7.

[145] Harush and Grosman 2021: 2.

[146] On the Iron Age II Oval Storage Jar, see Harush and Grosman 2021: 13-15, fig. 2.

[147] Harush and Grosman 2021: 17, fig. 13.a-b. It must be assumed that the vertical axis of the jars on figure 13 are located where the profile lines stop at the base level. Regarding the Intermediate Bronze Age storage-jars, most jars of Type 2 appear to be more elongated in proportion than the jars of Type 1.

[148] Harush and Grosman 2021: 12, 15-16, 18.

of the ceramic profiles should concentrate on the upper part of the kraters. The addition of nine RS bell kraters in the analysis should not change the global picture obtained so far (Appendix 3), since their dimensions and proportions are mostly similar or close to most kraters studied by Anson, for instance:
- a RS bell krater from Kition[149]: H. 26.1 cm, max. D. 25.6 cm, thus a ratio *maximum radius/height* of 0.49;
- a RS bell krater from Hala Sultan Tekke[150]: H. 25 cm, max. D. 26.6 cm, thus a ratio *maximum radius/height* of 0.53;

However, a RS bell krater from Ankastina is of squatter shape than the RS bell kraters studied by Anson (H. 22-23 cm, max. D. 28.5, thus a ratio *maximum radius/height* of 0.61-0.64)[151]. This suggests that greater variations in the shape proportions may occur with a higher number of RS bell kraters examined.

Nevertheless, the question is whether the fifteen RS bell kraters studied by Anson would become a cluster distinct from the clusters comprising pictorial ring-based kraters stylistically different from the Rude Style. As pointed out above, vases of different dimensions may have similar proportions. An LH IIIB1 Mycenaean pictorial krater from Pyla-*Kokkinokremos* (max. diam. of c. 36 cm, new estimated height of 31.7 cm)[152], whose dimensions are relatively close to Anson's krater no. 1, has similar proportions to Anson's kraters no. 18 and 26. An LH IIIB2 chariot krater from Pyla-*Kokkinokremos* as well[153], which is larger than all RS bell kraters examined so far, has also close proportions to these: H. 39.5 cm, max. D. 43.1 cm, thus a ratio *maximum radius/height* of 0.54; height of maximum radius of 25 cm, thus a ratio *height of maximum radius/height* of 0.62. This krater could thus be clustered together with RS bell kraters. This may also occur for a large LH IIIB2 or CypIII Early 1 krater decorated with fishes (H. 33.1 cm, rim D. 33.8 cm), whose proportions are similar to those of the RS bell kraters, unlike a carinated CypIIIC Early 2 krater (H. 23.3 cm, rim D. 32 cm)[154].

It is also unclear whether RS bell kraters may become a cluster distinct from the clusters including pictorial ring-based kraters from mainland Greece in an analysis of variations in the shape of ring-based kraters. The latter may constitute different (sub-) clusters, despite showing a similar style of decoration. For instance, two LH IIIB pictorial kraters from Midea decorated with a row of marsh birds in the upper body present different proportions, especially in the lower body[155]:

- one has proportions close to certain RS bell kraters, with a height of 28.2 cm and a maximum diameter of 30 cm (thus a *maximum radius/height* of 0.53; height of maximum radius of c. 17.2, thus a ratio *height of maximum radius/height* of 0.62; a base radius of c. 5.5, thus a ratio *(maximum radius – [minus] base radius)/height of maximum radius* of 0.55);

[149] Mountjoy 2018: 647, no. 470, fig. 322; also p. 72, fig. 29.
[150] Åström, Bailey and Karageorghis 1976: 75, no. 86, pl. L, LXVI.
[151] Mountjoy 2018: 719, no. 102, fig. 353, and p. 79, fig. 33 (Ankastina 3).
[152] Kostopoulou 2021: 280, no. 2, fig. 6 on p. 244 *(PK 14 172)*.
[153] Karageorghis 1982: 77-82, esp. 78, fig. 2, with a Cypro-Minoan sign painted on the bottom of the vase; Karageorghis and Demas 1984: 33, no. 12, pl. XVIII, pl. XXXIII; Iacovou 2006: 193-194, fig. 1, perhaps a local workshop. For the two marks, see also Hirschfeld 2006: 91, no. 24.
[154] Both FS 282: Mountjoy 2018: 930-932, no. 4, fig. 464 (globular); 719-720, no. 102, fig. 353 (carinated).
[155] Demakopoulou 2020: 115, fig. 3.a-c, and p. 119, fig. 6.

- the other is of squatter shape than all RS bell kraters, reportedly with a rim diameter of 30 cm (but c. 28.8 cm on the profile), showing on the profile a height of c. 22.3 cm and a maximum diameter of c. 30.3 cm (thus a ratio *maximum radius/height* of 0.68; height of maximus radius of c. 14 cm, base radius of c. 4.9, thus a ratio *(maximum radius – base radius)/height of maximum radius* of 0.73).

Likewise, two LH IIIB pictorial ring-based kraters from Tiryns vary in shape proportions:

- the earlier one (LH IIIB1)[156] is elongated as certain RS bell kraters, with a ratio of the height of maximum diameter to the vase height , which can be compared to all the above-mentioned pictorial ring-based kraters, reportedly having a maximum diameter of 40 cm, but showing on the profile a maximum diameter of 45 cm to a height of 40 cm (thus a ratio *maximum radius/height* of 0.56; height of maximum diameter of c. 28.5 cm, thus a ratio *height of maximum radius/height* of 0.71);

- the later one (LH IIIB2)[157] is more elongated than the two aforementioned pictorial ring-based kraters from Midea and most RS bell kraters studied by Anson, presenting a maximum diameter of 28 cm and its profile a height of c. 27.9 cm (thus a ratio *maximum radius/height* of 0.5; a height of maximum diameter of c. 15.3 cm, thus a ratio *height of maximum radius/height* of 0.54).

By comparison, in LH IIIC Early, two pictorial ring-based kraters (FS 282) from Korakou, whose motifs are a bird and a fish respectively, are both less elongated than the RS bell kraters studied here, but their ratio *height of maximum radius/height varies*. A LH IIIC Middle example from the area of Pylos in Messenia is even of squatter shape than one of the two kraters from Korakou:

- LH IIIC Early krater from Korakou[158]: H. 22.7 cm, max. D. 28.4 cm (thus a ratio *maximum radius/height* of 0.62; a height of maximum diameter of 14.1 cm, thus a ratio *height of maximum radius/height* of 0.62;

- LH IIIC Early krater from Korakou[159]: H. 19.7-20.2 cm, max. D. 24.2 cm, thus a ratio *maximum radius/height* of 0.6; a height of maximum diameter of 13.2 cm, thus a ratio *height of maximum radius/height* of 0.65.

- LH IIIC Late krater from Pylos-*Pisaskion*[160]: dimensions measured on profile, H. c. 25 cm, max. D. 32.3 cm, thus a ratio *maximum radius/height* of 0.64.

Finally, it must be stressed that, in the Post-palatial period, the rims of some pictorial ring-based kraters are as large as the bodies (for instance, a LH IIIC developed ring-based krater with a complete profile from Tiryns[161]; the LH IIIC Middle Warrior Vase[162]). In LH IIIC Early, some examples of the Mycenaean decorated ring-based krater have a rim as large as the body[163]. In LH IIIC Middle, the shape of Mycenaean decorated

[156] Güntner 2000: 64, Motiv Hirsch 1, pl. 28.1a-b.
[157] Güntner 2000: 58-59, Motiv Stier 52A, pl. 24.1a-b.
[158] Rutter 1974: 184, no. 39, fig. 65.2 on p. 187; Mountjoy 1999: 233-234, no. 190, fig. 76; Crouwel 2006: 16, fig. 3.
[159] Rutter 1974: 214, fig. 90.8; Mountjoy 1999: 233-234, no. 192, fig. 76.
[160] Blegen *et al.* 1973: 229, fig. 289; Mountjoy 1999: 355-356, no. 128, fig. 122; Crouwel 2006: 17, fig. 5.
[161] Güntner 2000: 156-157, Motiv Tintenfisch 39, pl. 82.1.
[162] Sakellarakis 1992: 124, no. 32.
[163] Mountjoy 1986: 149, fig. 188.2.

ring-based kraters (FS 282[164]) varies: the body may be rounded or carinated, the upper body may be incurving or quite straight[165], and at the end of this sub-phase, practically vertical, with a rim larger than the body[166].

In LH IIIC Late, the upper body of the Mycenaean decorated ring-based krater shape (FS 282) is also straight or very slightly incurving, with a squared rim larger than the body[167]. While pictorial pottery becomes rare in LH IIIC Late[168], this specific feature (straight upper body with a squared rim larger than it) is encountered in pictorial ring-based kraters too, as illustrated by an example from Ramovouni-*Lakkathela* in Messenia[169], and should be regarded as a relevant differentiation factor in the chronological development of this shape from LH IIIB to LH IIIC, in the Greek mainland as well as in Cyprus[170]. Nevertheless, such a fine-grained typological distinction does not require to be demonstrated through a technique of multivariate analysis. On the other hand, the possibility that further variations in the shape of ring-based kraters occurred in LH IIIC should be explored by a study encompassing a higher number of vases, involving a series of new measurements and calculations that goes beyond the frame of this article.

Dimensions and capacities of RS bell kraters

In order to better explore the idea that standard measurements were perhaps shared by potters producing RS bell kraters, the dimensions of the vases and their capacities should be now compared. In this purpose, the computer program *Pot Utility* or the web-based applet *Calculating vessel capacities* (© Synthèse et Analyse [LISA] and Centre de recherches archéologiques [CReA]) may be used[171]. Employing the CReA web-applet require to partially revise the drawings of Anson, by erasing the decoration, re-drawing the vertical axis of the vases, which must be straightened, and by calculating the height of the vases. Once that is done, the image is processed automatically; the height of the vase must then be changed. With *Pot Utility*, the capacities obtained by clicking on the profile can hardly be reproduced accurately, but there is no need to process the images through a Computer-Aided Design program beforehand, except for straightening the vertical axis of the vases. The dimensions of the vases can easily be checked in *Pot Utility* (Fig. 12). The capacities provided in this article should be regarded as approximative indicators of the maximum quantities that the kraters may have held. Of course, kraters used in commensal activities were never filled up to the top of the rim.

[164] Furumark 1972: 49, fig. 14: template drawing of this shape, FS 282, dated to LH IIIC1 late, vs. a FS 282 template drawing dated to LH IIIC1 early.

[165] Mountjoy 1986: 172-175, fig. 223-225.

[166] Mountjoy 1986: 175-176, fig. 226.

[167] Mountjoy 1986: 190-191, fig. 253.

[168] Crouwel 2006: 15.

[169] Mountjoy 1999: 359-360, no. 139, fig. 124; Crouwel 2006: 21, fig. 20.

[170] For a pictorial bell krater with a rim larger than the body, dated to the 12th or early 11th century, from Enkomi, see Courtois 1971: 269-270, no. 1042, fig. 106; the lower part is not preserved.

[171] *Pot Utility*: Thalmann 2007. Calculating vessel capacities: Engels, Bavay and Tsingarida 2009; https://capacity.ulb.be/index.php/en/home/. See Phialon 2020: 198.

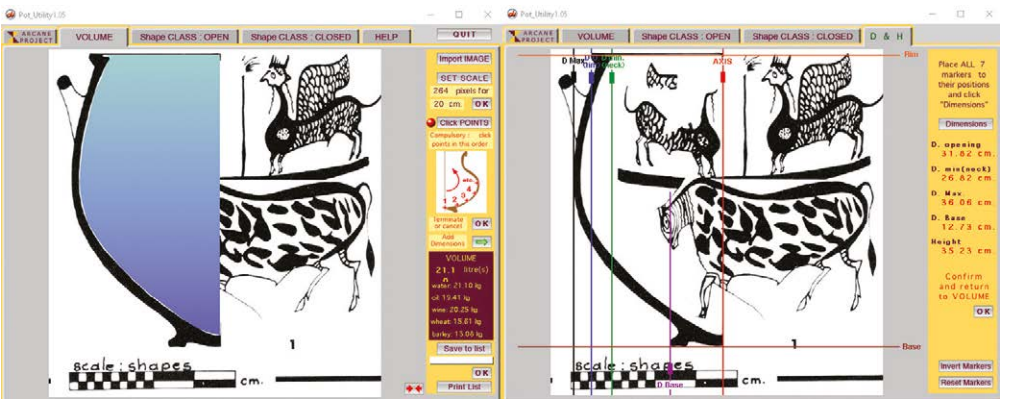


Fig. 12. Dimensions and capacities estimated using *Pot Utility* (krater shape no. 1 drawn by Anson 1980b)

First, it is worth comparing the dimensions of RS bell kraters studied by Anson (1980), especially the height and maximum diameter (see Appendix 2). The scatter plot shows unsurprisingly a positive linear relationship between the variables (the bigger a krater, the wider it is) (Fig. 13).

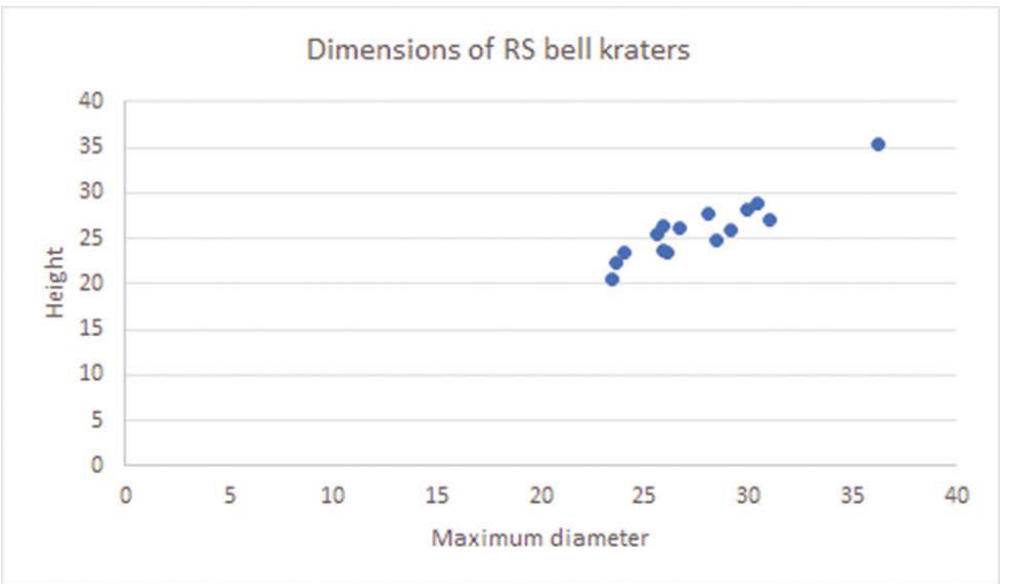


Fig. 13. Heights and maximum diameters of RS bell kraters (krater shapes drawn by Anson 1980b)

The dispersion of the dots is low (the kraters have dimensions close to each other), except for an outlier (krater no. 1, H. 35.31, max. D. 36.22, capacity of 21.1 litres), and there is no particular reason to divide data points into two groups. However, it is clear that a krater that exceeds slightly 20 cm in height and maximum diameter should be differentiated from a krater approximating 30 cm in height and maximum diameter: RS bell krater no. 18 is particularly small for a krater (H. 22.37 cm, max. D. 23.41 cm), holding only 4.81 litres, whereas krater no. 39, which is larger (H. 28.84 cm, max. D. 30.45 cm), has a capacity of 12.82 litres. The difference in size and capacity between the

RS bell kraters is thus obvious. The scatter plot showing the capacities of RS bell kraters (Fig. 14) presents the same characteristics as the previous one, with krater no. 1 as an outlier. In this graph, if data should be divided into two groups, the first would include the kraters having diameters larger than 28 cm and capacities greater than 9 litres, as opposed to the second.

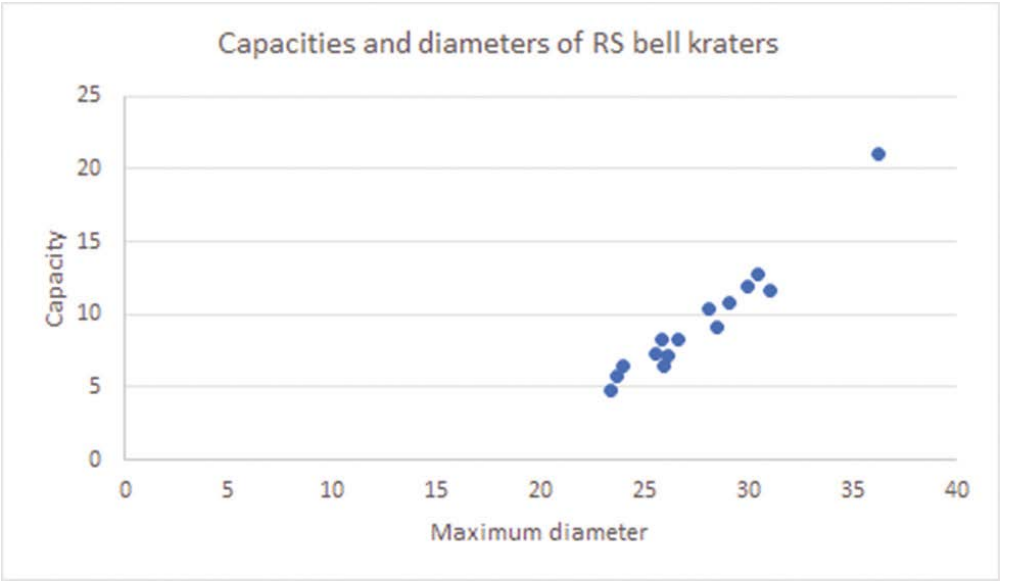


Fig. 14. Capacities and maximum diameters of RS bell kraters (krater shapes drawn by Anson 1980b)

Here again, it must be added that the nine additional RS bell kraters from various Cypriot sites (e.g. Kition, Hala Sultan Tekke, Pyla-*Kokkinokremos* and Pyla-*Verghi*), dated to LH IIIB, do not change the global picture obtained so far, since their capacities range from c. 8.3 litres to c. 12.3 litres (see Appendix 3). In one case only, the imported LH IIIB1 Mycenaean pictorial bell krater from Pyla-*Kokkinokremos* (20.59 litres) has a capacity close to Anson's RS bell krater no. 1 (21.10 litres), which is the largest RS bell krater. More drawings of the Mycenaean pictorial krater decorated with bulls would be needed to suggest that the potters were perhaps interested in fashioning RS bell kraters of a capacity similar as the Mycenaean pictorial kraters. The LH IIIB2 chariot krater from Pyla-*Kokkinokremos*, which is larger than all RS bell kraters examined so far, has a larger capacity of c. 36 litres. This krater is even bigger in size and capacity than most Mycenaean pictorial kraters with complete profiles mentioned above, except for a LH IIIB1 krater from Tiryns, decorated with deers, of slightly more than 41 litres. Therefore, ring-based kraters (FS 281 and 282), which are characterized by similar morphological features, may vary largely in size and capacity.

In the Post-palatial period, Mycenaean pictorial ring-based kraters varied in shape too, and it is generally agreed that the most robust kraters appeared in LH IIIC Middle, in a phase following and preceding a decline in the production of pictorial pottery[172]. It must be stressed that the krater shape in question is characterized by an almost vertical

[172] Crouwel 2006: 15-16, 21.

upper body and a square rim. The best example is the Warrior Vase from Mycenae (settlement), whose capacity reaches c. 52 litres. Its rim diameter exceeds slightly 50 cm. The fragmentary krater found in the settlement of Grotta (Naxos) is even larger, with a rim diameter approximating 60-61.6 cm[173] and a capacity probably greater than 100 litres[174]. This contrasts sharply with the capacities of 9.25 and 5.68 litres obtained for the two LH IIIC Early pictorial kraters from Korakou examined above.

Therefore, it seems that the dimensions and capacities of Mycenaean pictorial ring-based kraters produced in LH IIIB and IIIC may vary strongly. Some of them are quite similar in shape, size and capacity to the RS bell kraters, others are much larger (see Appendix 3). It is possible that most Mycenaean pictorial ring-based kraters produced in LH IIIB2 were not larger than 30 cm in height and diameter, by contrast to LH IIIC Middle, when the largest Mycenaean pictorial kraters are observed.

The question is whether Mycenaean pictorial amphoroid kraters would have capacities similar or close to Mycenaean pictorial ring-based kraters and RS bell kraters. It must be remembered that Mycenaean pictorial amphoroid kraters, which are dated to LH IIIA2 and LH IIIB, usually range in height from 25 cm to 48 cm (see Appendix 1). The six complete (or almost complete) Mycenaean pictorial amphoroid kraters (LH IIIA2 Early to LH IIIB) from tombs at Kalavasos-*Ayios Dimitrios*[175], vary considerably in size and capacity: they range in height from 34.1 cm to 54.5 cm, in maximum diameter from 30 cm to 49.8 cm, and in capacity from 12.3 litres to 53 litres[176]. The largest Mycenaean pictorial amphoroid kraters from Kalavasos-*Ayios Dhimitrios* could have then held much more beverage than the two LH IIIA1 open kraters (FS 7) from this site (11.55 litres and 19.85 litres)[177], and more than the largest RS bell kraters examined in this research.

Variations in size and capacity are also encountered in kraters of other pictorial styles. Interestingly, the largest Minoan pictorial amphoroid kraters found in Cyprus and in the Levant, dated to LM IIIB, exceed in height 55 cm[178]. It is thus likely that their capacities are even greater than most of the largest Mycenaean amphoroid kraters. Nevertheless, smaller examples of the Minoan pictorial amphoroid krater were also found in Cyprus. Further research on capacities of kraters and consumption practices should focus on the find-contexts of the vessels, distinguishing between settlement and funerary contexts[179].

Therefore, because of the variations in size and capacity of pictorial kraters, it impossible to confirm that any clear standard measurements have been applied to pictorial kraters during their manufacturing process in the Late Bronze Age, whatever the pictorial style. However, the number of complete pictorial kraters examined so far is too

[173] Vlachopoulos 2003: 227, fig. 10; cited by Yasur-Landau 2010: 138. Also Vlachopoulos 1999: pl. 1, see also esp. pl. 2, dim. on p. 75 (H. pres. 50 cm, body diam. 59 cm, rim diam. 60-61.6 cm); cited and illustrated by Crouwel 2006: 18, fig. 12.

[174] Rim diameter of c. 66.1 cm and capacity of c. 115 litres estimated as on the profile published in Vlachopoulos 2003: 227, fig. 10.

[175] South 2006: 144, eight Mycenaean pictorial kraters coming from four rich tombs.

[176] South 2006: 137-143, no. K-AD 1613, K-AD 1614, K-AD 1619, K-AD 1978, K-AD 2359, K-AD 2360, fig. 11-12.

[177] South 2006: 135-136, K-AD 690, K-AD 761, fig. 12.

[178] Crouwel and Morris 2015: Pyla-*Kokkinokremos* (octopus motif), see p. 190, no. 1, fig. 37, H. (restored) 57.3 cm; Larnaca museum (bird, bucranium), see p. 192, no. 2, fig. 38, H. (restored) 82 cm.

[179] On an exceptional cultic context, see the White Painted Wheel-made krater from Hala Sultan Tekke («Creature krater», rounded belly, low stemmed, 19.6 litres, H. 42 cm, max. D. 49 cm, LC IIIA Early), see Fischer and Bürge 2018: 61, 63, 239-240, 294-295, fig. 2.42, 3.19.b, 3.49.a-b, also p. 256. On two other White painted wheel-made pictorial style kraters (c. 6.8 litres and c. 36 litres), see Fischer and Bürge 2018: 56, 240-241, 296-297, fig. 2.31, 3.50:1; and p. 146, 148, 241-242, 372-373, fig. 2.99, 3.102.a-b.

low to draw definitive conclusions. A larger study encompassing various Late Bronze Age krater shapes may provide further insights on potters' practices. Groups of Mycenaean kraters may show only small variations in size and capacity. For instance, the dimensions and capacities of five complete Mycenaean decorated stemmed kraters (i.e. pedestaled kraters, FS 9) from the Palace of Nestor at Pylos (LH IIIB) are quite homogenous: they range in height from 29 cm to 35.5 cm, in rim diameter from 30.7 cm to 35.5 cm, in body diameter from 32 cm to 35.3 cm, and in capacity from 11 litres to 14.6 litres[180]. If further LH IIIB stemmed kraters (FS 9)[181] would have close or similar dimensions and capacities, I would not exclude the idea that potters may have referred to some standard measurements and applied them approximately.

Conclusions

This article shows that it is definitely worth integrating quantitative data such as dimensions and proportions into the study of a ceramic shape. Measurements and calculations may be used to demonstrate and *quantitatively* classify variations in the shape of vases that would just be qualitatively described. However, these data should be interpreted with great caution. Measuring the dimensions of vases, calculating their proportions and estimating their capacities to the nearest hundredth in no way reflects the potters' real technical concerns, even when potters may refer to standard measurements, using for instance measuring tools or a gauge resembling a *chandelier de jauge*[182] for controlling the dimensions of a series of vases. As regards RS bell kraters, there is little reason to believe that such a control happened during the manufacturing process, as the dimensions and capacities of these kraters vary too widely within a group that should be more homogenous to suggest this.

Nevertheless, RS bell kraters vary only slightly in shape proportions, especially regarding the ratio *maximum radius/height*, the ratio *height of the maximum radius/height*, the ratio *(maximum radius – base radius)/height of the maximum radius*, and the ratio *(maximum radius – rim radius)/(height – height of maximum radius)*. It may be assumed that the most significant characteristics of a vase that a potter may have to control in terms of measurements and proportions would be the maximum diameter as well as the rim and base diameters in addition to the height. However, a skilled potter may have worked with a model or shape template, without measuring dimensions and calculating proportions, but visually and tactilely ensuring that the proportions were respected. Regarding RS bell kraters, I even suggested in this article that different workshops may have employed similar shape templates, inasmuch the RS bell kraters chemically analysed, which do not to share as sources the same geographic origins in Cyprus (Enkomi, and perhaps Kition)[183], vary only slightly in shape proportions.

In other words, the potters from two different areas in Cyprus may have communicated sharing the same shape templates, in a way resembling what the painters may have

[180] Blegen and Rawson 1966: 400-402, fig. 387-388, Shape 63.

[181] E.g. in the Argolid, kraters FS 9: Mounjoy 1999: 139-140, no. 257, fig. 34 (Mycenae, LH IIIB1, complete), and pp. 148-149, no. 287, fig. 38 (Tiryns, LH IIIB2, almost complete). However, the maximum diameter of the krater from Mycenae is at the body height, unlike the krater from Tiryns where it corresponds to the rim diameter.

[182] Blondel 2001: 126.

[183] Anson 1980b: 14-15.

done using standard design forms. However, the transmission of a shape template, perhaps a krater used as a model, from a potter to another, did not necessarily involve a collaboration with the same painter. Moreover, the dimensions of the RS bell kraters studied in this article, though most of them have a height of c. 23-28 cm and a maximum diameter of c. 25-30 cm, fluctuate too much to suggest that the communication between potters would have extended to the point of sharing accurate measurements. There are also no particular reasons to believe that the consumers/purchasers of RS bell kraters were interested to acquire vases of the same capacities for the events they organised. An approximative knowledge of how much a krater may have contained was probably adequate enough for them. In addition, it is worth noting that the painted or incised marks observed on pictorial pottery found in Cyprus, limited in number[184], do not include typical RS bell kraters so far[185]. This lack of evidence on vases produced and used in Cyprus is not surprising, since these marks are preferably interpreted as traders' marks rather than potters' marks[186].

Furthermore, the question arises whether the work of a potter may be evidenced by specific morphological features encountered in a series of vases and whether proportions, such as the ratio *height/ distance from rim to handle start* («handle height»), may be used in this purpose. In the case of the examined RS bell kraters, the sequence obtained for this ratio is compatible with the stylistic groups established by Anson (see Fig. 3)[187]. However, a set of corroborating morphological features should be considered to confirm this hypothesis. Their bases, which were shaped by trimming (French: *tournassage*[188]), vary slightly[189], but these variations cannot be linked to the «handle height» sequence.

Another issue is to process the numerical data related to shape proportions using statistical methods and cluster analyses in order to classify variations in the shape of vases such as the RS bell kraters (see Fig. 1) or Mycenaean pictorial amphoroid kraters. A new «fine-grained numerical typology and classification of variations» in the shape proportions[190] should also be consistent with a chronological sequence. This reflects only partly in the shape classification of Anson[191], considering that only Group B includes RS bell kraters with complete profiles, which are homogenously attributed to the Middle stage of the Pastoral style by Vermeule and Karageorghis[192]. The other groups do not show such homogeneity with kraters assigned to the middle and late stage of this style (see Fig. 4). However, it is true that the production of RS bell kraters was limited in time, covering c. 50 years (LH IIIB2), in comparison with the production of other pictorial kraters. A diachronic test would be more relevant if it were not limited to a pictorial style or if it applied to a krater shape produced over a longer period, as in the case of the pictorial amphoroid krater, but the analysis should be then started afresh from the initial stage of drawing and measuring dimensions of vases.

[184] Hirschfeld 2006: 83-84, 85 (32 of the 37 marked pictorial vases were found on Cyprus).

[185] I.e. RS bell kraters with bull or bird motifs. For a Pastoral style chariot krater with marks: Hirschfeld 2006: 94, no. 24, see Karageorghis 1982: 78, fig. 2.

[186] See discussion in Hirschfeld 2006: 86-88.

[187] Anson 1980b: 10, Table II.

[188] Blondel 2001: 130.

[189] Anson 1980b: fig. 1-3.

[190] Anson 2017: 3.

[191] Anson 1980b.

[192] Vermeule and Karageorghis 1982.

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Appendix

Appendix 1. Measured heights and diameters of Mycenaean pictorial amphoroid kraters according to Morris (1989) and Anson (2017), with references to Vermeule and Karageorghis (1982 = MPVP) and Recht and Morris (2021 = R&M)

Measurements in cm
* restored / reconstructed (may affect the original dimensions)
+ larger diameter indicated in column 13 (50%) or column 14 (60%) in Anson's Table 1 (2017)

Morris 1989				Anson 2017					MPVP	R&M
No.	H.	Rim D.	Base D.	No.	H.	Rim D.	Base D.	Max. D.	No.	No.
6	36.7	27.5		2	36.7	34	16.7	46.8	III.16	21
13	38.5	27	12.2	7	38.5	34.5	16.4	43.9	III.18	24
14	42.5	31	13.3	16	42.5	34.4	16.4	46.1	IV.1	20
15	48	35	15	5	48	29.2	16.8	42.3	IV.3	5
25	37.5	26.4		1	37.5	33.2	14.7	46.7	III.2	11
27	37.7	28	12.5	6	37.5	31.6	17.2	47.3	IV.12	65
28	46.8	29	13.3	10	47.2	27.6	14.9	41.1+	IV.19	107
29	45.9			11	45.9	31.7	13.5	43.1	IV.21	58
30				12	46	28.7	12.9	38.8	IV.24	105
41	41.3*	24.6	14*						IV.25	142
44	25.9	19	9.5	8	26	33.1	18.7	44.3	IV.16	64
49	42.5	31		7	42.5	34	14.2	45.3	IV.15	108
50	42.6	31	c. 13	9	42.4	34.1	15.5	43.9	IV.18	86
53	43.5	26	13	13	43.5	28.9	15.7	42.6	IV.27	87
57	39.3	28	12.3	3	39.3	35.6	15.7	46.9	IV.49	144
64	44-45.5	32.5	13.5	35	44.7	34.8	15.9	45.8	XII.4	126
69	45*	26	13						IV.73	134
70	43	37.6							IV.50	154
77	43.5		12.7	15	43.4	29.3	14.9	43.3+	IV.48	74
78	42.5	30	13	37	44.5	29.9	16	39.2*	XII.3	123
79	46*	28.5-29		17	45.9	34.6	16.2	43	IV.51	61
84	44	25	12	19	44.45	27.3	15.9	40.6	IV.62	59
85	46	28		14	?	30	16.4	38.9+	IV.28	75
86	41.5	31		18	41.5	27.4	14.5	43.1	IV.55	109
94	39.5	29.5	12						V.10	60
95	38	23	11							112
124	33	25.5		36	43	34.6	14.9	41.7	XII.6	124
141	44.4	27		20	41.6	37.1	15.9	44.5	V.1	257

142	42	31		21	42.4	32.5	16.4	43+	V.2	258
143	45			22	46.99	30.4	17	43+	IX.1.1	290
145	45.5*	26.5–27							IX.1	287
146	48	30.4	14.5	26	38	31.5	16.4	39.9	V.8	314
161	43.6	Max.D. 35.5		29	43	28.5	17	39.5+	V.14	255
167	44.5	29.2	13	28	43.6	30	15.9	41.9	V.13	240
168	43	30	13	30	43	35.9	17.1	45	V.17	253
169	39	31	13.8	31	38	26.8	15.5	41.8	V.18	239
170	37.8	28.5	12.5	32	37.8	33.3	14.2	41.2	V.23	236
171	45.6	31	15	23	43	33.7	15.2	40.7	V.4	256
172	38.4*	26		25	?	27.3	13.6	38.5+	V.6	254
173	43	30		24	43	30.2	14.3	38+	V.5	244
174	46.5–45.5	26.5	12.8	27	46.2	29.1	14.8	39.8+	V.11	241
176	32	24.5							V.19	291
177	26.6	31.5							V.22	249
178	46.5	30	14						V.21	306
202	c. 45*	24.8	14							296

In Anson's Table 1 (2017: 12), I assume that rim diameters are noted in column 18, and base diameters in column 8, and not a series of vase radius to height ratios, as indicated in the legend (Anson 2017: 11). There are also two vases bearing the number 7, contrary to what appears in the dendrogram of this article (Anson 2017: 7, fig. 2).

Appendix 2. Calculated heights and widths (diameters) of RS bell kraters drawn by Anson (1980b: 3-6, fig. 1-3) along with estimated capacities

Dimensions in cm; capacities in litres.
Columns 2–12: the width of each vase at 10% along the vase's vertical axis.
Width (or diameter) = radius on the drawing of the vase multiplicated by 40 (i.e. 2x20), divided by 2.86 or 2.87 or 2.85.
H = Height; Max D = Maximum Diameter; h of MD = height of the maximum diameter; Cap. = Capacity

No.	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Max D	h of MD	H	Scale	Cap.
1	12.86	14.12	22.79	29.37	33.70	35.80	35.94	35.38	33.70	31.74	31.88	36.22	20.34	35.31	2.86/20	21.10
6	10.90	13.28	19.02	23.63	26.99	29.37	29.93	29.37	28.53	27.41	27.97	29.93	16.15	28.11	2.86/20	11.87
7	9.65	11.18	16.78	21.53	25.03	26.01	25.87	25.45	24.75	23.07	23.49	25.87	13.63	26.36	2.86/20	8.22
8	9.37	8.67	13.84	18.60	21.81	23.07	23.49	23.63	23.49	22.37	22.51	23.63	15.10	22.37	2.86/20	5.73
9	9.79	9.51	14.54	18.88	22.23	24.19	25.31	25.17	24.19	22.51	23.49	25.59	16.15	25.45	2.86/20	7.23
18	9.05	9.40	13.44	17.49	20.97	23.13	23.13	22.43	21.39	20.34	21.25	23.41	10.73	20.55	2.87/20	4.81
19	10.59	10.17	14.77	18.95	22.85	25.22	25.78	24.39	22.57	20.62	22.29	25.92	13.51	23.69	2.87/20	6.47
21	11.14	11.21	17.56	23.62	28.22	30.59	31.01	30.24	29.54	28.15	29.00	31.01	15.19	27.00	2.87/20	11.65
26	9.89	11.98	17.83	23.97	26.89	28.15	29.12	28.71	28.01	26.75	27.03	29.12	15.81	25.92	2.87/20	10.83
34	10.38	12.35	17.40	21.47	24.28	26.38	27.92	27.92	27.22	25.96	27.78	28.07	18.45	27.64	2.85/20	10.36
39	11.08	12.77	19.22	25.68	29.19	30.17	30.17	29.89	29.33	28.35	28.91	30.45	16.14	28.84	2.85/20	12.82
40	10.10	10.80	16.14	20.77	24.84	27.50	28.35	27.78	27.08	26.10	26.66	28.49	14.24	24.77	2.85/20	9.16
41	9.54	9.54	13.33	18.94	23.15	25.26	26.10	25.68	24.56	22.87	23.85	26.10	14.17	23.36	2.85/20	7.16
44	11.22	13.19	16.84	20.21	23.15	25.54	26.66	26.10	24.98	23.85	24.00	26.66	16.35	26.24	2.85/20	8.27
53	9.54	10.10	14.87	19.22	22.31	23.85	23.85	23.15	22.03	20.91	22.03	24.00	12.98	23.43	2.85/20	6.49

Regarding krater no. 21, the diameter (corresponding to the rim diameter, i.e. at 100%) and the height of the vase are noted in the catalogue of Anson (1980b: 17).

For the bibliographical references, see the Appendix of Anson (1980b: 16-18).
For krater no. 26, to add: Mountjoy 2018: 919, no. 4, fig. 455 on p. 918 (see Catling 1957: 43, fig. 20.191).

Some variations in the dimensions provided in the following publications:
No. 1: Smith 1925: 8 (II c b), no. 1, pl. 10.1, H. 35.6; Karageorghis 1965: 240-241, no. 3, pl. XXV.1, H. 35.5, D. 32.5; British museum catalogue online, C417: H. 41, W. 40.50, D. 36.6.
No. 6: Smith 1925: 8, no. 9, pl. 10.9, H. 28.2; Karageorghis 1965: 239-240, no. 1, pl. XXIV.6, H. 28.5, D. 27.9; British museum catalogue online, C421: H. 28.5, D. 28.
No. 7: Dikaios 1969-71: 917, no. 45, pl. 233.3, H. 27; Mountjoy 2018: 549, no. 15, fig. 279 on p. 550, H. 27-28.2, rim D. 27 (25.7 at handle), base D. 10.4; *capacity: 11.52 L.*
No. 8: Dikaios 1969-71: 917, no. 47, pl. 233.1, H. 24.
No. 9: Louvre museum catalogue online, AM679: H. 24.5, D. 26.5.
No. 18: Karageorghis 1965: 249, no. 2, fig. 54, H. 19.5, D. 21.2.
No. 19: Smith 1925: 7 (II c b), no. 9, pl. 7.9, H. 23.3; British museum catalogue online, C420: H. 23.4, D. 26.

No. 34: Smith 1925: 7 (II c b), no. 3, pl. 8.3, H. 26.6; British museum catalogue online, C423: H. 26.5, D. 27.7; Mountjoy 2018: 151, no. 7, fig. 79 on p. 149, H. 26.4-6, rim D. 26 (27.2 at handles), base D. 9.8; *capacity: 10.41 L.*
No. 39: Karageorghis 1965: 242-244, no. 6, fig. 53, pl. XXIV.7, H. 28, D. 30; see Gjerstad *et al.* 1934, pl. XCI, third row from top, fourth from left.
No. 40: Smith 1925: 7 (II c b), no. 7, pl. 7.7, H. 24.2; British museum catalogue online, C418: H. 23.8, D. 26.5.
No. 41: Nicolaou 1972: 63, no. 9, fig. 4.9 on p. 84, H. 24, D. 24 (Mycenaean IIIB1).
No. 44: Smith 1925: 7 (II c b), no. 1, pl. 8.1, H. 26; British museum catalogue online, C422: H. 25.9, D. 27.4.
No. 53: Smith 1925: 7 (II c b), no. 3, pl. 7.3, H. 23.5; British museum catalogue online, C419: H. 23.9, D. 22.8.

Appendix 3. Dimensions and capacities of RS bell and pictorial ring-based kraters with complete profiles from Cyprus (in addition to Anson 1980b) as well as Mycenaean pictorial ring-based kraters from mainland Greece.

in italic: new dimensions (cm) and capacities (litres) estimated in this article; motif(s): only the main pictorial motif(s) indicated

RS bell and Pictorial ring-based kraters from Cyprus

Ankastina, Tomb; LH IIIB2; FS 281; Rude Style, motifs: tree spirals; H. 22-23, rim D. 27.2 (26.7 at handles), max. D. 28.5, base D. 9.4, *capacity: 8.73*; Mountjoy 2018: 924, no. 3, fig. 458 on p. 925 (or CypIIIC Early 1, i.e. LH IIIC Early); see Nicolaou 1972: 62, no. 1 (LH IIIB1), pl. XV.3.

Hala Sultan Tekke, Tomb 1; LH IIIB; Rude Style, motifs: goats; H. 25 [as completed], D. 24 [rim], *max D. c. 26.7*, *capacity: 8.92 [as completed]*; Åström, Bailey and Karageorghis 1976: 73, no. 22, pl. L, LXVI.

Hala Sultan Tekke, Tomb 1; LH IIIB; Rude Style, motifs: goats; H. 25, *max. D. 26.6*, D. 24 (restored) [rim], *capacity: 8.43*; Åström, Bailey and Karageorghis 1976: 75, no. 86, pl. L, LXVI.

Hala Sultan Tekke, Building C, Room 61, Well F1750; CypIIIC Early 2 (LH IIIC Early); FS 282 carinated; motif: fish; H. 23.3, rim D. 32, base D. 12, *capacity: 10.68*; Mountjoy 2018: 719, no. 102, fig. 353 on p. 720; see Åström 1998: fig. 106.

Kition, Temenos A Pit H 3228; LH IIIB2; FS 281; Rude Style, motifs: bull with tree; H. 26.1, rim D. 23.5-8, max. D. 25.6, base D. 10, *capacity*: 8.31; Mountjoy 2018: 647, no. 470, fig. 322 on p. 646; see Karageorghis *et al.* 1981: pls. V.20, XI.5.

Kyrenia, Tomb; LH IIIB2; FS 281; Rude Style; motifs: bull, tree spiral; H. 26.8, rim D. 27.6-28, base D. 9.4-6, *capacity: 11.35*; Mountjoy 2018: 925, 927, no. 1, fig. 460 on p. 927; see Vermeule and Karageorghis 1982: VI.19.

Pyla-*Kokkinokremos*, settlement, Rooms 5.5 and 5.15; LH IIIB1, i.e. LH IIIB Middle; FS 281; Mycenaean pictorial (imported), motifs: bulls and birds; H. c. 38 *(with scale, 31.7)*, rim D. 32.7-33.3, *max D. c. 36*; *capacity: 20.59 (cf. scale)*; Kostopoulou 2021: 280, no. 2, fig. 6 on p. 244 (*PK 14 172*), also p. 245, 247, 274, 279.

Pyla-*Kokkinokremos*, settlement, Room 2 (Sector 4); LH IIIB2; FS 281; Rude Style (middle phase), motifs: bulls; H. 29.5, rim D. 26.2, *max D. c. 29*; *capacity: 12.34*; Kostopoulou 2021: 281, no. 12, fig. 21 on p. 260 (*PK 14 156*), also p. 259, 277.

Pyla-*Kokkinokremos*, settlement, Room 7 (Sector 4); LH IIIB2(-IIIC Early 1?); FS 281; Rude Style, motifs: bulls; H. 27.5-27.9, rim D. 25.7-26.5, *max D. c. 28.5*; *capacity: 11.2*; Kostopoulou 2021: 281, no. 13, fig. 22 on p. 260 (*PK 14 157*), also p. 259, 261, 278, 280.

Pyla-*Kokkinokremos*, settlement, Room 3.1 (Sector 3), LH IIIB2; FS 281; Rude Style, motifs: bulls; H. 26.8-27.4, rim D. 25.7-26.4, *max D. c. 28.5*; *capacity: 10.7*; Kostopoulou 2021: 281, no. 9, fig. 20 on p. 258-259 (*PK 14 186*), also p. 275, 278, 280.

Pyla-*Kokkinokremos*, settlement, LH IIIB2; motifs: chariots; H. 39.5, *max. D. 43.1*, D. 41 [rim?] *(rim D. 39)*, *capacity: 35.98*; Karageorghis 1982: 77-82, esp. 78, fig. 2; Karageorghis and Demas 1984: 33, no. 12, pl. XVIII, pl. XXXIII; Iacovou 2006: 193-194, fig. 1; Mountjoy 2018: 543, no. 1, fig. 276 (LH IIIB2); Kostopoulou 2021: 278-279 (LH IIIB Developed).

Pyla-*Verghi*, Tomb 1; LH IIIB2; FS 281; Rude Style, motif: tree/bush; H. 24.5-25.5, rim D. 22.8-23.5, base D. 9, *capacity: 8.3*; Mountjoy 2018: 549, no. 16, fig. 280 on p. 551; see Dikaios 1969: pl. 233.4 (T.1.48).

No provenance (Cyprus), LH IIIB or CypIIIC Early 1 (LH IIIC Early); FS 282; motifs: fishes; H. 33.1-6, rim. D. 33.8 (31.6 at handles), base D. 14.5, *capacity: 24.15*; Mountjoy 2018: 930-931, no. 4, fig. 464 on p. 932.

Mycenaean pictorial ring-based kraters from mainland Greece

Midea, settlement; LH IIIB2; FS 281; motifs: birds; H. 28.2, max. D. 30, rim D. 28, base D. 11, *capacity: 12.46*; Demakopoulou 2020: 115, fig. 3.a-c.

Midea, settlement; LH IIIB; FS 281; motifs: birds; *H. 22*, rim D. 30 *(or 28.8)*, *max. D. 30.3*, *capacity:10.16*; Fisher 2007: 109, no. 1373, fig. 123; Demakopoulou *et al.* 2017: 42, MidW, fig. 64 on p. 45; Demakopoulou 2020: 119, no. 1373, fig. 6.

Tiryns, settlement, find-context: end LH IIIB-post-palatial; style: LH IIIB1; motifs: deers; *H. 40*, D. 40 *(or 45)*, *rim D. 43.6*, *capacity: 41.87*; Güntner 2000: 64, pl. 28.1a-b.

Tiryns, settlement, find context: LH IIIB developed-IIIC late; style: LH IIIB2; motifs: bulls, birds; *H. 27.9*, *rim D. 26.2*, D. 28 [max.], *capacity: 11.11*; Güntner 2000: 58-59, pl. 24.1a-b.

Tiryns, settlement, find-context: LH IIIC developed; style: LH IIIC developed/advanced; motif: octopus; *H. 29.4*, D. 36 [max.], *rim D. 36.3*, *capacity: 19.32*; Güntner 2000: 156-157, pl. 82.1.

Korakou, settlement; LH IIIC Early; FS 282; motif: bird; H. 22.7, max. D. 27.5 (*max. D. 28.4*), rim D. 25-26.2, *capacity: 9.25*; Rutter 1974: 184, no. 39, fig. 65.2 on p. 187; Mountjoy 1999: 233-234, no. 190, fig. 76; Crouwel 2006: 16, fig. 3.

Korakou, settlement, LH IIIC Early; motif: fish; H. 19.7-20.2, *max. D. 24.2*, rim D. 23, *capacity: 5.68*; Rutter 1974: 214, fig. 90.8; Mountjoy 1999: 233-234, no. 192, fig. 76.

Mycenae, settlement; LH IIIC Middle; FS 282; motifs: warriors (Warrior Vase); H. 42.7, body D. 49.8, rim D. 50.2, base D. 17.8, *capacity: 52.21*; Sakellarakis 1992: 35-37, 124, no. 32. Also Vermeule and Karageorghis 1982: 222, XI.42 (with previous references).

Pylos-Pisaskion, Tomb K2 Dromos; LH IIIC Middle; FS 282; motifs: lion, dogs, stag, man; H. 24-25.5, body D. 31 *(max. D. 32.3)*, rim D. 33-34 *(rim D. 31)*, base D. 11, *capacity: c. 12.7*; Blegen *et al.* 1973: 229, fig. 289; Mountjoy 1999: 355-356, no. 128, fig. 122; Crouwel 2006: 17, fig. 5.

Ramovouni-Lakkathela; LH IIIC Late; FS 282; motif: bird; H. 36.4, rim D. 45.3, *body D. 44.6*, base D. 18.5, with a hole pierced through it, *capacity: 36.13*; Mountjoy 1999: 359-360, no. 139, fig. 124, see Karagiorga 1972: 18, pl. K.a; Crouwel 2006: 21, fig. 20.

Diachronic and Cross-Cultural

Stamped, incised, inscribed – some remarks on notation practices on textile tools from Bronze Age Greece

Agata Ulanowska

Abstract: Different notation practices have been observed on a limited number of Aegean textile tools, specifically loom weights, throughout the entire Bronze Age. They comprise markings with impressing seals and other objects on them, incising signs and writing. This contribution aims to present a brief overview of the observed practices and discusses their possible meanings, with a reference to long lasting practices of marking textile tools in Europe and the Mediterranean, as well as experimental tool making and weaving.

Introduction[1]

Textile tools, especially clay spindle whorls and loom weights, are the most frequently preserved material remains of textile production in Bronze Age Greece. Although they were only parts of more complex implements, such as spindles and warp-weighted looms, their functional parameters (ratios of height, diameter/thickness and weight) had an impact on the quality of threads and fabrics made using them, and became diagnostic features for reconstructing the range of textile products manufactured at a specific spot[2]. A craftsperson's choice of a spindle whorl or a set of loom weights required therefore a precise practical knowledge of the functional relationship between a specific tool and intended product, complementarily to the technique of use. On the other hand, an emotional attachment between craftspeople and their tools can be anticipated from the agency between the object and its user[3], possibly enhanced by the time-consuming nature of spinning and weaving, both rich in symbolic meanings. Amongst Greeks and Romans, such attachments were occasionally expressed explicitly in textual evidence[4]. For the pre-literate periods, an intimate user-tool engagement can perhaps be grasped through the burial offerings of textile tools, traditionally seen as distinctive markers of

[1] The research underlying this paper has been undertaken within my research project «Textiles and Seals. Relations between Textile Production and Seals and Sealing Practices in Bronze Age Greece» that has been funded by the National Science Centre, Poland, ref. no. 2017/26/D/HS3/00145, at the Faculty of Archaeology, University of Warsaw. I would like to express my particular thanks to Dr Olga Krzyszkowska for the generosity in sharing her knowledge of Aegean seals and critical comments on this paper.

[2] For the functionality of various types of textile tools, see Andersson Strand and Nosch 2015.

[3] For the relationships between people and objects see, e.g. Dobres and Hoffmann 1994; Ingold 2000; Joy 2009; Dobres 2010.

[4] E.g. Davidson 1952; Gleba 2008; Öhrman 2022.

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gender and social status[5].

In this contribution, a possible range of the user-tool relationships is examined through notation practices observed on a limited number of textile tools, especially loom weights. These practices, attested throughout the entire Bronze Age in Greece, comprised marking tools with incised signs, impressing objects (predominately seals) and even writing on them, as is demonstrated, so far, by a single example of an inscribed loom weight from Akrotiri on Thera[6]. However, the notation practices on textile tools are a much wider phenomenon, attested in Europe and the Mediterranean from the middle Neolithic[7], to the very recent past where non-industrial textile tools, such as wooden distaffs or rigid heddles were occasionally marked by their producers or users[8]. Those Europe-wide practices are potential *comparanda* illustrating the possible range of communications conveyed through marked textile tools. The author's hands-on experience with forming clay copies of Aegean loom weights and using them for weaving is employed as yet another form of comparative evidence, which can help to narrow down the range of potential communications or meanings.

Notation or decoration? Towards defining notation practices on textile tools

In this paper, notation practices are defined as marking textile tools with scratches, incisions, inscriptions and impressions made by pressing or stamping items such as finger tips, finger nails, leafs, threads, various personal objects and seals on the moist clay. Ideally, notation should be restricted to a limited surface of a tool and appear as a single sign/inscription rather than a series of signs placed all over the tool surface. It is also assumed that notation conveys certain communication through non-verbal symbols, numerical values or script. Decoration can be achieved using similar techniques, such as incisions and impressions, but it is designed to fill a larger space of the tool or its entire body. It creates a visually attractive embellishment made of motifs merged into a pattern or an ornament, but it can also convey a symbolic message. Therefore, a clear distinction between decoration and notation on textile tools is not always possible.

The ambiguity in distinguishing between these two can be illustrated by, e.g., a spindle whorl from Chamaleveri and a spool-like tool from Quartier Mu, Malia, both tools marked by multiple stamping of a single seal (Fig. 1). The hemispherical spindle whorl from Chamalevri comes from the so-called «Bolanis workshop» dated to MM IA period, a location which has been interpreted by the excavator M. Vlazaki as a communal perfume workshop[9]. The whorl bears 39 impressions of a partially impressed single seal with a floral depiction of what has been interpreted as three iris flowers[10].

[5] E.g. Barber 1994; Pipes *et al.* 2019: 80-83. Cf. Vakirtzi 2018 for a more complex view on textile tools as possible markers of gender in the Prehistoric Cyclades.

[6] Karnava 2019.

[7] E.g. Chmielewski 2009: 216; Pipes *et al.* 2019.

[8] E.g. Grömer 2016: 263-264 with a further reference to Grieshofer 2004; http://www.maie.lodz.pl/pl/dzialy/zespol-dzialow-archeologicznych/wirtualne-muzeum/spotkania-z-etnografia/gospodarstwo-i-przemysl-wiejski/o-tkackich-przeslicach/?wcag=1; https://digitaltmuseum.no/search/?q=Båndgrind&aq=owner%3F%3A"NF"; accessed on 5/09/2020.

[9] Vlazaki 2010.

[10] CMS VS3 no. 323; p. 476; Vlasaki 2010: 362-365. Cf. Andreadaki-Vlazaki 1997 for the first interpretation of this motif as flax plant.

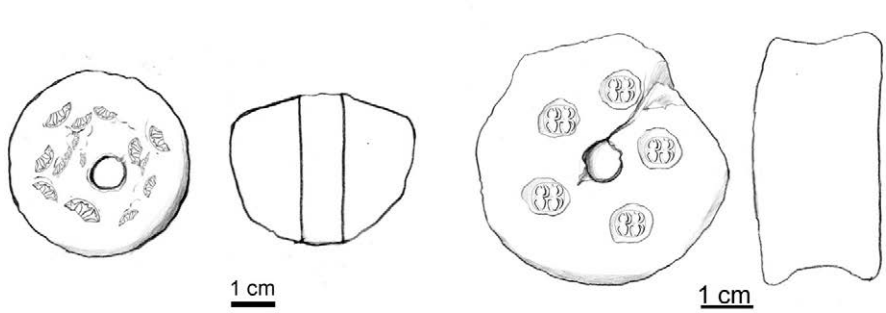


Fig. 1. Multiple markings with a single seal-impression on the spindle whorl from Chamalevri and spool-like tool from Quartier Mu, Malia. Reconstruction drawings after CMS VS3 no. 323 and CMS II,6 no. 192, by the author

The seal edge was impressed with different pressure and its impressions appear randomly on the tool surface, with a possible concentration around the perforation in the lower part of the whorl. The potential decorative effect is overall meagre. Although multiple seal impressions of the same seal were already attested on a loom weight from Lerna[11] and are present in the sealing practices in the Protopalatial period[12], the spindle whorl from Chamalevri with its 39 impressions is an extreme case[13]. The other example is a spool-like tool dated to MM IIB and found in Quartier Mu, Malia. It was impressed five times on each side by the same seal bearing a depiction of two spiders[14]. Here, the regular distribution of the stamps around the tool's perforation on both sides, as well as the apparent care taken to impress the seal image in the same direction, can be considered decorative, beside potential other meanings of the stamps.

An overview of notation practices from Bronze Age Greece

While the presence of marked textile tools is generally mentioned in publications, more comprehensive information about their number, type, weight, and the properties of the clay fabric in relation to the assemblage of all textile tools found at a specific location or site, is often missing[15]. However, given the quantity and dispersion of the available information, creating a corpus of marked textile tools is beyond the scope of this contribution. Instead, it aims at presenting a preliminary overview of the observed practices and distinguishing the main types of markings, such as impressions, seal-impressions, incisions, writing and combined markings[16].

[11] CMS V no. 51; Wiencke 1969: 500, 508, Pl. 129: 191.

[12] Cf. Kanta 1999: 390-391; Kanta and Tzgounaki 2000.

[13] Relaki 2012: 297.

[14] CMS II,6 no. 192, inv. no. 69 M 1662; Detournay *et al.* 1980: 205, fig. 276.

[15] For an overview on marked or seal-impressed textile tools, see e.g., Poursat 2001; Cutler and Andersson Strand 2018; Karnava 2018; 2019; Vakirtzi 2019; Cutler 2021.

[16] For the collected evidence, cf. «Textiles and Seals» database and its module with seal impressed and marked textile tools: https://data.textileseals.uw.edu.pl/textile_tools/search, accessed on 10/01/2023.

Impressions of objects other than seals

Unlike southern and central Europe in the Bronze Age, textile tools impressed with objects other than seals seem to be exceptional in Greece, or perhaps not always documented. Incisions and impressions are also reported or mentioned together, without a further distinction of the marking type[17]. Among the impressed artefacts, are, for example, the possible impression of a leaf attested on single cuboid weights from Skarkos on Ios[18] and Cave Zas on Naxos[19], a cord, a piece of fabric and non-identified object. A cord-impressed discoid loom weight classified to a piriform sub-category, was recovered in Pillar Pit 64N at Akrotiri, Thera, in an EC/MC context[20]. The cord was stretched and impressed vertically from a lower edge of the perforation to the lower edge of the loom weight. According to S. Vakirtzi, this impression might have reflected the use of cord as a measuring device that could help transferring specific measurements from one tool to another during the tool production stage[21]. A spherical loom weight of a «melon shape» type, impressed with three large cross signs, was found in the South House at Knossos in a disturbed Neopalatial context, but there is no information on what might have been used to make these impressions[22]. I am also aware of the existence of an unpublished truncated pyramidal loom weight from Crete, impressed on an upper edge with a woven fabric[23].

Seal impressions

The evidence for seal-impressed textile tools is apparently more frequent; however tools stamped with seals are known from a limited number of sites and always comprise unique examples or a minority in tool assemblages. The tools with legible seal impressions have been systematically recorded in the *Corpus der minoischen und mykenischen Siegel* (hereinafter CMS). In the open access CMS Arachne, a database with a large amount of data transferred from the CMS volumes: 47 seal-impressed textile tools are published, accessible through the search engine: «*Individual object – Surfaces containing seal impressions*», under a general keyword «*Gewicht*»[24]. This number can now be augmented with two seal-impressed loom weights from Akrotiri, a discoid and, possibly, a spherical implement[25], and an uncertain number of textile tools that have not (yet) entered the CMS, including some with illegible impressions[26].

[17] E.g. Marthari 2018: 190.

[18] Marthari 2018: 190. For a functional interpretation of the Skarkos weights, please see note 27.

[19] Zachos and Dousougli 2008: 132, Fig. 10.13b.

[20] Vakirtzi 2019: 492, 494.

[21] Vakirtzi 2019: 492.

[22] Burke 2003: 197, Fig. 8.1.11.

[23] I thank Dr. Maria Anastasiadou for kindly sharing this information with me.

[24] Old version of CMS Arachne database: https://arachne.uni-koeln.de/arachne/index.php, accessed on 5/09/2020; cf. Müller 1999: 380-388.

[25] Karnava 2018: 166-169.

[26] E.g. EC seal-impressed cuboid weights from Skarkos Ios, of which only six are published in CMS VS3 nos. 169-174; Marthari 2018, 190; cf. CMS VS3 p. 58-59; possibly MM loom weights from Monastiraki, Kanta 1999: 390; MM cylindrical loom weights from Phaistos, Militello 2002: 88-89, Figs. 23-27; 17 LM truncated pyramidal loom weights from Palaikastro, Weingarten1991; 2000.

J. Weingarten (2000: 490-491) has identified both the truncated pyramidal and four-holed cuboid loom weights as sack fasteners or tags attached to goods. Accordingly, the cuboid weights with two perforations from Skarkos on Ios (Marthari 2018: 191) and from Zas, Naxos (Zachos and Dousougli 2008: 132) have been interpreted in a similar way. However, in this paper, both truncated pyramidal and cuboid weights with two perforations are considered possible loom weights.

As for the chronology of the seal-impressed textile tools, from 47 loom implements published in the CMS Arachne database, the archaeological context is known only for 30 tools. From these, eight examples are dated to EBA, 14 to MBA and eight to the LBA, including a few implements with problematic contextual dating. The two seal-impressed loom weights from Akrotiri are LC/LM IA in date. According to the stylistic attribution of the impressed seals, seven are dated to EBA, five to EBA III-MBA I, 26 to MBA, and six to LBA, including five implements from Palailastro impressed with the same seal. Impressing a loom weight with a seal that is stylistically earlier than the times in which the loom weight was produced and used, can perhaps be suggested for both loom weights from Akrotiri[27]. It seems that the practice of stamping seals on textile tools might have been more frequent in the MBA; however, given the seal-impressed weights from Skarkos that are not in the CMS and generally limited evidence, this chronological observation can be accidental.

Among the seal-impressed tools recorded in the CMS Arachne, there is only one spindle whorl – the already mentioned hemispherical whorl from Chamalevri. Typologically, the seal-impressed loom weights consist of one spool-like tool and examples of the cuboid (26 examples), spherical (nine examples), pyramidal truncated (25 examples) and discoidal (five examples) forms (Fig. 2).

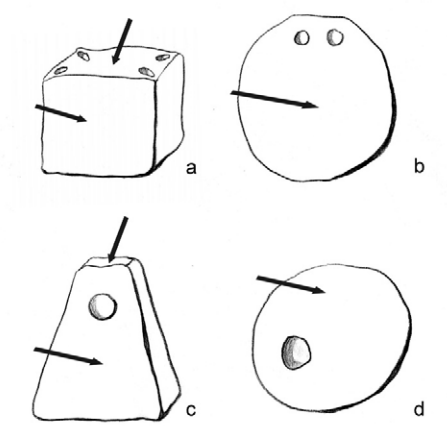


Fig. 2. Types of the loom weights impressed with seals: a) cuboid, b) discoidal, c) pyramidal truncated, d) spherical; arrows point to surfaces where the seals were stamped. Drawing by the author

The form of truncated pyramids and the mass of the Palaikastro weights (103-119 g) is not only comparable to later Greek loom weights (cf. Lawall 2014), but it is also efficient in weaving on the warp weighted loom, according to my own unpublished weaving experience with clay copies of the Palaikastro set. The cuboid weights with two perforations are more problematic. At Skarkos, they appeared in storage domestic contexts and in a workshop in the Building of the Figurines, in a wide range of sizes and weights. The smallest examples weighed only 14 g (Marthari 2018: 191), which makes their use with the warp-weighted loom unlikely. But even the very light examples might have still been used as weights for band looms (cf. Ulanowska 2018a) or as off-loom devices for braiding cords and perhaps twining. These weights are similar to later Minoan cuboid weights (cf. Burke 2010: 58-60; Cutler 2021), which were also recovered in various ranges of masses. The Minoan cubes proved to be functional implements for weaving open tabbies, weft faced weaves and twills (cf. Firth 2015; Ulanowska 2018b), as well as for cord braiding (according to my unpublished experiments). However, the EC cuboid weights usually have only two perforations and their form is indeed rather rectangular cuboid than cubic. Therefore, an assessment of their functionality in weaving, as well as potential functionality of the diagonally pierced holes, would require further experimenting.

[27] Karnava 2018: 169-172, 175.

The cuboid and spherical weights might have been used for weaving fabrics of similar structure, i.e. either open or weft faced weaves, whereas discoidal and pyramidal weights are characterised by various functionalities and different kinds of fabrics must have been produced using them[28]. Except for Skarkos, if more seal-impressed loom weights were found at one site, they belonged to various types, e.g. discoidal, pyramidal truncated, cuboid, spherical and spool-like at Malia; discoidal, cuboid and pyramidal truncated at Palaikastro; and discoidal and spherical at Akrotiri.

Small sets comprising a few loom weights stamped with the same seal are known from Palaikastro and Malia. At Palaikastro, one possible set of five pyramidal truncated weights comes from an unknown archaeological context[29], the second one was recovered in LM IA/B Room ε 36 and consists of four cuboid weights[30], the third, comprising 17 truncated pyramids, was found scattered along the street under a LM IB destruction level[31].

In all those sets, individual loom weights were closely comparable in dimensions[32], implying that they might have been used together as a functional batch for setting-up a warp-weighted loom. However, a different picture emerges from Malia, where three MM IIB spherical weights impressed with the same seal were found in Room 3.3 on the north-east borders of the Palace[33], whereas the fourth one was recovered in Quartier Mu, Building A, III.8[34].

Not only were these tools found in different locations, but also their dimensions varied: the loom weight from Quartier Mu and two loom weights from Room 3.3 were similar in measurements, but the third implement from Room 3.3 (inv. no. MA 83/E368-003) was c.1.65-1.7 cm larger in diameter than the others[35]. Given the spherical form, this difference must have had a notable impact on the loom weight's weight.

Incisions

Loom weights incised with various signs comprise perhaps even a more difficult phenomenon to examine. The incised loom weights are generally dated from EBA to LBA, being possibly the most prevalent between MBA III-LBA I[36]. They are reported from more numerous Aegean sites as compared to seal impressed tools, e.g., to name a few, from Knossos[37], Gournia[38], Malia[39], Petras[40], Palaikastro[41], Kato Zakros[42], Monastiraki[43],

[28] Cf. Andersson Strand and Nosch 2015: 371.
[29] Eccles 1939-1940; CMS II,6 no. 247, inv. nos HMp 4798-4802.
[30] CMS II,6 no. 244, inv. nos HMp 4793-4796.
[31] Weingarten 2000: 485, ll. 1-2.
[32] CMS II,6 no. 244; II,6 no. 247; Weingarten 2000: 485, ll. 3. The masses of the loom weights impressed with seals CMS II,6 no. 247 and II,6 no. 244 are not known.
[33] CMS II,6 no. 213, inv. nos MA 81/0613-002, 83/E368-003; 83/E0369-002.
[34] CMS II,6 no. 203, inv. no. M 67/E31.
[35] CMS II,6: 234, 246. The masses of these loom weights are not known.
[36] Evely 2000: 502.
[37] Burke 2010: 53, 57-58.
[38] Karnava 2019: 502.
[39] E.g. at Malia, Godart and Olivier 1978: 100-105; Poursat 2001.
[40] Tsipopoulou 1990: 99-103, figs. 3-4; 1995: Σχ. 4; 2016: 148-149; Burke 2010: 60-61.
[41] Eccles 1939-40: 49, figs. 30-44; Burke 2010: 59-60.
[42] Hogarth 1900-1901: 127, figs. 38-39.
[43] Kanta 1999: 388-389; Godart *et al.* 1996.

Aghia Triada[44], Skarkos[45], Aghia Irini on Kea[46], Akrotiri[47], Seraglio on Kos[48] and Mikro Vouni on Samothrace[49].

The seal impressed and incised tools were occasionally recovered at the same sites, however they could appear in different locations[50].

The incised marks are simple and partially repetitive, despite the spatial and chronological spread of the marked tools. They comprise vertical and diagonal crosses (e.g. Skarkos, Knossos: the Loom Weights Basement and Unexplored Mansion, Petras, A. Irini), single and parallel lines (e.g. Skarkos, Aghia Irini, Petras), as well as individual marks that can be considered script and numerical signs, such as a double axe (CHIC[51] 042, Aghia Irini , Palaikastro, Petras), «cloth sign» (CHIC 041, Petras)[52], crescents (AB 34), a «z letter» (CHIC 061), a «y letter» (AB 01, *DA* or AB 31, *SA*), an «x letter» or cross (CHIC 070; AB 02, *RO*), a «plant-like» mark (AB 04, *TE*) or an «arrow» (CHIC 050), e.g. at Malia, Aghia Triada, Petras, Akrotiri and Seraglio (Fig. 3).

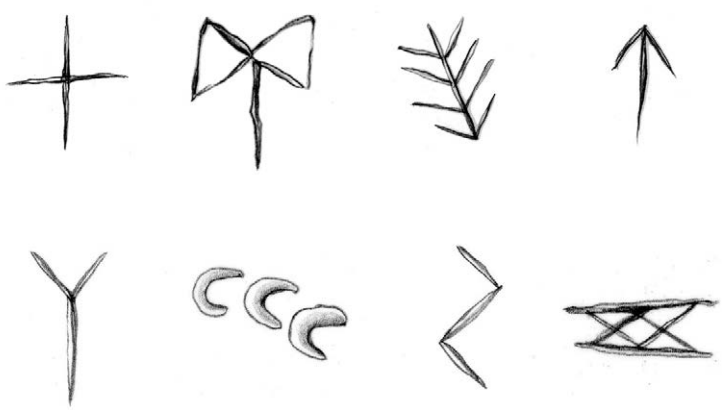


Fig. 3. Signs incised on loom weights from top to left to bottom right: cross, double axe, «plant-like» mark, «arrow», «y letter», crescents, «z letter», double «x letter». Drawing, not to scale, by the author

A similar range of signs is attested as mason's, potter's and inlay marks[53], however there may be no relationship between the potter's and loom weight marks at a specific site, as for example in Quartier Mu, Malia where contemporary marks on textile tools and pottery were different[54]. Interestingly, the repertoire of marks incised on textile tools from Bronze Age seems to be rather universal, possibly due to their graphic simplicity, and similar signs, especially variations of crosses and diagonal lines, can also be found

[44] Militello *et al.* 2015: 211, fig. 6.3.4.
[45] Marthari 2018: 190.
[46] Cutler 2021: 172, 184, figs. 7.13, 7.20, 7.43.
[47] Tzachili 1990; 2007: 264-265, figs. 2-3.
[48] Morricone 1972-1973: 279, fig. 240.
[49] Karnava 2019: 502.
[50] E.g. at Malia, cf. Poursat 2001.
[51] Corpus Hieroglyphicarum Inscriptionum Cretae = Olivier and Godart 1996.
[52] Cf. Tsipopoulou 2016: 148-149, fig. 33.
[53] Cf. Evely 2000: 641-650.
[54] Poursat 2001: 28.

incised on textile tools elsewhere in Europe and the Mediterranean, from the Neolithic to Iron Age and later[55].

A possible batch of similarly marked tools is known from Aghia Irini, Kea, where 13 out of 15 discoid weights found together had incised diagonal lines and formed a uniform weight/thickness cluster, which, according to J. Cutler, made them a possible functional weaving set or a firing lot[56]. However, the incised tools, even if of the same type and marked with the same signs, may have been single tools within larger assemblages of non-marked implements. For example, all 12 incised tools from Quartier Mu, Malia, published in 1978, were spherical[57]. They were dispersed in different buildings of the Quartier Mu, including weights incised with the same «z letter» signs[58]. These marked weights were made of different clay than their non-marked counterparts found with them. According to J.-C. Poursat, the incised tools might have denoted batches for a loom set-up comprising from 32 to 38 unmarked loom weights[59].

Script and numerical signs

Occasionally, a possible meaning of marks incised on the loom weights has been related to writing and numerical values. For example, a «plant-like» mark on discoidal loom weights from Seraglio and Aghia Triada has been recognised as Linear A AB 04 (*TE*) sign and connected to the later Linear B logogram *TE+PA* and *TELA+TE* denoting a cloth[60], while a «cloth sign» on cuboid loom weight from Petras[61] resembles CHIC 041. Similar notation practices and indeed similar marks attested on loom weights from Monastiraki and Quartier Mu (double «x letter» and crescents), have been related to Cretan Hieroglyphic script and numerical values respectively[62]. A discoidal loom weight from Palaikastro (Fig. 4) was seal-impressed with a four-sided Hieroglyphic seal, which signs are transcribed as: CHIC 044–{065}–005 (see discussion below)[63].

In all Aegean syllabic writing systems, a «true» inscription is a combination of at least two signs[64]. According to this definition, only one inscribed textile tool was recovered so far. It is a MC discoidal grooved loom weight found in Pillar Pit 66P at Akrotiri[65]. The loom weight was functionally related to at least two other unmarked discoidal weights found in the same context. It was most likely a non-local tool perhaps of a Cretan origin, which is suggested by the two suspension holes and the composition of clay fabric. According to A. Karnava, the incised signs can be transcribed as follows: AB 164a–AB 53–AB 01, where the AB 164a sign resembles the logogram *TELA* denoting a textile; however the reading of the signs is admittedly dubious[66].

[55] For diagonal lines and crosses, see, e.g. Gleba 2008: 134-135; Chmielewski 2009: Ryc. 119; Belanová Štolcová and Grömer 2010: 16; Durkovič 2015: fig. 5. Przymorska 2020. A «double-axe» sign has been reported, e.g. from Portella Sant'Anna in Sicily, Longhitano 2022: 109-111, fig. 7.4.

[56] Cutler 2021: 184, fig. 7.43.

[57] Godart and Olivier 1978: 100-104.

[58] E.g. cat nos. 45, 48,49, Godart and Olivier 1978.

[59] Poursat 2001: 28-29.

[60] Morricone 1972-1973: 254; Militello 2014: 276, Fig. 15.11; Militello *et al.* 2015: Fig. 6.3.4.

[61] Tsipopoulou 2016: Fig. 33.

[62] Godart *et al.* 1996.

[63] CMS II,6 no. 245, inv. no. HMp 4815, CHIC #174.

[64] Olivier 1981: 105.

[65] Karnava 2019: 501.

[66] Karnava 2019: 501.

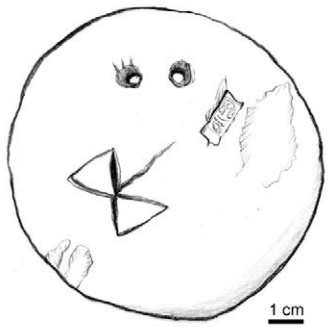


Fig. 4. Incised and inscribed discoidal loom weight from Palaikastro. Reconstruction drawing after CMS II,6 no. 245, by the author

A combined notation

A combined notation is attested on the abovementioned two-holed discoidal loom weight from Palaikastro[67] (Fig. 4). It bears an impression of the Hieroglyphic transcribed: CHIC 044–{065}–005 and, additionally, there is a double axe mark incised on this weight. The discoid weight comes from the early excavations and the archaeological context is described as the lowest level of Room δ46[68], while the impressed seal is stylistically dated to MM II[69].

Towards understanding the possible meanings of notation practices on textile tools

In Aegean archaeology, the meaning of the marked loom weights has been usually related to their use in batches on the warp-weighted loom. They have either been seen as entire weaving sets, as, for example, the tools from Aghia Irini and, perhaps, Akrotiri[70], or as markers used to denote a set consisting of non-marked tools, as in Quartier Mu[71]. The meaning of possible numerical values incised on tools from Malia and Monastiraki, has been related to a weight system and a designation of the loom weight's mass[72]. As for the redistribution of marked weights, Karnava, in her discussion on the inscribed loom weight from Akrotiri, has suggested that marked tools «*could very well travel on their own, with the mark functioning as some sort of provenance, destination or even 'brand' notation*»[73]. But it is also commonly assumed that textile tools, including those with notations, travelled with people, most likely female weavers[74].

[67] CMS II,6 no. 245, inv. no. HMp 4815, CHIC #174.
[68] Eccles 1939-1940: 49, which could be MM or LM, cf. CMS II,6: 275.
[69] CMS II,6 no. 245.
[70] Cutler 2021: 184; Tzachili 1990: 385.
[71] Poursat 2001; cf. Burke 2010: 43-44; Militello *et al.* 2015: 222.
[72] Godart *et al.* 1996: 588.
[73] Karnava 2019: 503.
[74] Cutler 2012; 2016; 2019; Gorogianni *et al.* 2015.

A broader range of possible meanings, however, has been suggested for the notation practices observed on textile tools in Europe and the Mediterranean[75]. It has also been noted that there cannot be a single, universal explanation for all notations on textile tools[76]. On the basis of the already suggested hypotheses and comparable practices from Europe and the Mediterranean, the following interpretations of marking are proposed as potentially plausible: 1) potter's marks or instructions for potters, 2) owner's marks and expressions of user-tool emotional engagement, 3) instructions for weavers and weaves; 4) «speaking tools» and symbolic allusions to textiles and textile production. The proposed explanations for the marking of the tools are not sharply distinguished and may overlap each other.

Discussion

Potter's marks or instructions for potters

The identity of textile tools producers in Bronze Age Greece, i.e. the question if they were potters, textile workers or their apprentices, cannot be securely recovered. But it can be suggested that tools made of well procured clays, uniform in mass and forms, and replicated in high numbers, were produced rather by potter's workshops or in co-operation with them[77]. A possible co-operation could have included using some potter's facilities, such as ready-to-use clay fabrics and kilns. According to my own observations on producing copies of Bronze Age textile tools from fine clays[78], this task does not require much experience or manual dexterity, since the majority of spindle whorls and loom weights have simple forms, easy to model in the hands. However, making functional textile tools requires some practical knowledge about textile manufacture.

In BA/IA central Europe, loom weights were occasionally found in potter's kilns, which may suggest that cooperation between potters and weavers was a widespread practice[79]. In southern Europe, production of textile tools exclusively by potter's workshops seem to be a late practice dated to 4th century BCE and related, e.g. to the manufacturing of discoidal loom weights termed *oscilla*. They had very similar form to the two-holed discoidal weights of Minoan type, but *oscilla* were made in moulds with relief stamps. The stamps most likely belonged to the ceramic workshops producing them[80].

A difference between potter's marks and incisions on loom weights in Quartier Mu, Malia, provides an argument for possibly different agents who marked both types of objects. Some markings on textile tools might have potentially served as instructions for potters. For example, single marked tools could have been templates to be replicated in certain numbers, whereas the marked sets could reflect an order from a potter and facilitate recognising the owner of tools after firing. The cord impression on the discoidal loom weight from MBA Akrotiri interpreted as a measurement, has already been seen as an aid facilitating the manufacture of uniform tools in a series. Perhaps, a large cross

[75] Cf. Gleba 2008: 137-138; Belanová Štolcová and Grömer 2010: 16; Quercia and Foxhall 2014a; 2014b; Marchesini and Migliavacca 2018; Longhitano 2022.

[76] Gleba 2008: 138; Quercia and Foxhall 2014a.

[77] Cf. Siennicka 2020: 28-30; Ulanowska 2020.

[78] Cf. Ulanowska 2020.

[79] Gleba 2008: 134; Przymorska-Sztuczka 2020: 27, 232.

[80] Gleba 2008: 134; Quercia and Foxhall 2014a: 75-77.

incised on one of the loom weights from Aghia Irini period IV deposits[81], stretching between the side edges and from a lower part of the perforation to the lower edge, served a similar purpose. In this case, however, the marked tool was made of non-local clay.

Owner's marks and expressions of user-tool emotional engagement

In the Greek world, a well attested habit of marking loom weights with personal ornaments, such as seals, fibulae, ear and finger rings, tweezers, keys, etc., developed in the 6th century BCE and continued, in Lucania, until the late 4th century BCE[82]. According to A. Quercia and L. Foxhall, women must have been somehow involved in the production of loom weights and, by impressing their personal and perhaps intimate belongings, they manifested their personal identity and the ownership of textile tools. In this personalising practice, the same object was occasionally impressed on a set of weights[83], or replicated in multiple impressions on a single loom weight. Multiple impressions might have been combined with incisions, creating together a decorative effect. Similar emotional expressions might have been reflected by the seal-impressed textile tools from Bronze Age Greece. This seems especially plausible for the tools with multiple impressions of the same seals, such as the above-mentioned spindle-whorl from Chamalevri and the spool-like tool from Quartier Mu.

Surprisingly, the need for personalising textile tools was also expressed during the experimental modelling of copies of Aegean textile tools by students of archaeology from the University of Warsaw[84] (Fig. 5). Since a couple of weeks is required for clay tools to dry sufficiently well for further use or firing, tool manufacture is always scheduled at the very beginning of the course, usually right after the first introductory meeting. At this time, students are not yet aware of the functionality of textile tools, nor did they know about the notation practices on ancient tools. During the first course, back in 2011, students independently started to mark their tools. Since then, they are informed that, if they wish, they can make marks on the tools they are copying. Students report that they want to remember which tools were made by them, but it seems that it is also tempting to impress something on moist clay for pleasure. The repertoire of impressed objects and incised marks fits quite well to the ancient notation practices. Incised were crosses, parallel and zigzag lines, dots, simple geometric ornaments, such as a meander, and figurative motifs. Notably, also impressed were personal objects, such as necklaces and rings. There are few modern graphic signs, such as smilies, as well as attempts of anthropomorphising a tool. Tools could have been occasionally decorated by patterns distributed on the entire surface or inscribed, including inscriptions in Ancient Greek. Interestingly, a few of these personalising marks were symbolically alluding to textile production, e.g. by incising spiders (repetitively over years and by different students), and fleecy rams.

[81] Cutler 2021: Fig. 7.20.
[82] Davidson 1952; Lawall 2014; Quercia and Foxhall 2014a; 2014b.
[83] Quercia and Foxhall 2014a: 73-74.
[84] Cf. Ulanowska 2016; 2019.



Fig. 5. Examples of personalised copies of the Aegean tools made by students of the Faculty of Archaeology, University of Warsaw. Photos, not to scale, by the author

Instructions for weavers and weaves

It has been already suggested that incised and impressed loom weights could have denoted batches for the warp-weighted loom: either sets composed of similarly marked tools, or sets of plain tools with only one being marked as a set designator. Marking a set might have conveyed various types of information for weavers[85]. It would facilitate collecting a set of tools of similar functional properties if many tools were stored together, it could denote the identity of a weaver or perhaps a master weaver, if more weavers were engaged in work. It could also convey a specific message on how to set-up the loom weights, e.g., how many warp threads should be tensioned by one weight[86], what type of

[85] E.g. Gleba 2008: 137-138; Belanová Štolcová and Grömer 2010: 16; Lawall 2014; Marchesini and Migliavacca 2018: 238.
[86] This choice however, is always related to the qualities of threads, cf. Olofsson *et al.* 2015.

fabric would be optimal to produce using them, or how broad the woven fabric would be[87]. Marking has also been seen as a technical instruction for patterning[88].

A hypothesis that incised and impressed loom weights might convey information about their weight, is not regarded plausible for the marked textile tools from Pre-Roman Italy[89], and I am also reluctant to accept it straightforwardly for the Aegean tools. Although it has been proved that using loom weights of the same weight is optimal for weaving[90], *in situ* remains of the warp-weighted looms demonstrate some differences in mass and, sometimes, even in form of the loom weights used in a set[91].

Furthermore, according to my experience, a set of tools with uniform weight can only be produced when portions of wet clay are separately weighed for each individual tool[92], which is rather unlikely for the past. If tools were replicated based on templates or, as in case of discoidal weights, were made of slices cut-off from a larger clay bar, the differences in weight between individual tools are notable, reaching up to 91 g[93]. Still, such tools look similar and can be used effectively in one set, despite the weight differences.

Therefore, in my opinion, it is more likely that the marks would have rather denoted a set of tools than the mass of an individual loom weight.

Using marked weights as an instruction for patterning in weaving seems also to be problematic according to my weaving experience. The main difficulty is the generally poor visibility of loom weights during weaving (Fig. 6).

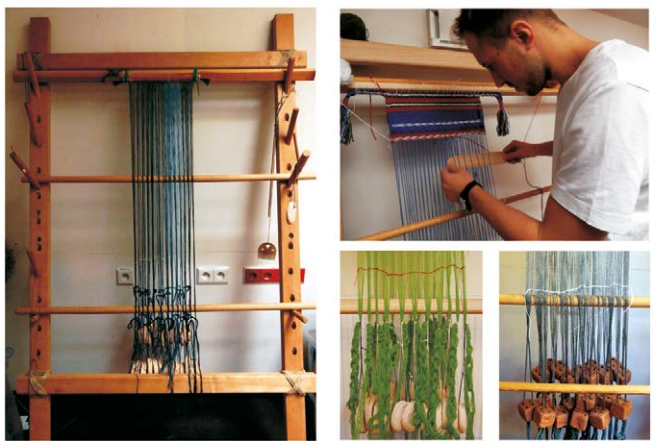


Fig. 6. Loom weights in a set-up for the warp-weighted loom and a technical gesture in pattern weaving. Photos by the author

They are positioned down the loom and close to the floor or ground, hanging under the shed bar and behind it, being, therefore, barely noticeable for a standing weaver. Moreover, the weaver must focus on shed changing and picking the weft, which, according to my

[87] Cf. Gleba 2008: 137.
[88] E.g. Belanová Štolcová and Grömer 2010: 16.
[89] Gleba 2008: 137.
[90] Cf. Olofsson *et al.* 2015.
[91] E.g. Andresson Strand and Nosch 2015.
[92] Cf. Ulanowska 2016.
[93] Cf. Ulanowska 2019: 747-748.

experience, are the most effective and comfortable when performed at about the height of the weaver's breast. Additionally, when a large-size fabric is produced, the extra length of warp threads has to be stored and it can make the weights even less visible, especially if it is stored above them (Fig. 6). Still, the top parts of the cuboid, truncated pyramidal and spherical weights can remain visible, therefore markings placed on the tops might have been legible for weavers, even if their perception was poor and uncomfortable.

However, notations on discoidal weights would not be visible at all, except for the first and the last loom weight in each row, since these weights are set-up being positioned close one by one (Fig. 6).

«Speaking tools» and symbolic allusions to textiles and textile production

In antiquity, textile tools from the Mediterranean were occasionally inscribed with a full or abbreviated name of an owner, or the name of the deity to whom they were offered to. The identity of the deity could also be expressed symbolically, e.g. by a stamp showing an owl and human hands spinning for Athena[94]. Sometimes the stamps were combined with inscriptions[95]. In later antiquity, tools could become «speaking objects» by bearing longer, sometimes humorous messages directed to a tool's user. For example, a Roman-period spindle whorl from Trier, inscribed with two *graffitti* on both sides, says: «*imple me*» (load me up) and «*sic versa me*» (turn me this way)[96]. Gallo-Roman spindle whorls from the Late Iron Age were inscribed with sayings: «*moni gnatha gabi buđđutton imon*» (come on, girl, take my kiss), «*geneta vis cara*» (dear girl, do you want?) or «*nata vimpi curmi da*» (pretty girl, give [me] beer) that, according to K. Grömer, may imply that these whorls could have been love gifts for the spinners[97]. Although the above examples come from much later chronological contexts, they imply a variety of messages conveyed by «speaking tools», ranging from denominations of owners or dedications to gods, through the messages (sometimes humorous) addressed to the spinners and weavers.

Occasionally, seals impressed on textile tools bore images referring to textile production, such as the already mentioned spinning hands on loom weights devoted to Athena and depictions of a single loom weight impressed on conical loom weights from 5th-4th century BCE Corinth[98]. A chronologically and geographically closer analogy comes from LBA Enkomi on Cyprus, where a pair of loom weights was found impressed by the same seal-ring, possibly bearing a depiction of loom weights[99].

Potential textile production-themes amongst the seal impressions may also be occasionally recognised among the Aegean tools. They may be represented by the «spider» motif from the spool-like tool from Quartier Mu, Malia, where the spiders could be seen as a universal motif symbolising spinning and weaving[100], an «iris» motif from the spindle whorl from Chamalevri which, if recognised properly, could perhaps allude,

[94] Davidson 1952: 156-160; Gleba 2008: 135-138; Lawall 2014: 168-169; Cipriano 2018.

[95] Davidson 1952: 153-154.

[96] Wild 1970: 33; cf. Öhrman 2022: 179, for a possible meaning of the first person plural «we» used on a loom weight from Cesaraugusta.

[97] Grömer 2016: 263 with a further reference to Grieshofer 2004: 125-129.

[98] Davidson 1952: 154-155.

[99] Smith 2002: 292.

[100] Nosch and Ulanowska 2021: 95-96.

i.a., to the use of iris flowers as precious dyes[101], and an «interlaced band» motif[102]. This term refers to the «interlace» motif in glyptic, which resembles interlaced woven bands, threads or strands of fibres and alludes to technical concepts of looping, plaiting and weaving, all resulting in interlacing single elements. Seals with «interlaced band» motif were impressed, for example, on cuboid weights from Chamaizi[103] and Palaikastro[104].

Concluding remarks

Notation practices on textile tools, although never common, have been observed in various socio-cultural and chronological contexts in Europe and the Mediterranean, from the Neolithic to late antiquity, and from the household production mode to ritual production in sanctuaries. A brief overview of the evidence from Bronze Age Greece, suggests that the notation practices can be provisionally classified according to the type of marking. The main types of markings comprise impressions, predominantly made with seals, incisions and inscriptions, as well as combined notations, such as in the unique, so far, case of the Palaikastro loom weight impressed with the Hieroglyphic seal and incised with the double axe sign.

There is no a single pattern of distribution of the tools with markings that could help understanding the notation practices better. In Bronze Age Greece, the impressed, incised and inscribed textile tools could have been used together at one location, but also only one type of marking could appear. The marked tools might have been redistributed to different locations within one site, as at Malia, or transferred to places very distant from the production spot, as in the case of loom weights made of Cretan clays but found at Akrotiri and Aghia Irini.

Understanding of the notation practices on textile tools can be improved thanks to more careful field documentation of this phenomenon. The position of marked textile tools when found *in situ* should be recorded, their weight and clay fabric should be analysed with regard to other tools that were recovered at a site. The use-wear of marked tools should be examined and compared to the use-wear observed on other tools found in the contexts. Presently, the meaning of the notation practices remains ambiguous and it had possibly varied, according to the specific socio-cultural setting and type of marking. However, it can be suggested that the messages conveyed by markings of the Aegean tools were not entirely different from comparative practices observed in Europe and the Mediterranean. Amongst the briefly discussed possibilities, I would like to suggest that the personalisation of tools, including expressions of the emotional user-tool attachments, and instructions to potters and weavers seem to me the most convincing hypothesis for explaining the notation practices. However, given the limited number of pieces of evidence and the variations of this practice documented in well investigated contexts, such as Malia for example, these very general conclusions will hopefully become more refined by the future research.

[101] Cf. Crişan *et al.* 2018.
[102] Ulanowska 2022.
[103] CMS II.6 no. 153, inv. no. HMp 3517.
[104] CMS II.6 no. 243, inv. no. PK/91/3223 and CMS VS1A no. 061, inv. no. AN 6883A.

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Letting the Cretan-Hieroglyphic cat out of the bag

Judith Weingarten

Abstract: Drawing evidence primarily from the Cretan Hieroglyphic seals and seal impressions, this paper first aims to: 1) throw light on the cultural significance of the administrative and symbolic functions played by seals and seal impressions; 2) gain an appreciation of the peculiarities of this relatively short-lived glyptic writing system, particularly its presumed use of formulas; and 3) restore the CAT sign to its place in the Hieroglyphic script as both a phonogram and a logogram, and follow its changing shape while maintaining function, in the Linear A script. In the second part, we offer further new evidence for continuity in the use of some signs in administration from Cretan Hieroglyphic to Linear A and draw new lessons as to their sphere of interest[1].

Part I: The Middle Minoan Cat

At the end of Middle Minoan IIB, in some places perhaps a little later, we find relatively rich deposits of clay documents written in Cretan Hieroglyphics as well as seal impressions with Hieroglyphic signs at Malia Quartier Mu, the Hieroglyphic Deposit at Knossos, and at Petras in the East. And, of course, we find Hieroglyphic sealstones scattered throughout eastern Crete, with occasional outliers elsewhere. There are three main seal shapes, the Petschaft, the three-sided prism, and the four-sided prism (Fig. 1).



Fig. 1. Characteristic Cretan-Hieroglyphic Seal Shapes: a) 3-sided prism, b) 4-sided prism, c) Petschaft

[1] This is the third and last paper in a series examining Cretan Hieroglyphic seals from a new holistic viewpoint. The first paper examined the Hieroglyphic seals from Myrtos Pyrgos (Ferrara, Weingarten, Cadogan 2016), which involved a reinterpretation of the role of the CAT on seals. The cat became the leitmotif of a ZOOM seminar (SCRIBO Seminars on Scripts in Bologna, 20/05/2020 [available online]), a study expanded and published in Ferrara and Weingarten 2022. In this paper, I recap some earlier administrative studies on sealings (Weingarten 2017) which, when put together, allow us to begin to understand some inscribed Linear A sealings as discussed in Part II, below.

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The Petschaft is really the best designed of the three for making seal impressions, especially on clay, because it's easy to hold by its handle, stamp, and lift it out cleanly. It does seem designed, in fact, for a career of palatial administration[2].

What can we say about the Hieroglyphic script itself? Reading and interpreting Cretan Hieroglyphics is obviously problematic, a difficulty faced across the board in all early writing systems (whether Egyptian, cuneiform, Chinese, Mayan, whatever). But the Cretan situation is extra complicated because of the difficulty of distinguishing between signs for words (logograms) and signs for sounds (phonograms). This is especially true when we try to «read» the *seals*. In fact, the signs engraved specifically on the seals were long considered not to be true writing. True writing was recorded only on administrative clay documents, such as those incised on clay bars and medallions, while the symbols on the seals were demoted to what was called «ornamental» writing. This distinction was based on two main points: first, several sign sequences were found only on seals and not ever on the archival clay documents. And, second, many such sequences were so often repeated in the seal corpus that they came to be defined as **formulas** (Table 1).

Formula	*Frequency*	Formula	*Frequency*
	70		9
	29		9
	14		7
	23		3
	12		3

Tab. 1. Frequencies of the Cretan-Hieroglypic so-called «formulas» (courtesy of S. Ferrara)

This is where the problems begin. The catalogue of Cretan Hieroglyphic inscriptions, published in 1996, *Corpus Hieroglyphicarum Inscriptionum Cretae*, popularly known as *CHIC*, chose to disregard all the signs that disrupt the harmony of the formulas, dismissing them as *insignificant*, and omitting them in the transcriptions, or placing them within parentheses, another way of saying «dubious; do not read this».

The Trowel-Eye formula is a good example (Fig. 2). One of the most frequent of formulas, it combines two signs, one shaped like a human eye, and the other seemingly an instrument or tool, conventionally called a trowel[3]. On some seals, other symbols are added, such as a double axe, or the head of an animal, and so forth. These signs allegedly operate according to no rules and pirouette about, changing their positions and

[2] Jasink and Ferrara 2017.
[3] Ferrara and Cristiani 2016

order – in ways which, for the authors of *CHIC*, are not phonetic. The Trowel-Eye is just one example, but such omissions are applied throughout the corpus, signs that should be recognized in the repertory being struck out.



Fig. 2. Some Seals with Trowel-Eye Formula

Now, a counter-reaction has set in. In 2009, Anna Margherita Jasink published *Cretan Hieroglyphic Seals: A new classification of symbols and ornamental/filling motifs*. This rehabilitated a number of signs and symbols that had not been included in *CHIC*. In part, she was following Arthur Evans, who had originally included many of these signs in his *Scripta Minoa* – such as the full-bodied cat or cat mask, and various other animals and designs. Her approach stimulated a number of younger scholars to reopen this and many of the other questions pertaining to the Hieroglyphic script, especially as it appears on sealstones.

Discussion also revived about another aspect of Hieroglyphic seals, that is the occurrences of single signs on seals (Fig. 3).



Fig. 3. Some Single-signs on seals

Oddly enough, many of these same signs *are* recognized as part of the Cretan Hieroglyphic script, when they are not isolated. But when they stand alone, they fall outside the conventional definition of an inscription (which is «*at least two consecutive signs aligned together in coherent succession*») – and therefore they, too, were banished from *CHIC*. However, if we look at them closely, we notice features that nonetheless point to the images representing, in all likelihood, some form of language notation. The small

crosses scattered on the faces of some of the seals are defined as stiktograms (that is, punctuation), normally understood to indicate reading direction; and the same function is said to apply when stiktograms appear on Hieroglyphic seals. Is that really the case? How can it possibly give the reading direction for a single sign, which has no direction to be read? In such cases it must have a different purpose. Still *another* explanation is needed when the cross stiktogram is doubled or even tripled as happens on some seal faces.

We suggest that the explanation must lie on the fluid boundaries between icons and images. So, the question is: when does an image become a sign? In order to distinguish what is iconic and what is writing *stricto sensu*, we suggest that the Minoans applied a conventional cross, to underline (as it were) that the symbol is not a picture, but a sign. In other words, the stiktogram can indicate on seals the way that the symbols are to be understood.

If this is the right way to view these single-sign seals, we clearly need to develop a new methodology for understanding this script on seals; and from the bottom up. The new methodology we propose, entails considering *every single element* that is engraved on the seal face; not disregarding or dismissing any mark that meets the eye. We argue that Minoan engravers made every single mark on the seal for some reason and that this reason might be to record specific linguistic or administrative features. If patterns emerge, as they do, it is our job to try to understand them rather than to neglect or understate them.

So, let us take another look at some of the common formulas, beginning again with the trowel and eye (Fig. 2) – but now viewed through a more holistic filter. We see that the cross stiktogram is at times repeated, and that marks, such as small dots, intersperse the signs, accentuating some as if singling them out. The effect is often one of separation of elements, rather than of unity. The trowel sign appears particularly emphasised, as if it were an entity on its own, and not meant as the initial sign in a two-sign text.

A good example how this works is on a jasper prism from Myrtos-Pyrgos (Fig. 5: CMS VS.1A 165 [*CHIC* # 309]) that was republished by Ferrara, Weingarten, and Cadogan, in our first attempt to apply a holistic understanding of Hieroglyphic glyptic.

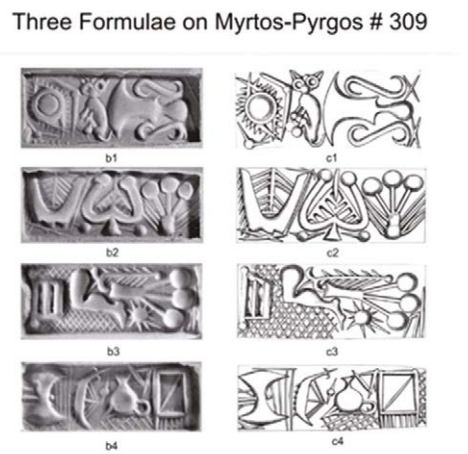


Fig. 5. Myrtos-Pyrgos 4-sided prism (Ferrara, Weingarten, Cadogan 2016: 83, fig. 2) CMS VS.1A 165; *CHIC* # 309)

Here, the trowel and the eye are not only divided by a cat sign, but the trowel is «cartouched» (as it were) by S-spirals, while the eye is encapsulated by so-called fillers – which act to stress, we believe, the separation of the signs. And this is true whether or not the cat has phonetic meaning. We'll come back to this seal a little later because there are two more formulas on it, which might indicate that it has a specific function.

What we'd like to stress now is the visual «tinkering» with the so-called Trowel-Eye formula, and this is really very common: By «tinkering», we mean that it is never laid out plainly on the seal face. Here are the figures that Ferrara and Cristiani published in 2016: Table 2.

Formula [Trowel-Eye]	
Aligned, 'Linear Formula'	---
Decorative or Supplementary Elements in *Initial* Position	#147, #246, #247, #250, #253, #261, #264, #266, #268, #288
Decorative or Supplementary Elements in *In-Between* position	#140, #158, #309
Decorative or Supplementary Elements in *Final* Position	#138, #145, #165, #295, #297, #301, #308
044 Rotated or 'Cartouched'	#144, #165, #174, #194, #254, #261, #263, #274, #287, #299, #305, #308, #309, #311
×	#138, #158, #247, #283, #295, #301, #309

Tab. 2. «Trowel-Eye» Formula (after Ferrara and Cristiani 2016)

As we see, Aligned, by itself, in «proper linear form», none; Decorative or Supplementary Elements in Initial position, in in-between position 3; in final position, 7; Rotated or cartouched, 14; with cross stiktogram, often repeated, 7. So we never actually have an unmolested Trowel-Eye formula on seals. And very much the same thing happens when we examine the Trowel-Arrow formula, which is the most common of all the formulas on Hieroglyphic seals: Table 3 and Fig. 4.

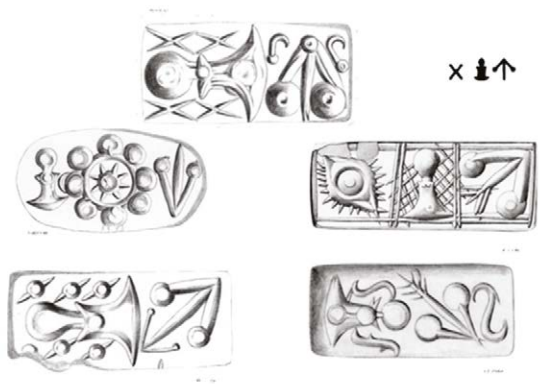


Fig. 4. Some Seals with Trowel-Arrow Formula

There is almost always something setting the signs apart: that may be signs placed between the Trowel and the Arrow, or stiktograms, or signs rotated or cartouched: just *three* examples have the signs in supposedly readable, linear form. All the others are tinkered!

In short, the Minoan engravers almost always tinkered with the trowel, either adding an iconographic symbol that might look to us like decoration – at the beginning, or in between, or they rotated it, or they wrapped it up in a cartouche of decorative fillers, or they put in a cross stiktogram, which might be duplicated or triplicated. So, what is going on? Surely, something is telling us to look at the trowel sign more closely, in a more systematic way, to capture – rather than dismiss – the richness of the glyptic message. For that's the only way, we believe, to discover what it was used for, and, ultimately, what it meant. And what we actually see, in almost all cases, is that the trowel sign is *formally* emphasised, if not virtually separated or isolated. There is, in other words, a deliberate attempt to make it stand out, as a singular feature. And despite the trowel being so frequently found on seals, it is *always* accompanied by *only* one of two other signs, **either** the eye **or** the arrow.

Formula [Trowel-Arrow]	
Aligned, 'Linear' Formula	#210, #233, #297?
Decorative or Supplementary Elements in *Initial* Position	#157, #161, #188, #208, #209, #217, #230, #237, #240, #244, #249, #253, #258, #260, #264, #266 (x2), #274, #285
Decorative or Supplementary Elements in *In-Between* Position	#261, #266, #270?, #300, #301, #314
Decorative or Supplementary Elements in *Final* Position	#207, #215, #278, #293, #295
044 Rotated or 'Cartouched'	#150, #159, #170, #213, #216, #220, #221, #223, #224, #225, #231, #247, #277, #278, #284, #287, #290, #293, #296, #299, #301, #303, #305, #311
×	#207, #211, #219, #235, #258, #274, #283, #301

Tab. 3. «Trowel-Arrow» Formula (after Ferrara and Cristiani 2016)

Are we still sure these are formulas?

Probably not: rather, Trowel-Eye and Trowel-Arrow ought to be decoupled and deconstructed. And that means, if we are correct, **that what we have here is probably logographic writing, not syllables**[4]. To verify this, Ferrara and Cristiani[5] extended their analysis to all the formulaic patterns that we find on seals, to see if such readings should, and could, be extended. There are half a dozen more such formulas (Tab. 1). The

[4] Of course, Trowel-Eye and Trowel-Arrow also occur on administrative documents where they are understood to be phonograms. However, there is no reason why a single sign cannot represent an ideogram in one context or medium and a syllable or abbreviation in another (e.g. AB 30 «ni»/Figs, AB 54 «wa»/TELA, AB 23 «mu»/BOS). It is worth noting too, that the Trowel, despite being such a prominent sign in Cretan Hieroglyphics, does not survive into Linear A, an unexpected disappearance if it represented a common Minoan-language sound.

[5] Ferrara and Cristiani 2016.

third most common formula is the famous Gate + Leg, mostly but not always followed by a three-branched plant. Arthur Evans interpreted this formula as a mark of princely status: the Leg as that of a Leader, and the Gate the sign of a Guardian. Rather more soberly, this is what we found: Table 4.

Formula 𐄫𐄪 and 𐄫𐄪𐄮

Aligned, 'linear formula' 	#162, #169, #195, #242, #248, #250, #254, #257, #258, #261, #262, #263, #264, #269, #270, #274, #279, #284, #293, #299, #300, #302, #312, #314
Decorative or Supplementary Elements in *Initial* Position	#288
Decorative or Supplementary Elements in *In-Between* position	Petras ME 259
Decorative or Supplementary Elements in *Final* Position	#275
Any Sign Rotated or 'Cartouched'	#309
[1]	##265, #271, #272, #298

Tab. 4. «Gate-Leg» Formula (after Ferrara and Cristiani 2016)

Clearly, the Gate-Leg formula normally behaves in a more linear manner; that is, as a sequence of signs to be read consecutively, rather than as single signs meant to be isolated from each other. Compared to Trowel-Eye and Trowel-Arrow, it does look, quite literally, straight-forward, as if meant to be read.

Returning to the seal from Myrtos-Pyrgos (Fig. 5), which we looked at above, in addition to Trowel-Eye, the seal has two more identified formulas: Gate + Leg + three-branched plant, which, for convenience, I simply call «the Gate formula». It also has the fourth most common formula, composed of the Template sign + Pronged Instrument – usually, but again not always, ending with the three-branched plant. Obviously, both the Gate and Template formulas have a lot more activity on their seal faces than just the dry signs by themselves. What I'd like to stress in this paper, however, is that the Template formula is almost always partnered with the Gate formula. Altogether, there are 16 seals with the Template formula, and 13 of them share the seal with the Gate formula. In other words, most of the seals with the Template formula must work, in some sense, with the Gate formula. The opposite, however, is not true. The Gate formula frequently appears on its own and does not have the Template formula with it. So, it seems reasonable to hypothesize that the function of the Template formula all but requires the additional presence of the Gate formula. Whatever job, or rank the Template represents, it seems to need additional support from the Gate-formula. But not the other way round. What we can surmise is that the two sequences often work in combination and that, together, with Trowel + Eye or Trowel + Arrow, they create a hierarchy of functions.

But the big question, of course, towards which we are working, is: to what extent is Cretan hieroglyphic ON THE SEALS involved in language notation? Despite the

presence of highly iconic symbols, such as the trowel sign, there is *no reason* to assume that the Hieroglyphics on the seals was not already at the stage of language recording.

Here is one irresistible example. A sign on the seals that was mysteriously expunged from the repertory of signs in the Corpus, not only should now be reinstated in its own right, but also can give us an avenue into explaining what category it may represent. That is the full-body cat sign and *pars pro toto* the cat-mask[6]; cf.: Fig. 12, below.

We can be certain that this sign on the seals is a phonogram which has a long life throughout the Aegean tradition of scripts, ending up as our deciphered /ma/ sign of Linear B, where it is also used in the WOOL ideogram, having passed from Hieroglyphics through Linear A. Its genealogy can be reconstructed diachronically and phonologically. There is every reason to believe that /ma/ was exactly what a Minoan cat would say. Onomatopoeia at work? Perhaps.

We can see how the cat works in the Hieroglyphic system on the beautiful carnelian 3-sided prism (CMS VI 93, *CHIC* # 257; Fig. 6) which contains both the Template formula and the Gate formula, the latter with the CAT plump in the middle.



Fig. 6. Carnelian Cat three-sided prism (CMS VI 93, *CHIC* # 257)

I would be willing to wager that the CAT is already saying «ma»; and that it could already be an ideogram connected with Cretan WOOL, the abbreviation of the Minoan word for wool, *maru* or *malu*)[7], and precursor of the Linear A WOOL ideogram (MA-RU, A 557-560), borrowed in turn by Linear B (AB 145 LANA)[8], as I argue in Part II.

Part II: The Late Minoan I Cat

Some time after about 1700 bc, the Linear A script expanded from Phaistos, soon to be used across the island. Cretan Hieroglyphic essentially disappeared, and with it has gone the concept of script on seals. All written documents, whenever they appear, are

[6] *Scripta Minoa* 75 and 74; Jasink 2009: 31, 140; Jasink and Ferrara 2017: 48

[7] The pre-Greek word ancestral to Greek **μαλλός** («wool, fleece»: Hesychius 45; Hesiod *Op*. 234, for «fleece». I believe this connection was first proposed by David Packard 1974: 60 – an early study in computational linguistics that was ignored until recently by Linear A scholars.

[8] A thorough study of the linguistic background in Civitillo 2007, especially 642-647. For cat images on seals, Civitillo 2016: 150-157; Krzyszkowska 2015. For the debate over «Were there domestic cats on Middle Minoan Crete?» see Pomadère and Papayiannis 2020. Despite the absence of domestic-cat bones in MM middens, their iconographic existence suggests, to my mind, that they were not normally eaten along with sheep, goats, and other edible animals, but kept in a closed and probably privileged environment. Note also their appearance, both full-bodied and as cat-masks in Cretan Hieroglyphics, almost certainly already representing the phonogram 'ma' (as I argue below).

now written in Linear A. In addition to tablets, there is a rich variety of sealed clay documents, including the Minoan roundel, a document unique to Minoan culture (Fig. 7).



Fig. 7. Roundel KH Wc 2010 stamped by lentoid seal, CMS VS 1A 158 (after Hallager 1996: Vol. 2)

Roundels are flattened clay disks, with (usually) a very brief Linear A inscription on one or both sides and one or more seal impressions on the rim. The documents are coeval with Linear A administration: they appear along with the script in Middle Minoan IIB and vanish after the Late Minoan IB destructions. Most of the ca. 182 published roundels are stamped by a single seal-type – once or repeatedly – with the number of impressions varying from 1 to 15. They are generally interpreted as receipts for commodities, the recipient of goods acknowledging units of «debt» by marking the rim of the roundel with the equivalent number of seal impressions, thereby accepting responsibility for removing that number of units from palatial or villa storerooms[9]. Or, on the contrary, as I have recently argued, they might rather be marking the *entry* of those goods into those storerooms[10].

It is worth taking the time to review the activities of two seals that stamped roundels at LM IB Khania in western Crete[11], for it is a vital building block on which rests the conclusions of this study. These two seal-users were specialists: their extant roundels show them dealing with only a single type of cloth, described by the rare ideogram AB 164 (Fig. 8c).

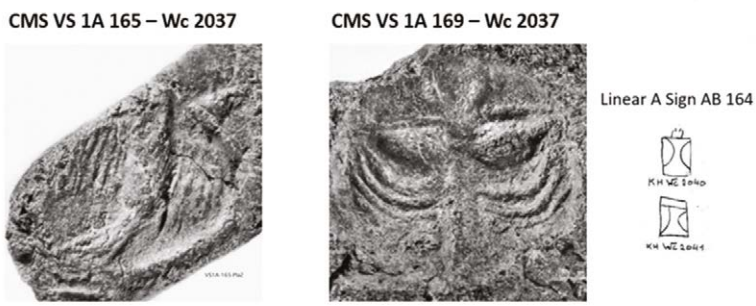
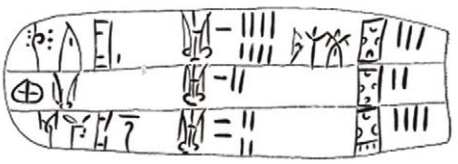


Fig. 8. a) Roundel stamped by CMS VS IA 165; b) Roundel stamped by CMS VS IA 169; c) Linear A sign AB 164 incised on their roundels

[9] Hallager 1996: 117, with citations.
[10] Weingarten 2017.
[11] As published in Weingarten 2017.

One seal was a soft-stone lentoid depicting a butterfly (Fig. 8b; CMS VS IA 169), stamped on eight surviving roundels (one to five times each), all roundels marked with the ideogram *164. The second seal was a soft-stone amygdaloid of slightly irregular shape (Fig. 8a; CMS VS IA 165), with the image of a flying bird; in front of the bird, an enigmatic cone-shape object with protruding «horns». This seal owner stamped four (or five?) roundels, three fully preserved with three to five seal impressions each and a fragment with at least two impressions; all are inscribed with the same ideogram *164.

Because ideogram *164 survives into Linear B, we can glean some information from a later record at Knossos (Fig. 9: KN L 520)[12]; for the Linear B sign, LANA, cf.: Fig. 12, below.



*At [these three] villages, 54 units of LANA/WOOL were «made into» or «woven for» 9 CLOTHS of *164 type.*

Fig. 9. Drawing of KN L 520 (after Del Freo, Nosch, Rougemont 2010: 362, Fig. 17.22; Lane 2012: 99 n. 133; drawing by L. Godart)

Since one Mycenaean unit of WOOL weighed ca. 3 kg, it obviously required 6 units (18 kg) of WOOL to produce one unit of *164. Assuming that the proportions in earlier times were the same, the Late Minoan I owner of the butterfly seal and the owner of the bird seal would have needed some 250-300 kg of WOOL to make the 30 pieces of cloth marked on their roundels.

The same butterfly seal had *also* stamped eight hanging clay nodules, each of which was inscribed with a single Linear A sign: two were marked A 301 (Fig. 10a) and six AB 74 (Fig. 10b). This is the only seal-owner at Khania who stamped documents inscribed with these particular signs; indeed inscribing clay nodules with any sign(s) at all is rare at Chania.



Fig. 10a. A 301, KH Wa 1011 (after *GORILA*)



Fig. 10b. AB 74 (ZE), KH Wa 1010 (after *GORILA*)

[12] After Del Freo, Nosch, Rougemont 2010: 362, Fig. 17.22; Lane 2012: 99 n. 133.

The same combination of A 301 and AB 74 is very well known from LM IB Ayia Triada. At Ayia Triada, about 70% of the more than one-thousand stamped clay nodules were inscribed – most commonly with one of six Linear A signs – which cluster into just two Groups[13]. Seals that stamp Group II nodules use the same two signs, A 301 and AB 74, individually, never together on a single nodule, exactly as at Khania. At Khania, however, we now have an *added* link through the butterfly seal, which stamped nodules marked A 301 and AB 74 but was also exclusively involved with *164 CLOTH on his roundels. Naturally, one wonders if signs A 301 and AB 74 were also connected with textiles in some manner.

It may be no more than coincidence that well over half of Group II nodules at Ayia Triada – 133 of 238 nodules – also happen to be stamped by a seal with the image of a flying bird (Fig. 11).

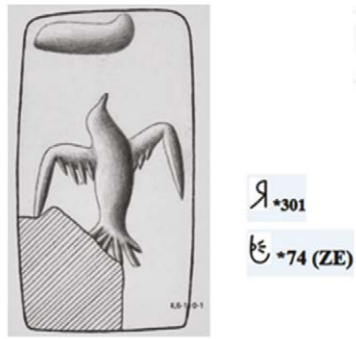


Fig. 11. Ayia Triada «Leader of Group II» (CMS II.6 110)

But what *cannot* be coincidence is the enigmatic conical object floating before the Khania bird (Fig. 8a, Fig. 12), which strongly resembles the Cretan Hieroglyphic CAT-mask (a resemblance also noted in the CMS, see CMS VS.1A 165, p. 168), which becomes the Linear A sign AB 80, the syllabic *ma*. In Linear A, *ma* combines with *-ru* to make a monogram, A 559, spelling out the Minoan word for wool, a sign used as the ideogram for WOOL (though «ma» alone is used, perhaps three times, as an abbreviation apparently for «wool»: most pertinently the LC I ostracon THE Zb5.1[14]; and in LM IB: HT 110.b.5, HT 146.3) while the visual monogram of *ma+ru* survives into Linear B as the ideogram *145/LANA[15]; hence our certainty that we are dealing with wool.

In short, this seal-owner put the sign of his trade on his seal: he deals in WOOL or woollen goods. So, we can be reasonably sure that the seal-owner was regularly dealing with WOOL (some of which, at least, would be turned into *164 cloth). A «trade mark» on a Minoan seal is unique.

[13] Weingarten 1987: 15-17.
[14] Michailidou 1995: 11-12.
[15] Salgarella 2020: 33.



Fig. 12. The Minoan Cat and Cat-sign (after Ferrara and Cristiani 2016; with the kind permission of S. Ferrara)

But we can now draw further links between Group II signs A 301 and AB 74 and textiles[16].

Looking again and comparing the four-sided prism from Myrtos-Pyrgos (Fig. 5) and the famous carnelian three-sided CAT prism (Fig. 6), they have more in common than the shared full-bodied CAT signs[17]: both also have the full GATE-LEG-PLANT and TEMPLATE formulas. As we said above, almost all the seals with the TEMPLATE formula also depict the GATE-LEG formula (but not always vice versa, there being many more of the latter than the former). We have not previously looked at Side δ on the Myrtos-Pyrgos prism nor side γ on the carnelian seal. At first glance, they are entirely different: while Side δ of the four-sided prism has the CLOTH sign, arguably not as a phonogram[18], Side β of the CAT prism depicts a relatively rare formula, CH 046-044 (Tab. 1) which appears at most seven times in the Hieroglyphic corpus (four times with GATE-LEG, of which two are with TEMPLATE as well). But if we flip CH 046 on its vertical axis, it becomes the clear precursor of Linear A sign A 301 (Fig. 10a); that is to say, A 301 is the graphic equivalent of CH 046 the CH forerunner of that LA sign, an insight dating back to Arthur Evans[19]. So it is entirely possible that the owner of this Middle Minoan II seal with the full-bodied CAT sign was also involved with what would later be marked A 301

[16] A 74 only appears once on a Linear A tablet (HT 16.4), along with two other items, the unknown 188+ «81», and the CLOTH ideogram.

[17] Cf. A crescent sealing from Knossos (*CHIC* #27b), with a CLOTH sign within one of three inscriptions, is stamped by two different seals; one, a flat round hard-stone seal (Petschaft?), *CHIC* #123 = CMS II.8 90, with two central signs 092-058, surrounded by a border of eleven cat masks (*Scripta Minoa* P64).

[18] While the double axe is rotated 90° and separated by four thin lines from the rest of the inscription (Ferrara, Weingarten, Cadogan 2016: 90), the textile sign (041) is rotated 180° from the vase sign (053), perhaps to indicate that it is, in some sense, separate: the intention may have been not to read it as the syllabogram 041 but to make it stand on its own, I would think, as an ideogram. Cf.: the clay document, *CHIC* 089 from Malia (MM IIB): 034-041-084 | 051-051-051-041, where the final CLOTH sign is raised above the tripled 051, a sequence hardly to be read syllabically.

[19] SM 71, Fig. 41; J.G. Younger: http://people.ku.edu/~jyounger/Hiero/SignNotes.html; see recently Ferrara, Montecchi, Valério 2022 [Appendix I: 84]; confirmed in Appendix I: 98; and Salgarella 2020: 341-342.

on nodules; much as the butterfly seal-owner at Late Minoan I Khania who dealt in *164 CLOTH on roundels and this same WOOL-related(?) commodity, A 301, on nodules.

That leaves AB 74, previously «read» back from the Linear B syllabogram ZE (as an abbreviation of */dzeugos/* «pair»). However, *ZE* evidently was coined by a Greek-speaking scribe. It is also used ideographically on two Linear B tablets from Knossos (K 740.5 and the very fragmentary R 1562+1563), i.e., it represents a true ideogram, not a syllabogram used ideogrammatically[20]. This ideogram, *235, is now distinguished from AB 74. Unlike the Linear B syllabogram ZE, the separate ideogram *235 descends from the Linear A sign A 74, which can itself be traced back to the Hieroglyphic sign CH 45, the so-called «saw» sign (Fig. 13).

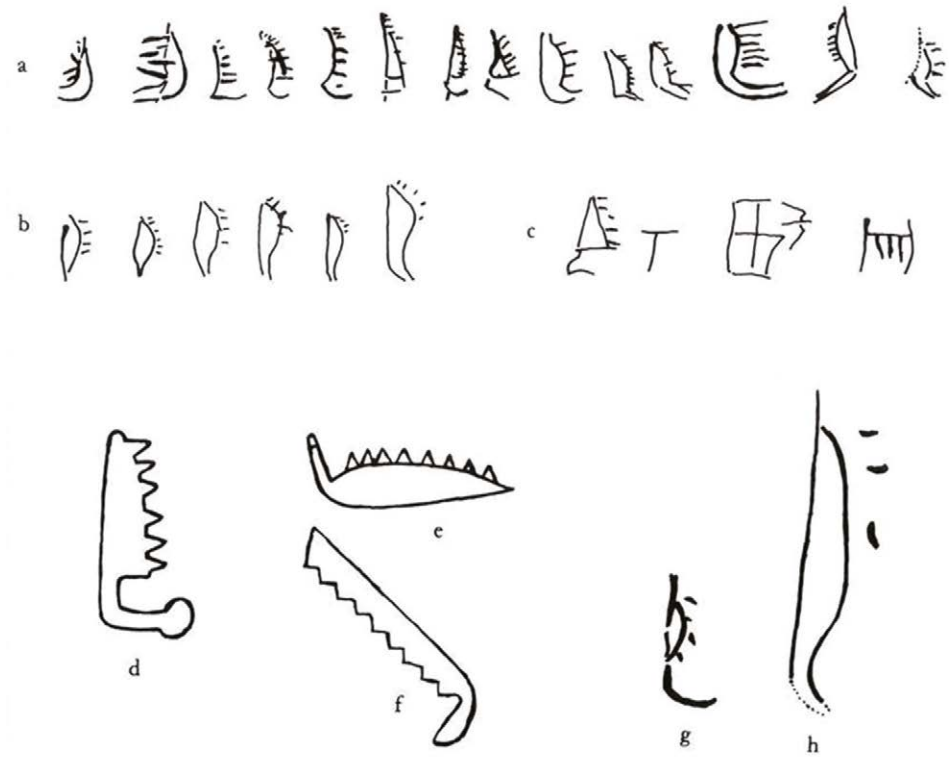


Fig. 13. The «saw» sign in Cretan Hieroglyphic (d), Linear A (a, b and c), Egyptian (e, f) and Linear B (g, h) (modified from Melena 1987: Fig. 1)

As José L. Melena[21] discussed in great detail, Bronze Age sheep were not shorn but their wool was obtained by plucking; that is, the wool was removed from sheep by means of a comb. The pictograph behind the signs CH 045, AB 74 and B *235 then makes excellent sense in that it illustrates the comb used for plucking wool (idem. Fig. 14), complete with teeth and wooden handle.

[20] Melena 1987: 392-393.
[21] Melena 1987.

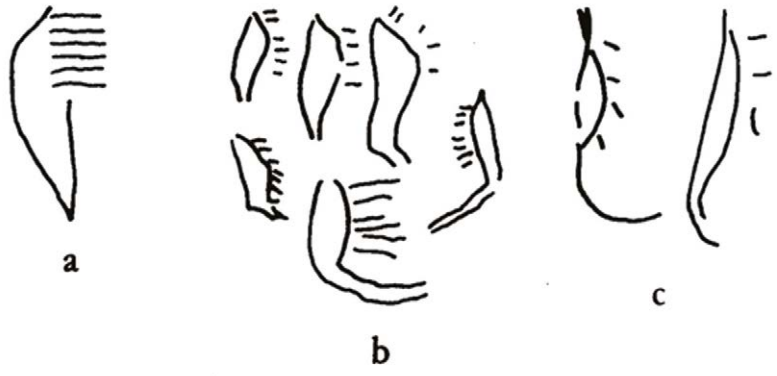


Fig. 14. Sumerian UR_4 (a), Linear A 74 (b) and Linear B *235 (c) compared (after Melena 1987: Fig. 3)

The plucked wool, perhaps already washed and carded in the Cretan uplands, could then be transported to an administrative centre in wicker baskets or leather bags, either of which might then be sealed by Group 2 nodules marked AB 74 as recorded at Ayia Triada and Khania.

Further we cannot go.

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Les marques de potier: question de méthode

Anna Sacconi

Abstract: The potter's marks are present in all civilizations, from the most ancient to the most recent ones. Assuming on the sole basis of the analysis of potter's marks, any kinship between different civilizations is wrong. The comparison between signs attested in the Aegean world and Amazonian populations clearly demonstrates this.

Traitant des marques de potier, je me réfère à tous les signes isolés, peints ou incisés avant ou après la cuisson sur n'importe quel type de vase et à n'importe quel type d'époque.

Les marques de potier sont des signes attestés dès l'époque préhistorique sur des vases de toute provenance. Il s'agit de signes réalisés de manière occasionnelle et non systématique qui n'évoluent pas de manière substantielle au cours des siècles et ne diffèrent guère en fonction des endroits où ils sont attestés. Aucun de ces signes ne fait partie intégrante d'un système d'écriture.

À côté de cette nébuleuse de signes occasionnels que l'on retrouve aux époques les plus hautes et aux endroits les plus divers, on constate l'apparition de l'écriture en tant que système, uniquement dans des endroits bien déterminés et à des époques précises, liée à des raisons économiques et politiques qui requièrent l'usage constant de l'expression écrite.

Les marques de potier n'ont aucune valeur phonétique car ne faisant pas partie d'un système d'écriture (ni logographique, ni syllabique, ni alphabétique), ils ne représentent ni des syllabes (comme les signes des écritures syllabiques), ni des lettres (comme les signes des écritures alphabétiques); pour utiliser la nomenclature de Bennett, les marques de potier sont des documents d'écriture sématographique et non lexigraphique[1]. Ils n'avaient une signification que pour celui qui les traçait mais cette valeur nous échappe totalement même si l'on peut avancer – et l'on a avancé en effet – diverses hypothèses les concernant; ces dernières demeurent en substance au niveau de suppositions pures et simples.

Ces marques sont généralement considérées comme des signes apposés par des artisans lorsqu'ils ont été appliqués avant cuisson ou comme des marques de propriété lorsqu'ils ont été réalisés après cuisson. D'autres interprétations ont été proposées en

[1] Bennett 1962: 98-123.

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fonction de l'endroit du vase où apparaissent ces marques (sur les bords, l'anse, le col ou la base du vase) : on a pensé à des signes liés au numéro du vase, à sa classification, à son contenu, à sa capacité, à sa valeur, à sa provenance, à sa décoration, à sa destination.

Les marques de potier ainsi que les signes semblables laissés par des artisans sur divers types de matériaux comme les murs (les soi-disant Steinmetzzeichen), les lingots, les armes, les objets en os en ivoire ou en faïence et d'autres produits artisanaux, sont amplement diffusés tant du point de vue géographique que chronologique. L'usage de tels symboles fut et est toujours tellement répandu qu'il est impossible d'en dresser une liste complète eu égard au manque de publication exhaustive.

En Crète et sur le continent grec l'usage des marques de potier va bien au-delà non seulement du domaine de la diffusion chronologique et spatiale de l'écriture mycénienne linéaire B, mais aussi des écritures minoennes (hiéroglyphique et linéaire A). On les retrouve identiques en des endroits et des périodes divers : outre le continent grec et la Crète, dans les Cyclades (surtout à Melos et Keos), au Proche-Orient (surtout en Syrie et Palestine), en Égypte, à Chypre, dans les civilisations danubiennes, en Italie (surtout dans les îles éoliennes) et ailleurs.

Le caractère élémentaire du tracé de bien des marques de potier et d'artisan en général (elles font partie souvent du répertoire des signes les plus spontanés et communs comme la croix, le trident, le rectangle, le rameau, la double hache, etc.) explique les raisons pour lesquelles elles apparaissent de manière identique à des époques et des endroits les plus variés.

Des processus de créations analogues et autonomes ont très bien pu se manifester en des endroits géographiquement et chronologiquement différents. En outre le caractère élémentaire du tracé de beaucoup de marques de potier explique le fait qu'elles apparaissent quelquefois identiques aux signes les plus simples des divers systèmes d'écriture du bassin égéen: l'écriture hiéroglyphique, le linéaire A, le linéaire B et l'écriture chypro-minoenne.

L'existence d'un ou de plusieurs *corpora* complets de toutes les marques de potier découvertes sur le continent grec, en Crète, dans les îles égéennes et en général dans tout le bassin méditerranéen, fait défaut. Ces marques sont actuellement publiées uniquement pour quelques sites et souvent de manière incomplète. Les observations faites à ce sujet par A. Kober en 1948 au sujet du manque de publication de cette catégorie de documents sont toujours valables[2]. Parmi les publications exhaustives des marques de potier, il me plaît de souligner celle relative à Phylakopi de Melos par Edgar et Evans en 1904, celle datant de 1982 des marques trouvées par Caskey à Keos, par Bikaki, celle relative aux marques découvertes à Mallia à la fois dans les sondages au sud-ouest du palais et au Quartier Mu respectivement par Olivier et Godart et Olivier, celle des marques provenant des îles éoliennes par Bernabò Brea[3].

Des références aux marques de potier sont éparpillées dans des dizaines de publications. J'ai donné dans le *«Corpus delle iscrizioni vascolari in lineare B»*, pour le Néolithique et les diverses phases de l'Âge du Bronze, une liste tout autre qu'exhaustive des localités du continent grec, de Crète et des îles de l'Égée qui ont restitué ce type de

[2] Kober 1948: 100 et n. 52.

[3] Edgar and Evans 1904: 177-185; Bikaki 1984: 135-136; Olivier 1968: 135-156; Godart and Olivier 1978: 121-204; Bernabò Brea 1958: 219-233.

documentation incisée avant ou après la cuisson ou bien peinte. Cette liste doit être mise à jour.

Les marques de potier sont présentes tout au long du second millénaire (et dans certains cas bien avant) dans toutes les civilisations du bassin méditerranéen. À Chypre on a mis au jour des marques de potier appartenant aux diverses phases de l'âge du bronze. Un corpus de ces marques a été publié par Aström. En Italie des marques de potier peintes datant du début du Néolithique initial ont été découvertes dans la grotte de S. Angelo III a Cassano Ionio dans la région de Sybaris. En outre l'usage de marques sur les céramiques s'est maintenu longtemps dans les cultures éoliennes de l'Âge du Bronze. On les retrouve en effet dans deux couches culturelles distinctes et successives, celle de Capo Graziano e celle de Milato. En Égypte on en a découvert dès l'époque de la I^{ère} et de la II^{ème} dynastie. Dans bien des localités de Syrie et de Palestine on trouve des marques de potier dès le III^{ème} millénaire. A Bogasköy on a trouvé des marques de potier allant du début à la fin du II^{ème} millénaire avant notre ère ; celles incisées avant cuisson ont été publiées par U. Seidl[4].

Une valorisation de ces marques de potier pour la reconstruction des moments précoloniaux en Méditerranée n'a pas été prise en considération de manière systématique eu égard au nombre considérable d'attestations et au fait, comme on l'a vu, du manque de publication de la plupart d'entre elles.

Toutefois dans les réflexions avancées par les chercheurs, il existe plus d'une référence à l'évaluation critique de ces marques et celle-ci va dans deux directions.

La première consiste à voir dans la présence de marques apparentées en des endroits éloignés, le témoignage d'un rapport qui a pu exister entre les régions en question.

La seconde est celle d'utiliser les marques de potier, lorsque ces dernières sont apparentées à des signes d'écriture, pour supposer dans les endroits en question la présence d'une écriture constituée, même en l'absence d'attestations directes de cette dernière.

Il faut dire que l'on trouve des marques de potier au tracé identique en des régions qui pour sûr n'ont eu aucun type de contact entre elles. Cela naturellement remet en question les hypothèses avancées par certains chercheurs quant à la valeur de ces marques de potier. Par ailleurs cela ne signifie nullement que la coïncidence entre le tracé de marques de potier en des endroits différents doive être interprétée comme privée de toute signification mais une évaluation adéquate de ces coïncidences ne peut se faire qu'au sein d'une analyse complexe d'éléments tendant à démontrer l'existence d'une *koinè* culturelle entre les zones prises en considération.

De même en ce qui concerne la seconde hypothèse, la présence de marques de potier au tracé identique à celui de certains signes d'une écriture, peut uniquement être prise en considération dans le cadre d'un examen diachronique des attestations de cette écriture sul le même site et dans le même contexte archéologique.

Ce que je viens de dire porte à exprimer une réserve de poids quant aux thèses soutenant l'existence d'une écriture dans les régions où ne sont attestées que des marques de potier, quand bien même certaines de ces marques auraient un tracé correspondant à des signes d'écriture présents sur des sites différents, éloignés géographiquement.

Prenons quelques exemples concrets.

[4] Pour les références bibliographiques, je renvoie à Sacconi 1974: 207-212.

En ce qui concerne le premier point relatif à la présence de marques de potier au tracé identique attestées dans des régions différentes, et interprétées comme preuve de contacts entre les régions en question, il faut remarquer qu'il existe des similitudes de tracé quelquefois nombreuses entre des marques de potier et plus généralement entre des marques d'artisan présentes non seulement dans les cultures des anciennes civilisations de la Méditerranée mais aussi dans des régions les plus disparates géographiquement et chronologiquement parlant, comme, outre le continent grec, la Crète et les Cyclades (surtout Melos et Keos) à l'Âge du Bronze, l'Égypte des périodes comprises entre la XII^{è} et la XVIII^{è} dynastie (localités de Kahun et Gurob), Cassano Ionio dans le région de Sybari à l'époque néolithique, les îles éoliennes à l'Âge du Bronze mais aussi les civilisations danubiennes au Néolithique, le Pérou entre le I^{er} et le IX^{è} siècle de notre ère et deux tribus amazoniennes contemporaines, les Indiens Caduveo à la frontière entre le Brésil et le Paraguay et les Indiens Guajiro en Colombie[5].

La même coïncidence existe entre le tracé de marques de potier et d'artisan présentes dans des localités et aux époques les plus disparates, et des signes d'écriture. Que l'on note dans la Fig. 1 certaines coïncidences de tracé entre des signes attestés dans les écritures crétoises (hiéroglyphique, linéaire A et linéaire B) et des signes présents à Cassano Ionio au Néolithique, dans les Cyclades occidentales (Melos et Keos), les îles éoliennes aux diverses phases de l'Âge du Bronze et les deux tribus amazoniennes d'aujourd'hui, les Caduveo et les Guajiro.

Afin de démontrer la totale non pertinence de simples coïncidences de tracé entre des signes pour soutenir l'existence d'un rapport éventuel entre des régions différentes, je voudrais fournir un exemple qui me paraît significatif de coïncidences de signes au sein de véritables systèmes d'écriture (Fig. 2 et 3).

Depuis longtemps on a souligné qu'au moins neuf signes du syllabaire chypriote classique (indiqué comme CC) sont identiques ou du moins ressemblent fort à des signes du syllabaire linéaire B (indiqué comme LB) et ont exactement la même valeur phonétique. Cela peut paraître suffisant pour conclure à un rapport étroit entre les deux systèmes d'écriture mais la prudence est de rigueur lorsque l'on constate (Fig. 3) qu'il existe un rapport identique entre ces signes dans le syllabaire chypriote classique et le syllabaire japonais.

Il est facile de démontrer que l'origine des signes japonais n'a rien à voir avec Chypre mais en réalité si nous ne savions rien de leur origine, nous pourrions penser qu'il exista jadis des contacts entre Chypre et le Japon[6].

Les rapports entre le syllabaire chypriote classique et le linéaire B se peuvent justifier par la proximité de Chypre avec la zone où l'on utilisait le linéaire B et dans le cadre des contacts bien attestés entre les régions où ces syllabaires sont attestés. C'est uniquement sur la base de ces éléments que ces coïncidences apparaissent comme significatives.

[5] Pour les références bibliographiques, voir les notes 3 et 4 et, en outre, Masson 1984: 89-123; Dannan 1971: 460 sq et fig. 3 pour le Pérou; Levi-Strauss and Belmont 1963: 102-108.

[6] Chadwick 1979: 139-143.

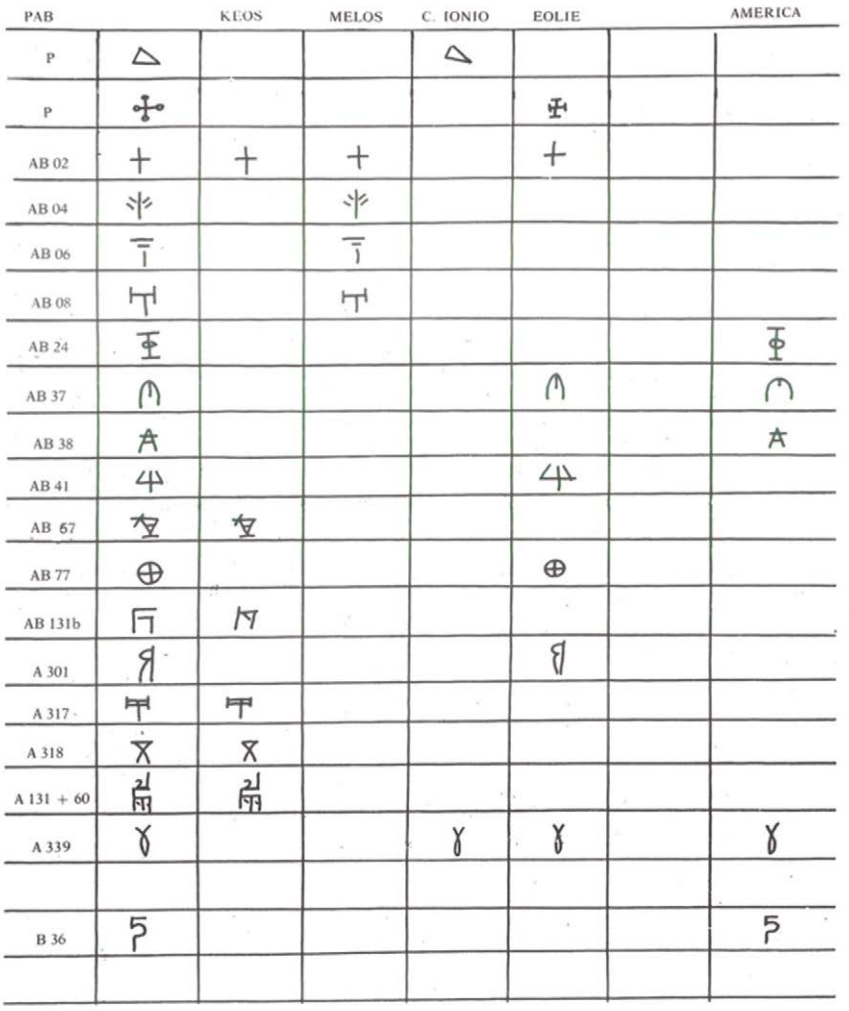


Fig. 1. Coïncidences de tracé entre les marques attestées dans les localités les plus disparates du point de vue chronologique et géographies et des signes des écritures crétoises (P = pictographique ou hiéroglyphique, A = linéaire A, B = linéaire B) agrégées avec les lettres PAB

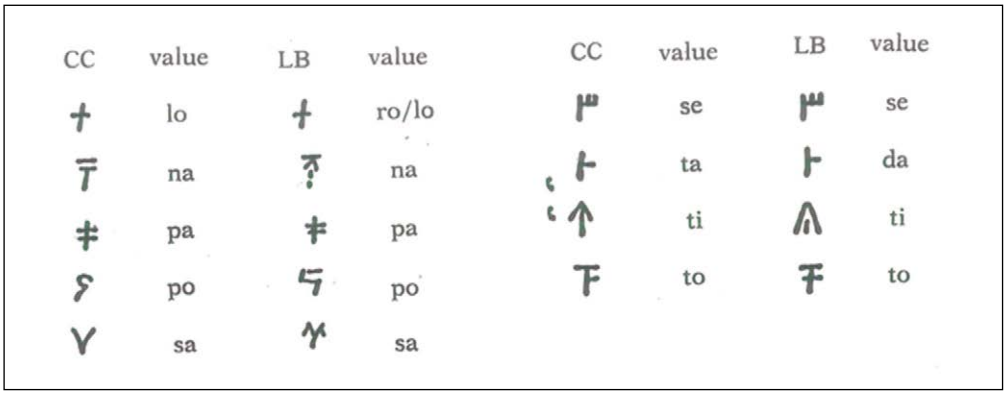


Fig. 2. Signes du syllabaire chypriote classique identiques à des signes du linéaire B et porteurs des mêmes valeurs phonétiques dans les deux systèmes

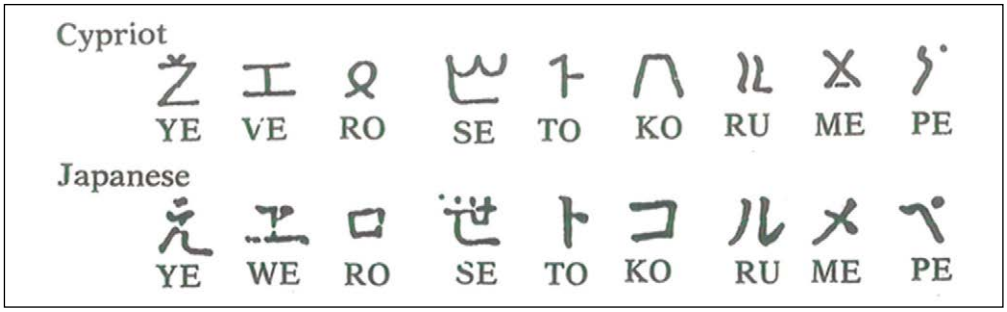


Fig. 3. Signes du syllabaire chypriote classique identiques à des signes du syllabaire japonais et porteurs des mêmes valeurs phonétiques (Cooper 1918)

Passons à présent à l'analyse du second point.

Ce qui a été exposé jusqu'ici ne signifie pas que la coïncidence de tracé entre des marques de potier attestées en des endroits différents doive toujours être considérée comme dépourvue de signification, tout comme pertinente peut être la présence de concentration particulière de marques de potier en des régions différentes mais une appréciation adéquate de ces coïncidences ne peut se faire que dans le cadre d'un examen plus complexe des éléments qui amènent à supposer l'existence d'une *koinè* culturelle entre les régions en question.

Prenons un exemple concret.

La découverte de très nombreuses marques de potier dans les Cyclades occidentales et à Lerne en Argolide est indubitablement à mettre en relation avec la *koinè* culturelle liée aux échanges commerciaux qu'eurent les Minoens avec les Cyclades occidentales, en particulier Théra, Melos et Keos entre le début du Bronze Moyen et le Bronze Récent IB (entre 1950 et 1450 avant notre ère).

Ainsi comme avec la Crète, les établissements de ce que Davis a défini le «Western String Network» avaient des contacts fréquents entre eux et, en particulier à la fin du Minoen Moyen II et au début du Minoen Récent, avec l'Attique et le Péloponnèse nord oriental[7].

À l'intérieur d'un ensemble d'échanges culturels aussi évidents, la présence de fortes concentrations de marques de potier à Melos et Keos peut être le témoignage des échanges ayant existé à la même époque entre ces diverses régions.

La route commerciale et par conséquent la *koinè* culturelle, confirmée également par la présence considérable de marques de potier identiques, qui reliait la Crète à travers les Cyclades occidentales (Keos, Théra et Melos) au continent grec est exactement celle que suivit l'écriture linéaire A et amena à la création sur le continent de l'écriture linéaire B à l'époque de l'Helladique Récent I en Argolide[8].

Je crois qu'il est significatif de rappeler qu'à cette koinè culturelle qui comprend la Crète, les Cyclades occidentales et certaines régions de la Grèce continentale, appartient également Lerne en Argolide là où les fouilles de Caskey ont mis au jour une forte concentration de marques de potier qui corroborent l'extension de cette *koinè* culturelle[9].

[7] Davis 1979: 143-146 et 153-155.

[8] Godart 1979: 27-42.

[9] Caskey 1958: 125-144, en particulier 142-143.

Examinons à présent la question du rapport graphique entre marques de potier et signes d'une écriture donnée au sein de sites et de contextes archéologiques bien déterminés.

Nous avons déjà dit que la présence de marques de potier ayant un tracé identique à des signes d'écriture ne pouvait constituer une preuve de l'existence d'une écriture à l'endroit en question mais tout au plus pouvait représenter un élément à prendre en considération dans le cadre d'un examen diachronique lié à la présence de l'écriture sur le même site et dans le même contexte archéologique.

En réalité les marques de potier ne constituent jamais une écriture en soi et si leur tracé coïncide avec celui des signes d'une écriture attestée sur le même site et à la même époque, il s'agit de toute façon de signes dépourvus de toute valeur phonétique et il convient de les cataloguer et étudier à part. En outre on doit rappeler qu'un travail de comparaison utile et indubitablement nécessaire, n'est faisable qu'en partie car souvent les marques de potier n'ont pas été publiées ou ne l'ont été qu'en partie.

Par conséquent cette étude n'est réalisable que pour les sites dont tous les témoignages du genre ont été publiés.

Deux catalogues exemplaires sous tous leurs aspects, des marques de potier trouvées à Mallia à la fois dans les «Sondages au sud-ouest du Palais» remontant au Minoen Moyen I et au «Quartier Mu» du Minoen Moyen II B ont été publiés par Olivier et Godart et Olivier[10].

Les marques de potier du «Quartier Mu» peuvent être classées comme suit:

1) Signes au tracé semblable ou identique à des signes de l'écriture;

2) Signes qui en l'état actuel de nos connaissances sont étrangers au système d'écriture hiéroglyphique.

Dans chacune de ces deux catégories on compte des signes au tracé simple et d'autres au tracé complexe.

Parmi les signes de l'écriture hiéroglyphique utilisés comme marques de potier, figurent des signes «simples» comme la flèche et le triangle, la croix, la croix de Saint André, un ou deux traits verticaux, horizontaux ou obliques et le cercle avec un trait horizontal au centre.

On trouve également des signes plus complexes comme les logogrammes pour le blé ou le vin et le signe de la main gantée mais aussi des signes beaucoup plus élaborés parmi lesquels le «pentacle». En outre on constate que certains signes qui sont sans correspondants parmi les signes hiéroglyphiques, réapparaissent ensuite comme des signes des écritures linéaires A et B, comme AB 2, A 318 et A 708.

Pour dresser un bilan diachronique des rapports entre marques de potier et écriture à Mallia, voyons les 35 documents découverts dans les «Sondages au sud-ouest du Palais» publiés par Olivier dans le volume XX des Études crétoises.

Notons tout d'abord, comme l'ont souligné Godart et Olivier, qu'il existe une parenté évidente entre les marques de potier provenant des «Sondages» et celles du «Quartier Mu». Outre la prépondérance du signe de la «main gantée» dans les deux ensembles, il faut remarquer que toutes les marques attestées dans les «Sondages» se retrouvent au «Quartier Mu», y compris la marque du «pentacle», un signe particulièrement élaboré qui ne correspond à aucun signe d'écriture. En outre ces marques, de part et d'autre,

[10] Cf. note 3.

sont attestées dans les deux groupes sur un type de céramique particulièrement grossier, ce qui confirme la continuité culturelle existant à Mallia entre le Minoen Moyen I et le Minoen Moyen II.

Le cas de Mallia peut nous permettre de conclure que l'étude systématique à la fois typologique et diachronique des marques de potier au sein d'un même site archéologique sert à mettre en évidence:

1) Le rapport existant entre le tracé de certaines marques de potier et celui de certains signes de l'écriture hiéroglyphique et par là conclure à la connaissance de cette écriture de la part des potiers;

2) L'importance de l'étude typologique et diachronique des marques de potier à l'intérieur d'un site archéologique permettant ainsi de conclure à la parfaite continuité entre deux phases de la même culture.

Ce que nous venons de voir à propos de Mallia démontre combien l'étude des rapports entre marques de potier et signes d'écriture a une valeur méthodologique dans la mesure où elle est réalisée au sein de documents provenant du même site archéologique où, outre les marques de potier, sont attestés également des documents écrits.

On peut donc affirmer que la tâche de l'épigraphiste consiste à réaliser dans le cadre d'un même contexte archéologique, une étude typologique et diachronique des marques de potier, identifier celles qui correspondent à des signes d'écriture, dresser une statistique prenant en considération les marques correspondants à des signes d'écriture et celles qui leur sont étrangères.

Après quoi l'épigraphiste doit affronter la question de la valeur à attribuer aux marques de potier présentant un tracé semblable à celui de signes d'écriture.

Cette étude doit également affronter la question des coïncidences de tracé entre des signes d'écriture et des marques de potier liées au même site archéologique mais remontant à une époque précédente à l'apparition de l'écriture sur le site en question.

Pour traiter de manière rigoureuse une telle question on doit à mon avis faire une distinction entre signes simples et signes compliqués. Dans le cas des signes simples, on peut sans doute songer à des processus de création analogues quoiqu'autonomes. Le tracé élémentaire pourrait être la raison de la présence de ces signes au sein des écritures crétoises.

On doit en revanche attacher une importance plus particulière aux signes complexes et à la fréquence de ces attestations à la fois parmi les marques de potier et les signes d'écriture.

Prenons un exemple tiré de l'expérience malliote: celui de la main gantée qui, par la complexité de son tracé et sa fréquence est particulièrement significatif.

La présence de la main gantée à Mallia dans deux contextes clairement datés comme celui des «Sondages au sud-ouest du Palais» remontant au Minoen Moyen I et celui du «Quartier Mu» à la fin du Minoen Moyen II est significatif de la continuité existant entre ces deux périodes. Le signe de la main gantée utilisé comme marques de potier dans les «Sondages» l'est dans la proportion de 1 sur 6 alors qu'il l'est de 1 sur 5 au «Quartier Mu».

Par ailleurs la présence parmi les marques de potier du Minoen Moyen I à Mallia de signes de l'écriture hiéroglyphique au tracé simple comme le signe de la flèche ou celui du triangle ne prouve absolument rien car de tels signes se retrouvent dans n'importe quel type d'écriture.

Le signe de la main gantée comme signe d'écriture est attesté de manière constante au Minoen Moyen II dans les documents hiéroglyphiques de Cnossos et de Mallia. Il correspond au signe P 9 et au signe P 123 (avec les variantes a et b) de Evans (Fig. 4).



Fig. 4. Les signes P 9 et P 123 des textes hiéroglyphiques ou pictographiques de Cnossos dans leurs variantes a et b (Evans 1909: 183 et 226).

L'attestation fréquente du même signe de la main gantée comme marque de potier dans un contexte Minoen Moyen I à Mallia nous autorise à supposer, même si nous ne possédons pas de documents écrits pour cette période, l'existence d'un système d'écriture pour la période en question.

Ces diverses constatations doivent suggérer aux spécialistes de procéder pour tous les autres sites, à un travail de classement typologique et diachronique des marques de potier, semblable à celui effectué pour Mallia. On pourra ainsi définir pour chaque site la continuité ou la rupture existant entre les diverses phases de la culture du site en question et focaliser avec précision les coïncidences existant au sein d'un même site, entre signes d'écriture et marques de potier.

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Precision weighing in the Late Bronze Age Aegean between eastern and western Mediterranean

Maria Emanuela Alberti

Abstract: The history of the precision weighing measures in the Aegean is quite a complex and still debated one: it seems however clear that local regional traditions merged with long-distance influences, suggesting that trade played a key role in shaping the measuring system(s), especially the trade in precious metals and spices. If it is clear that during EBA the weighing system of mainland Greece was actually based on Levantine standards, the situation for the next periods and for the Cyclades and Crete is less straightforward. The present investigation covers the timespan from the MBA – LBA transition to the central phases of the LBA (MM III – LB IIIA-B), i.e. the Minoan Neopalatial and the Mycenaean palatial periods (ca. 1700 – 1200 BCE). Even if the weighing system(s) of those phases have already been largely studied, a work on precision weighing and more generally light units and their fractions is still missing. This highlights the connections between precision weighing and craftwork or trade, the different local trajectories and chronological transformations, and the various interactions with the systems from the Mediterranean.

Mediterranean interaction is indeed one of the main concerns of the present contribution. In recent years, a series of new studies and research revitalised the discussion about Bronze Age trade and weighing habits in the wider Mediterranean and Europe. The general outline pictures the spreading of weighing and of weighing tools from the Eastern Mediterranean to the Italian peninsula and from there to central and then northern Europe, in a long process starting around the beginning of the LBA (in Aegean terms), i.e. ca. 1700 BCE. What has still to be detailed, and that the present work intends to address, is the role played by the Aegean in this framework.

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Introduction: precision weighing, Mediterranean interaction, and practical units

The history of the precision weighing measures in the Aegean is quite a complex and still debated one: it seems however clear that local regional traditions merged with long-distance influences, suggesting that trade played a key role in shaping the measuring system(s), especially the trade in precious metals and spices[1].

There is no space here to track the evolution of the precision weighing measures in the Aegean from the beginning of the available documentation (EBA). To frame the discussion, it is worth remembering that, since the early third millennium at the latest,

[1] Alberti 2016a, 2011 and 2003 with previous bibliography. It has even been proposed that the Minoan basic weight unit (c. 60 g) could be originally connected to the Egyptian gold *dbn* standard (12,9 g, Old Kingdom) (Michailidou 2004).

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Near Eastern societies developed complex systems of measuring weight, volumes, lengths and land area. Weight measures were used to quantify metals, wool, textiles and other commodities. Larger units of weight measurement, such as the talent and the mina (and also the wool unit) are quite close, if not identical, in many areas, while the smaller units, called shekels in Anatolia, Syria and Mesopotamia, and *qdt* in Egypt, are more different one to each other (Fig. 1)[2].

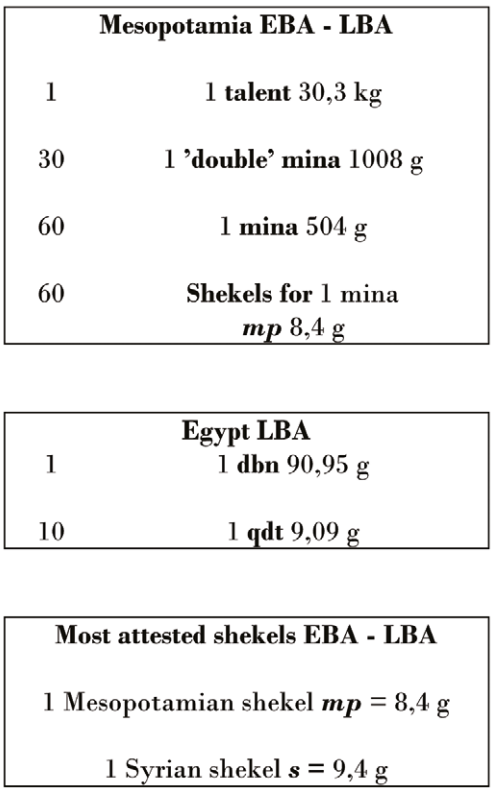


Fig. 1. Most important weight units in the Eastern Mediterranean from the EBA to the LBA

The scholarship of the last decades showed how these systems impacted also the Aegean, where the use of shekel units has been detected from the EBA, especially on the Helladic mainland, while the situation in the Cyclades and on Crete seems more complicated to assess[3]. In any case, it seems that during the MBA such knowledge faded away from mainland communities, which leaves us free to cast a fresh eye on the LH

[2] Parise 1984; Milano and Parise 2003; Sorda and Camilli 2003; Clancier *et al.* 2005; Alberti 2003; 2011; 2016a; 2017; Alberti and Parise 2005; Alberti *et al.* 2006; Ascalone and Peyronel 2006; Michailidou 2008: 205-216. Concerning the actual measuring systems, along with Aegean units, some parallels with Near Eastern standards is necessary. The evidence from Mesopotamia seems to be quite clear (e.g. Powell 1979; Hafford 2012; Chambon and Otto 2023), but the situation in Anatolia and Levant needs a reassessment, as the thorough review of the evidence by Enrico De Benedictis (De Benedictis forthcoming) suggests. Therefore, if any comparison is needed with Near Eastern materials, only two basic shekels will be used for the present analysis: the Mesopotamian of 8,4 g (***mp***) and the Syrian («Ugaritic») of 9,4 g (***s***). Both shekels are widely attested in the Eastern Mediterranean from the Early Bronze Age to the end of the Late Bronze Age, and the latter was also used in Egypt during the LBA (***qdt***).

[3] Rahmstorf 2006; 2010; 2016.

documentation[4].

The present investigation covers the timespan from the MBA-LBA transition to the central phases of the LBA (MM III-LB IIIA-B), i.e. the Minoan Neopalatial and the Mycenaean palatial periods (ca. 1700-1200 BCE). Even if the weighing system(s) of those phases have already been largely studied, a work on precision weighing and more generally light units and their fractions is still missing[5]. This highlights the connections between precision weighing and craftwork or trade, the different local trajectories and chronological transformations, and the various interactions with the systems from the Mediterranean.

Mediterranean interaction is indeed one of the main concerns of the present contribution. In recent years, a series of new studies and research revitalised the discussion about Bronze Age trade and weighing habits in the wider Mediterranean and Europe[6]. The general outline pictures the spreading of weighing and of weighing tools from the Eastern Mediterranean to the Italian peninsula and from there to central and then northern Europe, in a long process starting around the beginning of the LBA (in Aegean terms), i.e. ca. 1700 BCE[7].

Methodologically, according to the same studies, the spreading of weighing habits through Europe can be addressed considering the progressive convergence of measurement systems around some recurrent values, especially those employed in trade activities[8]. This would not be a regulated administrative phenomenon, but something issued from daily practice, apart from the palatial contexts[9]. Approximation and variability would be at play to shape these customary standards or Standard Average Quantities (thereafter SAQ): «practical» units that bridge the difference among official measuring systems[10].

What has still to be detailed, and that the present work intends to address, is the role played by the Aegean in this framework.

[4] Rahmstorf 2016; Alberti 2019a.

[5] Evans 1906; Parise 1986; Michailidou 1990; 2001; 2006; 2007; 2008; Petruso 1992; Alberti 2003; 2016a. For a thorough revision of the Minoan and Mycenaean weight units, and on light units, see de Fidio 2024, where the investigation focuses on the Aegean shekel (6,52 g) and the wool series. Unfortunately, I read this paper after receiving the first proof of the present work and could not include it in the discussion.

[6] Ialongo 2019; Brandherm *et al.* 2018; Ialongo *et al.* 2018a, 2018b and 2021; Ialongo and Rahmstorf 2019; Rahmstorf 2020; Prell and Rahmstorf 2021.

[7] For the chronology of the Lipari weights, see fn 29.

[8] «Our analysis aims at addressing the apparent convergence of different systems of measurement around recurrent values, and is based on the hypothesis that different systems of measurement show convergence around those quantities which, for practical reasons, are most frequently employed in exchange activities. On empirical grounds, it is then assumed that convergence phenomena produce arrays of 'portioned goods' whose weight measures tend to cluster in correspondence of such convenient values» (Ialongo *et al.* 2018a: 28).

[9] «Here, we show that the origin of weight systems in Western Eurasia can be explained with the random propagation of error from a single value, with statistical dispersion remaining at low levels due to an uninterrupted process of self-regulation put in action by networks of merchants over roughly two millennia» (Ialongo *et al.* 2021: 4).

[10] «The concept of 'Standard Average Quantity' (SAQ) was designed to account for such a duality and is meant to provide the middle-range tool to connect empirical observations to the broader interpretive framework. A SAQ can be defined as follows: a recurrent, conveniently tradable quantity (of mass), whose adoption is acknowledged within one, or across several different cultural systems. In this respect, a SAQ has a similar function to that of the *mina*, since both are meant to link together different standard systems and to provide utility in conversion operations […]. A SAQ can be measured in terms of any existent system of units, as its utility depends on the agreement between economic actors. A SAQ is, therefore, a 'practical unit' according to which goods are, in effect, portioned and traded. SAQs are ideally represented, on empirical grounds, by the statistically significant concentrations of weight values. In fact, SAQs are not exact, their approximate nature being due to either measure imprecision or inconsistency of different scales of measures. In our model, SAQs are not independent from normative (i.e. theoretical) systems of measurement, but are dynamically involved with them in a dialectical relation, reciprocally shaping each other» (Ialongo *et al.* 2018a: 28-29).

The end of MB/MM II: the «adoption» of Eastern standards in Minoan Crete

The formation and evolution of the Minoan weighing system(s) is still quite unclear, largely because of the lack of available documentation. The only MM evidence presently published are some weights from the *Quartier Mu* and another item from the Dessenne Building, both from Malia and both dated to the end of the MM IIB (c. 1700 BCE)[11]. These findings show the important link between craftwork, economic management, trade and the use of weighing tools: the various buildings yielded indicators of seal carving, pottery making, metallurgy (various places), textile production, storage on large scale and administration.

Within the framework of Mediterranean connections[12], the Malia evidence illustrates an experimental and possibly early stage of the Minoan weighing practices, where both typologies and standards are not well established and possibly Levantine units and shapes are present along local ones. The assemblage from the *Atelier de Potier* (where also some imported galena has been found) is especially noteworthy: along three balance weights, also two scale pans were recovered from the building. The three weights, though probably not belonging originally together, but coming from the same room, could have been based on a unit **k** of c. 20 g and formed, as a working set, a series: ½; 1; 1 +½(Fig. 2). This is quite significant: this unit will be well attested during the following centuries both in Crete and in the mainland.

Context	Inv. N.	Type	Mass (g.)	Aeg. Rel. Val	NE Rel. Val.	Unité (g.)	Marks	Cons.
Mu Potier VIII4	B 89	stone disc	21,45 (+).	**k**; 1/3x?		k=21,45(+); x=64,35(+);	Circle incised at the center of one face	Good. Concretions. Slightly overweight.
Mu Potier VIII4	B 90	stone disc	34,84 (-).	2/3x? **3/2 k**	**4 mp**	x=52,26(-) k=23,22 (-) mp= 8,71	\	Good.
Mu Potier VIII4	B 88	stone cylinder	9,7	**k??**	**s**	s= 9,7s k= 9,7	Arrow (three lines) incised on one edge	
Mu,B, IV4.	68 M 463	stone disc	95 ca.	**4k**; **3/2x**;	**1** ***dbn*** **=** **10** ***qdt/s***	k=23,75; x=63,33 dbn = 95 ; qdt/s=9,5	\	\
Mu A III 13.	M71/ B92bis	lead parallelepiped	16,5 ca.	**1/4x**	2 mp	x=66 mp=8,25	\	\
Mu, area of Building C	M69/ B55bis	lead disc	14,40 (+).	1/4x?		x=57,6(+)	Deux signes gravés sur une face.	\
Dessenne Building	N.Inv. ASO2014 – 01 – 0101 – OB002	hematite prism	10,92	**½ k**		k= 21,84		Complete

Fig. 2. Balance weights from Malia dated to the end of MM IIB (modified from Alberti 2019b). **x** = 60 g ca. ; **k/P** = 20 g. ca.

[11] Detournay *et al.* 1980; Poursat 1996; Alberti 2000 and 2019b.

[12] Poursat and Loubet 2005; Poursat and Oberweiler 2011.

In addition, the *Potier* cylinder of 9,7 g and the Dessenne hematite prism of 10,92 g seem to suggest some forms of imitation and appropriation of Levantine weighing habits: the first has an atypical shape, but is marked, and has exactly the mass of a Syrian shekel s, while the second has the same material of many Eastern weights, but a very Minoan shape – though used for seals. We can hypothesise that the first acted originally as a sound reference for the external unit, but was actually used as a fraction of **k**. On the other hand, the second could be the result of an attempt to create a local version of it, better suited to what will become the more common Minoan metrical series, with a unit of c. 60 g and fractions of 20 g and possibly 10 g. Therefore, the approximation of the mass replication can be due to technical factors and/or be intentional.

MB III-LB I-II. An Aegean shekel?????

The MB III-LB I-II (170-1440 BCE ca) period is the phase of major documentation of balance weights of Minoan/Aegean-type: disc-shaped items, made mostly in lead but also in stone, based on a standard ***x*** of ca 60 g (actually oscillating between 57 and 67 g, Fig. 3).

1	***L***	30,000 g	480
1/30	***M*** ***double mina***	1,000 g	16
1/60	***Mina***	500 g ca	8
1/120	**half mina**	250 g ca	4
1/480	***x***	60-65 g	1
1/1440 (1/1500)	***k***	20 g	1/3

Fig. 3. Simplified structure of the weighing system used during the Neopalatial period in the Aegean, reconstructed on the basis of the attested groups of weights. The wool (***l***) and textile (***f***) units and the smaller hypothetical fractions are not considered

They are largely present in Crete (main clusters are known from Knossos, Poros, Mochlos, Zakros, and Haghia Triada) and also in many locations in the Aegean: Ayia Irini (Keos), Akrotiri (Thera), Samothrace, Miletus, and Vapheio (Laconia). The diffusion of these weights is considered one of the most important marks of Minoanisation and of

the leading role of Minoan power in the Aegean[13]. The islands of the «Western String» yielded the largest groups, thus pointing to the relevance of their economic (trading and productive) activities and of their role in the processing and circulation of the Laurion minerals. The quantities of lead balance weights attested during this period points itself to the large scale of Laurion exploitation[14]. On the mainland, in the Vapheio tholos tomb (LH IIA), among other grave-goods that exhibited a complex pattern of cultural influences, an impressive assemblage of nine balance weights (lead discs) and ten bronze scale pans has been found. The set of weights is typically Minoan, both in shape and standards: they are all multiples of the main unit x[15].

However, for this phase the evidence for light weights is disappointingly scarce in the Aegean. Some information is now available from Akrotiri (Thera, LB/LC I), on the route of the Laurion lead and silver to Crete, and from Mochlos (Crete, LB/LM I), where metallurgical activity is attested. The weights reported from two LM IA jewellery workshops in Poros, near Knossos, unfortunately have not yet been fully published[16].

Akrotiri, Thera (LB/LC I, destruction level around 1600 BCE)
Overall, the number of balance weights from Akrotiri is impressive: the settlement provided by far the largest amount of the whole BA Aegean (Fig. 4).



Fig. 4. Lead weights from Akrotiri, from the National Archaeological Museum website Photographic Archive of the Hellenic National Archaeological Museum, Athens. Copyright: ©Hellenic Ministry of Culture – Hellenic Organization of Cultural Resources Development (H.O.C.RE.D.)

Almost every area of the excavation yielded several examples: weighing was thus quite widespread in the town, related to the various productive and domestic activities performed. Also some bronze scale pans have been recovered. Along with the most common lead discs, stone discs and other stone items are also present, as well as some Levantine-type weights[17]. Unfortunately, there are various storage, conservation, and research issues, that nowadays hamper a sound reconstruction of the actual list of items coming from each excavation plot and of the precise mass of each exemplar[18].

[13] Most recently: Michailidou 1990; 2004; 2006; 2007; 2008; Petruso 1992; Alberti 1995; 2003; 2006; 2016; de Fidio 2024.

[14] Gale and Stos -Gale 1990 and 2008; Stos Gale and Gale 2006; Michailidou 2008.

[15] The weights are clearly arranged in a series of multiples of based on ***x*** and M: 1 ***x***; 2 ***x***; 2 ***x***; 3 ***x***; 4 ***x*** = ***N***; 8 ***x*** = ***N*** 2; 16 ***x*** = ***M***; 16 ***x*** = ***M***; 16 ***x*** = ***M***. Every multiple from ***x*** to 4 ***M*** (64 ***x***) can be composed (Alberti 2006; Michailidou 2008: 156-178).

[16] Dimopoulou 2012 with previous references.

[17] Michailidou 1990; 2004; 2006; 2007; 2008; Petruso 1992.

[18] During the years, Akrotiri balance weights have been divided between the excavation storerooms and the National Archaeological Museum of Athens, with different preservation and conservation destinies. This is especially delicate

However, taking together all the available data from the publications by K. Petruso and A. Michailidou[19], and performing various analyses, some general considerations are still possible, especially because of the evidence provided by the stone weights, less affected by erosion and conservation:

- weight masses range from very heavy to very light, but light weights are a minority;
- the large part of the groups follows the Minoan/Aegean standard of 60 g. c. (***x***), with its fractions and multiples; *additions of fractions are also possible*; the unit is also attested by some stone weights;
- a number of examples are based on a unit of 20 g. c. (***k/P***), also attested by some stone weights;
- items lighter than 20 g are present;
- Levantine stone weights are attested;

The general picture is reinforced by the limited but more detailed analysis of the weight groups from the various areas of the excavations, mostly lead weights: West House, House Alpha East, House Delta West and House Delta North (Fig. 5-6)[20].

WEST HOUSE
Lead discs:

Unit	Quantities
x	1/6 ; ¼; ½; 2/3; ¾; 1; 4/3; 2; 3, 4; 5; 6; 12; 16 (= ***M***).
k/P	½; ½ +1/4; 1+1/2; 2; 2+1/2; 3; 4; 6; 9; etc.

HOUSE ALPHA EAST
Lead discs:

Unit	Quantities
x	1/10; 1/6 ; 1/3; ½; 2/3; 1 (-) [1 stroke]; 1 (+) [1 stroke]; 3/2; 2; 2+2/3; 3; 4; 5; /; 8; 12;
k/P	1/3; ½; 1 (various); 2; ; 4 5; 6; 8; 9; 12; 15; 20; 24; 36

The k/P unit is also represented by a stone disc of 20,2 g, bearing an incised triangle.

Fig. 5. Metrological analysis of the Akrotiri find-groups: West House and House Alpha East. Data from Petruso 1992: Table 14; Michailidou 2004: 248; 2006: 238-261, fig. 2a, 2 b, 12, 13, 16, 28; 2008: 70-96. Analysis: M.E. Alberti. ***x*** = 60 g ca.; ***k/P*** = 20 g. ca.

HOUSE DELTA WEST
Lead discs

Unit	Quantities
x	1/3; 1; 1+1/2; 2; 3; 5;

HOUSE DELTA NORTH
Lead discs + 1 stone cylinder

Unit	Quantities
x	[1/20?]; 1/6; ¼; ½; 2/3; 1 (-); 1(+); 1 +1/3; 1+1/2; 2; 2+2/3?; 3; 3+1/2?; 8; 16; 20; etc.
k/P	[1/6]; ½; ½ +1/4; 1+1/2; 2; 2+1/2; 4; 6; 8; 9; 10; 24; etc.
½ k	[1/3]; 1; 1,5; 3; 3,5; 4; 5; 7; 8; 9; 10; 16; 18; 20; 48; etc.

Fig. 6. Metrological analysis of the Akrotiri find-groups: House Delta West and House Delta North. Data from Petruso 1992: Table 14; Michailidou 2004: 248; 2006: 238-261, fig. 2a, 2 b, 12, 13, 16; 28; 2008: 70-96. Analysis: M.E. Alberti. ***x*** = 60 g c.; ***k/P*** = 20 g. c.; ½ ***k/P*** = 10 g c. Quantities in [ ] refer to the possible value of the short gypsum cylinder of 3,2 g.

concerning the lead weights, whose mass changed considerably according to the various stages of restoration. Inventory numbers also pose questions. For all these issues, see Michailidou 2008: 66-72.

[19] Petruso 1992; Michailidou 2006; 2007 and 2008.

[20] The data of the various weight groups are from Michailidou 1990 (West House); Michailidou 2006b and Michailidou 2008: 74-80 (House Alpha East); Michailidou 2008: 80-86 (House Delta West); *ibidem*, 86-96 and esp. Tab. II.4, 91 (House Delta North). For the stone weights, see Michailidou 2006. See also de Fidio 2024.

The latter area yielded several lead balance weights, including one cross-shaped and another weighing 15 kg; a lead ingot fragment is also recorded. In addition, a fragment of a hematite sphendonoid comes from the same wider area, seemingly cut on purpose and weighing 20 g. c. A lead disc (21,9 g) and a gypsum disc (20 g.) were found together with a small gypsum cylinder of 3.3 g.

To better appreciate the lighter fractions, it is necessary to look to the smaller stone weights (Fig. 7): they seem to compose a series that can be interpreted as both based on the main unit ***x*** of 60 g ca (1/3; 1/6; 1/10; 1/20) and on its main fraction ***k/P*** of 20 g. c. (1; 1/2; 1/3; 1/6). Some examples bearing a mark and weighing 20 g. c, point to the existence of this main fraction as a parallel standard *per se*.

Inv. n.	Mass (g)	*P*	*x*	Marks and other notes
B132/76N020 stone cylinder	3,3	1/6	1/20	Found with B131/76N020 and a lead disc of 21,9
3104 stone disc	6,4	1/3	1/10	
2263 stone disc	11,5	1/2	1/6	Found with 2192
2263 stone disc	11,5	1/2	1/6	
3053 stone disc	12,1	1/2	1/6	
2981 stone disc	18 (-)	1 (-)	1/3 (-)	
B131/76N020 stone disc	20 g	1		Found with B132/76N020 and a lead disc of 21,9 g
370 (Alpha) stone disc	20,2	1	1/3	One engraved triangle
1971 stone disc	20,2	1	1/3	One dot on each face
902 hematite sphendonoid	21,9 g	1	1/3	Seemingly intentionally cut from a larger exemplar. Groove under the base
2192 stone disc	22,7	1 (-)	1/3 (-)	Found with 2263 g
2265 stone disc	29	1 + 1/2	1/2	

Fig. 7. Akrotiri, Thera, LB/LC I. Stone discs and a hematite sphendonoid with light masses, possibly related to the ***k/P*** unit of 20 g. c. Data from Petruso 1992: Table 14; Michailidou 2004: 248; 2006: 238-261, fig. 2a, 2b, 12, 13, 16, 28; 2008: 70-96. Analysis: M.E. Alberti. ***x*** = 60 g ca. ; ***k/P*** = 20 g. ca.

Mochlos, Crete, LB/LM I to IB, c. 1670-1500 BCE.

As in Akrotiri, in Mochlos balance weights and scale pans come from various areas of the settlement, both on the coastal area and on the island, in connection with the lively economic activities of the inhabitants and indicators of maritime trade[21]. Metallurgical activities and deposits of bronzes and copper ingots are equally well attested, along with pottery production, stone carving, textile making and oil and wine pressing[22]. Various weights were found during the Seager excavations (1908) and their context is now impossible to reconstruct. Others come from various areas of the recent Greek-American excavations (1989 onwards): clusters are reported from the Artisans' Quarter and from Building B2. The latter is especially informative concerning small weights, along with the scattered evidence coming from various buildings of area C.

The main characteristics of the lead disc-shaped weights are similar to those of the Akrotiri weights (Fig. 8):

- weight masses range from very heavy to very light, but light weights are a minority;

[21] Brogan 2006 for a detailed presentation of the Mochlos weights.The recent publication of large part of the Neopalatial settlement provides better indications on findspots and context for some of the findings (Soles 2022: 1, 239). See also Soles 2005 and 2008; Brogan 2008; de Fidio 2024.

[22] See now the full publication of metal hoards and metallurgical materials and the discussion of the productive activities on site in Soles 2022.

- the large part of the groups follows the Minoan/Aegean standard of 60 g. c. (*x*), with its fractions and multiples; *additions of fractions are also possible*;
- items lighter than 20 g are present;
- Levantine stone weights are attested (especially in the Artisans' Quarter).

BUILDING B2
Lead weights

Unit	Quantities
x	1/2 ; ½ + 1/3; 3/2; 2

WIDER AREA C
Lead weights

Unit	Quantities
x	1/10; 1/6; ½; ¾; 2; 18??

ARTISANS' QUARTER
Lead disc and stone weight

Unit	Quantities
x	½; 2/3; 2/3; 8 (= mina); 16 (= double mina)

SEAGER EXCAVATIONS
Lead weights

Unit	Quantities
x	1/3; ½; 2/3; 3/2

Fig. 8. Metrological analysis of the Mochlos find-groups. Data from Brogan 2006, Tab. 1. Analysis: M.E. Alberti

Very light items are attested in the wider area C, but unfortunately coming from various buildings, contexts and levels (mostly LM IB), so their meaningfulness is reduced (Fig. 9)[23]. The lighter weights could have been directly in relation with the main unit, i.e. 1/10 x; 1/6 x; ½ x; ¾ x; 2/3 x; 2 x; etc. This is the same series we saw in Akrotiri, especially from Alpha East. Interestingly, both the lighter examples bear marks, but it does not seem possible to attribute any probable values to them.

Context	Inv. N.	Weight (g.)	Rel. Value x	Resultant unit (g.)	Other values	Marks	Preservation
E3 LM IB early	Pb 61	6,6	1/10	x= 66 g	1 (6,6 g)	Small incised cross	good
E3 LM IB final *House C3*	Pb 20 *IVA 260*	10,1	1/6 x?	x= 60,6	1 + ½ (6,6 g)	One dot and an arched line, both incised	good
E 3 ?	Pb 18	30	1/2	x = 60,2	5 (6,3 g)		
E3 LMI ? *House C2*	Pb 9 *Pb 1 IVA 275*	33,50 (--)	?? 3/4x ???	x = 60			1/3 missing; possible weight 45 g (?)
C12	*Pb 96 IVA 314*	38,20	2/3?	x= 57,3			intact
E 3 LM IB final	Pb 35	109,55 (-)	2 x	x= 54,775 (-)		one incised mark on one side, a possible stroke on the other	chipped and eroded
C12	*Pb 97 IVA 315*	181,50	3	x= 60,5			good
E3 surface	Pb 22	1125,90 (---)	18???	x= 62,55	M + 2x ????		bad conditions, very damaged

Fig. 9. Metrological analysis of the Mochlos find-groups: detail on area C weights. Data from Brogan 2006 and Soles 2022. Analysis M.E. Alberti

[23] Compare Brogan 2006 (table 1, 273) and Soles 2022 (1: 239, 262, 263, 267).

An Aegean shekel????

Presently, only Akrotiri and Mochlos provide sound evidence for very light weights from the whole LB I Aegean, i.e. coming from official excavations, and complete publications with only a handful from both sites. This is obviously the result of a serious retrieval bias and brings forward the need for the re-examination of the small stone and metal objects of most sites. However, the picture remains puzzling, especially in comparison with the high number of small weights attested in various locations in contemporary Levant[24].

The mass of c. 6,5 (here ***Am***, Aegean minoan) has been sometimes called the Aegean «shekel», in parallel with the smaller units from Levant and Mesopotamia[25]. The situation in my opinion is far more complicated, as illustrated in Fig. 10.

AKROTIRI HOUSE APHA EAST + [DELTA 16]
Lead discs and stone weights

gr	23,7	12,9	6,5 g	[3,2]
x	1/3	1/6	1/10	1/20
P	1	½	1/3	1/6
½ P	2	1	2/3	1/3
Am	3	1 +1/2	1	1/2

MOCHLOS LB IB (VARIOUS CONTEXTS)
Lead weights

gr	19,4	10,1	6,6
x	1/3	1/6	1/10
P	1	½	1/3
½ P	2	1	2/3
Am	3	1+1/2	1

Fig. 10. Evidence (?) for an Aegean - Minoan «shekel» Am of c. 6,5 g (M.E. Alberti)

Under a general point of view, this mass is simply a direct fraction (1/10) of the main unit x of ca 60 g. However, it can also be a fraction (1/3) of the k/P unit. There is only one case where the marks suggest that this unit could have been used as an independent base for counting: and this is the case of Pb 20 /IV A 260 from Mochlos C3 building (see Tab. 7). That is only one case for the whole LB I Aegean, when dozens of weights are attested from the most important sites.

Perhaps we should start considering if this is the right line of reasoning. Metrological tablets from Levant and abundant economic texts certify that the shekel and its fractions were at the heart of the Mesopotamian and related counting systems[26]. But what about the Minoans? Were they interested in having a «shekel» in the first place? Possibly not at all.

[24] E.g Ascalone and Peyronel 2006 (Ebla); Hafford 2012 (Mesopotamia).

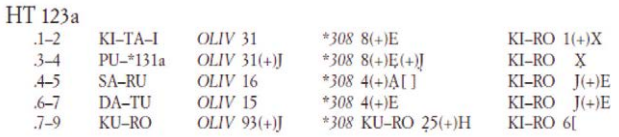
[25] Zaccagnini 1986: 422; Michailidou 2006: 235. As mentioned in fn. 5, I could not take into account the recent contribution on this topic by Pia de Fidio (2024).

[26] Most recently: De Benedictis in this volume with full bibliography and forthcoming; Bordreuil 2006; Chambon 2006 and 2011; Marti and Chambon 2019; Chambon and Otto 2023.

Minoan counting systems: Linear A and weights compared

The administrative texts of the Neopalatial period (mostly LM I) written in Linear A attest a counting system completely different from that used in Mesopotamia and Levant: not a series of grains and shekels structured in sexagesimal order, but a series of diminishing fractions following the unit, that was embedded in the logogram. Only the weight unit has its own symbol, that is like the «Talent» symbol of Linear B (AB *118). Linear A fractions signs are simple and composite, and count in the tenths. The situation is so complicated that scholars are still debating the exact order and values of the fractions[27]. Similarities, if any, are more with Egypt than with other contemporary societies.

For the purpose of the present paper, what seems meaningful is the *fractional relationship with the established unit*. Even if we do not know the meaning of the signs, we know that they form a series of quantities, from the largest to the smaller. Besides, it is clear from some registrations that sign fractions could be added to each other, e.g. ½ + 1/3 (Fig. 11).


HT 123a

.1–2	KI–TA–I	*OLIV* 31	**308* 8(+)E	KI–RO 1(+)X
.3–4	PU–*131a	*OLIV* 31(+)J	**308* 8(+)E(+)J	KI–RO X
.4–5	SA–RU	*OLIV* 16	**308* 4(+)A[ ]	KI–RO J(+)E
.6–7	DA–TU	*OLIV* 15	**308* 4(+)E	KI–RO J(+)E
.7–9	KU–RO	*OLIV* 93(+)J	**308* KU–RO 25(+)H	KI–RO 6[

Fig. 11. Transcription of Linear A tablet HT 123 (from Montecchi 2013: 13). Fractions occur after each registered good (*OLIV* and **308*), after the deficit (KI-RO) and the total (KU-RO)

All this echoes quite well the scheme we saw at work among the groups of balance weights from selected contexts (Tab. 3-7): a continuous series of values based on the main unit ***x*** of ca 60 g., both fractions and multiples. Multiples are arranged in simple manner and the presence of sexagesimal units is not attested from marks.

It seems that the mental scheme behind both counting practices (record keeping and weighing) is quite similar, even if details were different and many elements have been lost to us forever (Fig. 12). Subsequential fractional division was the main principle for the values inferior to the unit, while simple multiplication was used for the larger. There isn't any place left for a «shekel».

If this picture holds true, then a stronger unity of the mental accounting and counting processes in the Minoan and Minoanised world becomes visible.

[27] Bennett 1950; 1980;1999; Perna 1990; 2003; Karnava 2001; Montecchi 2009; 2013; 2017; Corazza *et al.* 2021 (where different interpretations of fractional signs are compared in Table 3). The system is well explained in Montecchi 2009: 29-30: «La lineare A dispone e di quarantasette segni per le frazioni (tra semplici e composti, trascritti tramite le lettere maiuscole: A, B, D-F, H, J-L, W-Y, W) utilizzati non solo per contare ma anche per misurare e per pesare, nel senso che l'unità maggiore è implicita nell'ideogramma stesso del prodotto e che le quantità più piccole sono descritte da un sistema addizionale di segni frazionali. Vi è un solo ideogramma che sembra indicare una misura ponderale standard: si tratta di AB 118 che, in lineare B, indica l'unità maggiore di peso.[…]. Tale differenza nei sistemi in cui le misure erano segnate scaturisce da una differenza nei sistemi pratici di misurazione. I Micenei avrebbero riempito vasi di diverse misure standard tante volte quanto fosse stato necessario per misurare la quantità complessiva di un determinato prodotto, mentre i Minoici lo avrebbero versato in una serie scalare di vasi dal più grande al più piccolo, fino ad esaurimento».

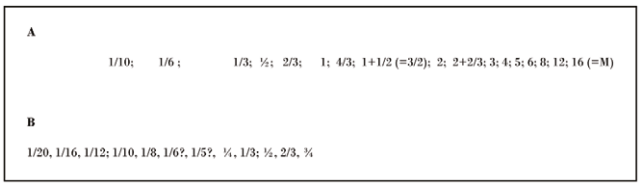


Fig. 12. Fractional values of LM/LC I weighing system and of Linear A compared. A) series of values from Akrotiri balance weights (see Fig. 5-7); B) series of values in Linear A according to Bennett 1950; Montecchi 2009; Corazza *et al.* 2021 (simplified) (M.E. Alberti)

Out of the Aegean: Lipari islands (2300-1500 BCE ca)

At the transition between MBA and LBA in Aegean terms, and during the MBA 1 in local terms, the Lipari islands show well-known traces of contact with the Aegean worlds, including several imported Mycenaean ceramics[28]. Also some balance weights of various typologies are attested, recently studied by N. Ialongo[29]. The important settlement on Lipari Acropolis yielded from the Capo Graziano phases (2300-1500 BCE) ca ten weights, mostly of the rectangular type. Unfortunately, on the basis of the excavation data it is not possible to be more precise in chronology. Ialongo already underlined the broad metrological affinities between the European rectangular weights and the discoid Aegean ones[30]. This is not the place for a thorough re-examination of the evidence: however, some more detailed observations can be made based on the data presented by Ialongo and Rahmstorf in a more recent work[31]. It is worth recalling that these data contained only the mass of the weight, with no information on the typology, the find-spot and on possible grouping, so that the present discussion is substantially abstract and needs further investigation. When plotting together, the masses of all the Capo Graziano weights from Lipari Acropolis (Fig. 13), seem to compose a typical Minoan series, based on the main unit ***x*** of ca 60 g, with its multiple and fractions. Also the unit ***k/P*** of ca 20 g seems to be at work. Addition of fractions to whole numbers can also be detected, which seems to be very Minoan indeed. At the same time, the heaviest item (469 g) can be seen as a mina, both in Aegean and in Levantine terms («Western mina»). Taken together, the examples from Lipari Acropolis weigh 1004,65 g, i.e. a double mina. *If* this metrological assumption holds true, then the Minoan/Aegean weighing practices also played an important role in the Mediterranean trade, at least in the areas touched by Aegean activities that, at this time, involved especially the Proto-Mycenaeans. The popularity of the Minoan system within the Helladic area has been already pointed out with the example of Vapheio.

[28] For LBA imports, see: Martinelli 2005; Bettelli and Cardarelli 2010; Jones *et al.* 2014; Levi *et al.* 2017; Bettelli and Martinelli 2024. For the comparative chronology, see Sabatini and Alberti 2021, Fig. 1.

[29] The first weights to be presently known from the central Mediterranean are those form Lipari, dated to the Capo Graziano phase (EB-MBA II, i.e. 2300-1500 BCE): the published evidence hampers a more precise dating of the findings (Ialongo 2019, Ialongo and Rahmsorf 2019). However, for historical reasons, it is here preferred to consider them as belonging to le late period of the phase, i.e. 1700 – 1500 BCE, which corresponds to the first presence of Aegean pottery in the Aeolian islands. I wish to thank both Nicola Ialongo and Lorenz Rahmstorf for their feed-back on this topic.

[30] Ialongo 2019: fig. 10. Here, all rectangular weights from BA Europe are plotted against the weights from Ayia Irini (Keos), based on the data from Petruso 1992.

[31] Ialongo and Rahmstorf 2021, data set published online within the supporting information https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.21058731l8/-/DCSupplemental , DATA SET 01.

Mass (g)	Value *x*	Value *k/P*
6,6	1/8 o 1/10	1/3
13,94	¼ o 1/5	2/3
18,73	1/3	1
20,26	1/3	1
37,95	2/3	2
62,75	1	3
122,56	2	6
138,41	2 + 1/3	
154,45	2 +2/3	
469,00	8 (mina)	

Fig. 13. Lipari Acropolis, weights from the Capo Graziano layers (EB 3-MBA 1-2). Data from Ialongo *et al.* 2021 supporting information https://www.pnas.org/doi/suppl/10.1073/pnas.2105873118, especially Data Set 01. Analysis M.E. Alberti

LB IIIA-B. An Aegean shekel!!!

The situation changes considerably in LB IIIA-B (1440-1200 BCE ca) when we have again enough data to sketch a picture. This is the period of intense Mediterranean interconnections on the 'southern route', from Levant through Cyprus, Crete, and Sicily to Sardinia, with circulation of prestige goods, ox-hide ingots, large containers, and fashionable pottery, and of technology exchanges, especially in the field of metallurgy and pottery making[32]. Levantine weight standard seems to take over in the Eastern Mediterranean and in Egypt, where the New Kingdom ***qdt*** and ***dbn*** (9,5 g and 95 g ca) are respectively a replica and a multiple of the Syrian shekel ***s*** (9,4 g)[33]. In the Aegean, following the general economic trend, weighing standards become more «international» or «globalised» during the Mycenaean palatial period, which leads to a closer connection between the local and the Eastern Mediterranean weighing systems. The few groups of weights that have been properly published from various sites of Crete, and from Nauplio, Thebes, Tiryns and Mycenae on the mainland[34] have both traditional Minoan/Aegean characteristics and innovative features and include various weights representing Near Eastern units. What is striking is that often typical Aegean weights appear along typical Levantine ones, almost side by side.

As various scholars pointed out[35], the Mycenaean weighing system presents some innovations in relation to the Neopalatial tradition, namely: the use of a decimal accounting system for multiples, along with the more traditional duodecimal multiples and fractions of the main talent/***x*** series; a reduced presence of the unit ***x*** (ca. 60-65 gr); an increased popularity of the ***k/P*** (ca. 20 g), especially as 10 ***k*** (200-220 g.) and 20 ***k*** (400-440 g.) and as fractions of ***k*** (Fig. 14). This series based on ***k***, integrated within the mina series, can be seen to be the main series of the period. This is a transformation *within* the Minoan system, more adapted to both Helladic tradition and its Near Eastern

[32] *E.g.* Laffineur and Greco 2005; Eder and Pruzsinszky 2015; Babbi *et al.* 2015; Fotiadis et al. 2017; Jung 2021; Perra and Lo Schiavo 2021; Bourogiannis 2022.

[33] *E.g.* Pulak 2001.

[34] Petruso 1992; Alberti and Aravantinos 2006; Rahmstorf 2008.

[35] Parise 1994; 1996; Petruso 2003; Alberti 2006; 2011; 2016; Rahmstorf 2008; de Fidio 2024.

counterpart (which was at the base of the Early Helladic weighing system, as we saw above).
Significantly, in this phase, weights lighter than 15 g are more attested than before, as the following examples will show.

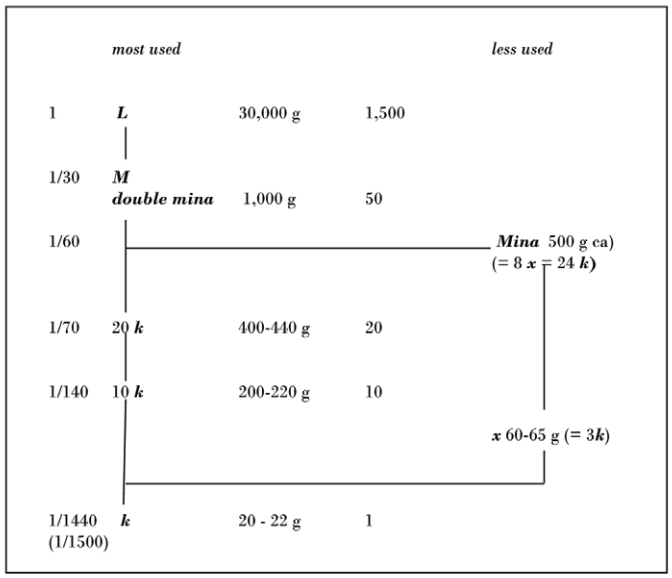


Fig. 14. Simplified structure of the weighing system used during the Mycenaean period in the Aegean, reconstructed on the basis of the attested groups of weights. The wool unit (l) and the hypothetical smaller fractions are not illustrated

LM IIIA2 Crete (1380-1320 BCE ca)
During this phase, Crete is already part ofthe Mycenaean cultural milieu. Unfortunately, the few light weights published from Knossos do not have a recorded find-spot. Better evidence is provided by the two tombs of Katsambas, near Knossos (Tomb H) and of Pankalochori (Rethymno area) (Fig. 15).

Site	Mass (g)	Type	Value *As*	Res. *As* unit (gr)	Value *k/P*	Res. *k/P* (g)	Value *x*	Res. *x* unit (g.)
Knossos	10,2	stone sfendonoid	1	10,2	1/2	20,4	1/6	61,2
Knossos	12,6	stone sfendonoid, a groove under the base	1	12,6	1/2	25,2	1/6?	75,6
Katsambàs tomb H (average *As* 10,24g)	5,7	stone sfendonoid	1/2	11,4	1/4	22,8	1/10	57 g
	10,2	stone sfendonoid	1	10,2	1/2	20,4	1/6	61,2
	10,5	stone sfendonoid	1	10,5	1/2	21	1/6	63
	28,0	stone sfendonoid	3	9,33	1 + 1/2	18,6	½	56
	48,9	stone sfendonoid	5	9,78	4 +1/2	19,56	4/3	65,2
Pankalochòri Tomb	11	fragment of raw hematite	1	11	1/2	22	1/12	66

Fig. 15. LM IIIA weights less than 15 g: the evidence for the use of an «Aegean shekel» As of ca 10 g is compelling (modified from Alberti 2011: Tab. 14)

In contrast with the Neopalatial period, most of these lighter weights have now a sphendonoid shape, a clear parallel to the Levantine items (Fig. 16). Their masses are seemingly close to the Levantine shekel *s* (9,4 g) and its multiples although the items representing that unit are heavier than the standard: one item from Knossos of 12 g , with a grooved line under the base, possibly represents the count unit.

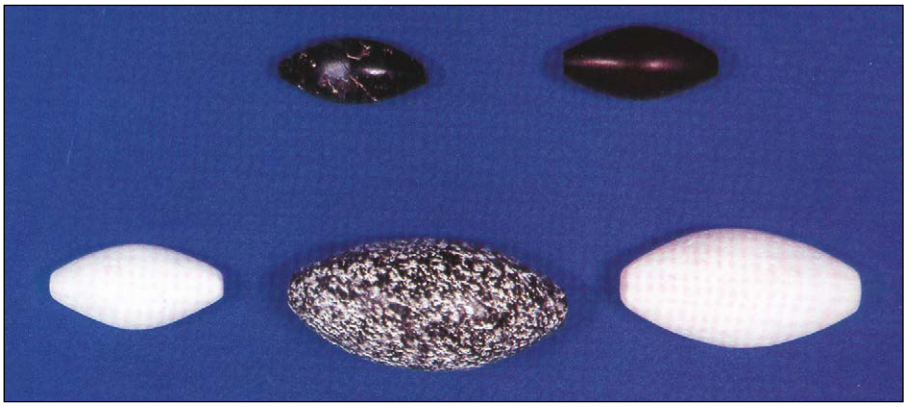


Fig. 16. Sphendonoid balance weights from Katsambas, Tomb H (LM IIIA2) (AMH L 2886, 2887, 2888, 2889, 2890; modified from Michailidou 2000: 144, fig. 29). Archaeological Museum of Heraklion - Copyright: ©Hellenic Ministry of Culture - Hellenic Organization of Cultural Resources Development (H.O.C.RE.D.)

Katsambas Tomb H (LM IIIA2) yielded some prestige grave-goods, including a splendid ivory pixis and other ivories, jewellery, several decorated ware, a few bronzes and stone vases, and also a group of sphendonoid weights[36]. These form a sound series based on a unit of 10 g ca, the average resultant being 10,24 g: ½, 1, 1, 3, 5.

In the Pankalochori tomb (LM IIIA2 early), a fragment of hematite and a fragment of rock crystal, both unworked, were found close to two bronze scale pans near to the larnax[37]. A bronze needle was on one of the two pans. The larnax contained the burial of a pregnant woman, with a bronze mirror with an ivory decorated handle, some decorated vases, faience jewellery, a seal, possibly a bone/ivory pixisand gold rosette cut-outs. Other findings from the chamber include two larnakes, a bronze chaudron, a stone mortar, a large steatite spindle-whorl, two earrings, and more jewellery. The hematite, the rock crystal and probably also the needle were quite possibly connected to the weighing sphere. Perhaps it is not a chance that the hematite weighs 11 g, i.e. close to the Katsambas unit.

LH IIIA2 Nauplio (1380-1320 BCE ca)

On the Mycenaean palatial mainland, the presence of light weights is also quite rare. A very important group comes from the area of the Ayios Yoannis church of Nauplio, seemingly from the discarded debris of a LH IIIA2 workshop area: along with animal bones, stone tools, fragmentary large stirrup jars, a spindle-whorl and part of a figurine, there were also the base of a Canaanite amphora, and three small stone weights, two sphendonoid and a flat parallelepiped (Fig. 17)[38]. The two small sphendonoids can be

[36] Alexiou 1963: 191-193; Alexiou 1967: 26-40, 51-58. Petruso 1992: 53-4.

[37] Baxevani-Kouzioni and Markoulaki 1996; Michailidou 2000: 144

[38] Kritzas 1973-4 and Piteros 2015. According to Kritzas, the two sphendonoid weights were half-worked, but this is not

seen as a tiny fractions of the Syrian shekel ***s*** of 9,4 g, even if the resultant unit seems too light or too heavy. The parallelepiped matches the mass of the second sphendonoid, and it is thus possibly also linked to the ***s*** series, but it is just slightly heavier, and the resultant unit fits better the ***k/P*** series. What seems important, in any case, is the contemporaneous presence of Levantine and Aegean types from the debris of a probable working area: are we seeing an attempt to transfer Levantine standard into Mycenaean ones?

Mass (g)	Type	Value *s*	Res. *s* unit (gr)	Value *k/P*	Res. *k/P* (g)	Value *x*	Res. *x* unit (g.)
1,5	sphendonoid, white stone (alabaster)	1/6	9	1/12	18		
3,3	sphendonoid, black stone	2/6 = 1/3	9,9	1/6	19,8		
3,5	flat parallelepiped, probably marble	2/6 = 1/3	10,5	1/6	21	1/18	63

Fig. 17. Nauplio, Weights from the area of the Ayios Yioannis church, LH IIIA2. Data from Piteros 2015: 251-2. Analysis: M.E. Alberti. I wish to thanks Enrico De Benedictis for his feed-back on the possible shekel values

LH IIIB2 Thebes and Tiryns (1240-1190 BCE ca)

The widespread presence of ivory and jewellery workshops in Mycenaean Thebes[39] could imply the parallel diffusion of precision weights. However, only one precision set has been found, interestingly from an ivory workshop (Loukou plot): it includes 5 sphendonoids, 2 cubes and 1 disc, all made of stone (Fig. 18 and 19)[40]. Each of the typological subgroups is apparently linked to a different tradition and could be seen as working separately: the Levantine sphendonoids seem to be based on ***s*** (9,4 g), but their resultant unit is actually slightly heavier than this (9,85 g); while the Aegean cubes and disc are based respectively on ***x*** (60 g ca.) and on ***k/P*** (20 g ca.). However, as already suggested by the present writer, the best choice is to see the set working as a whole. The incised circle on the second sphendonoid, weighing 19,5 g, points to ***k/P*** as the principal unit for the Theban users. The incision tells us that, even if these were different groups at the beginning, they were used as a complete and coherent working set in the ivory workshop.

Weight	Type	Marks	Mass (g)	*Value As/s*	*As Res. Unit.*	*Value k/P*	*k/P Res. Unit*	*Value x*	*X Res. unit*
TH.01	stone sfendonoid		4,9	½	9,8	¼	19,6	1/12	58,8
TH.02	stone sfendonoid	One incised circle	19,5	2	9,75	1	19,5	1/3	58,5
TH.03	stone sfendonoid		39,5	4	9,87	2	19,75	2/3	59,25
TH.04	stone sfendonoid		39,7	4	9,92	2	19,85	2/3	59,55
TH.05	stone sfendonoid		39,8	4	9,95	2	19,9	2/3	59,7
TH.06	stone cube		57 (-)	6	9,5 (-)	3	19 (-)	1	57 (-)
TH.07	stone cube		59,2 (-)	6	9,86 (-)	3	19,73 (-)	1	59,2 (-)
TH.10	stone disc		431,7	40	10,79	20	21,58	7	61,67

Fig. 18. Thebes, the «Ivory Workshop» weights as a whole set (modified from Alberti and Aravantinos 2006: Tab. V)

reported by Piteros, who on the other hand underlines the presence of a flat base in both examples.

[39] Keramopoullos 1930; Tournavitou 1988 and 1997; Laffineur 1995; Dakouri-Hild 2005 and 2012; Bennet 2008; Jones and Wager 2008.

[40] Sampson 1985; Aravantinos 2000; Alberti and Aravantinos 2006; de Fidio 2024.



Fig. 19. Thebes, the «Ivory Workshop» weights (courtesy of the Museum of Thebes)

During LH IIIB, various areas of metallurgical activities (bronze, lead) are attested in the Lower Citadel of Tiryns: however, very few light weights have been found, most items being medium-sized (Fig. 20 and 21)[41].

Area	Inv. n.	Mass (gr)	Type	Val. k	Res. k (gr)	Val. *s*	Res. *s* (gr)	Val. *qdt/dbn*	Res. *dbn* (gr)	Val. *x*	Res. *x* (gr)
Building VI LH III B1 Late	1208	127,8	stone dise							2	63,9
Building VI LH III B2 Early-Late	1214	129,6	stone dise							2	64,8
Building VI LH III B2 Early - Late	1211	436	??	20	21,8						
Epichosis	1216	89,9 (94,6 reconstr)	stone sphendonoid			10	9,46	1 *dbn*	94,6 (recons tr)	3/2	63,1
Building XI	1207	52,5 (53,6)	flat parallelepiped/cube								
Building III LH IIIB2 Early	1213	99,6	domed			10	9,96	1 *dbn*	99,6		
Building III LH IIIB2 Early	2166	143,8	Domed/cubed					1,5 *dbn*	95,86		
Building III LH IIIB2 Early	1215	94,9 (95,9 reconstr)	stone sphendonoid			10	9,49	1 *dbn*	94,9	3/2	63,3
Upper Citadel LH IIIB2 Late, under room XVI	2308	9,6	flattened sphere			1	9,6				
Upper Citadel secondary dep. LH IIIC	1210	6,8	parallelepiped			2/3? or 7/10?	10,2 or 9,71				
Upper Citadel secondary dep. LH IIIC	1212	5,6	parallelepiped			½ or 6/10?	11,2 or 9,4				
Listed together in excavation inventary	2536	126 (reconstr)	stone dise							2	63
Listed together in excavation inventary	2537	20,8	domed	1	20,8	1	10,4				
Listed together in excavation inventary	2538	93,9	stone sphendonoid	10		1	9,39	1 dbn	93,9	3/2	62,6
Mauerkammer 4 Ost LH IIIC developed	533	261,5 (reconstr)	stone dise							4	65,38
Hellenistic strata	1209	271 (285,3)	stone domed	30		9,51	3 *dbn*	(95,1)			

Fig. 20. LH IIIB weights from Tiryns. Data from Rahmstorf 2008: 153-163). Analysis: M.E. Alberti. For the English equivalent of the German Tiryns chronological phases, see recently Vitale-Van de Moortel 2020: Tab. V

[41] Rahmstorf 2008: 153-163, and 2015; Maran 2004; Brysbaert and Vetters 2013; de Fidio 2024.



Fig. 21. LH IIIB weights from Tiryns (from Rahmstorf 2008: tafel 93,1; courtesy of L. Rahmstorf)

Once again, we find typical Aegean weights along typical Levantine ones. The group from the area of Building VI seems to be quite «Mycenaean», having stone discs and masses related to both ***x*** and ***k/P***. On the other hand, those from Building III are completely Levantine or even Egyptian: sphendonoid and domed examples are linked to the ***qdt/dbn*** series. The alternate occurrence of Aegean and Levantine/Egyptian weights appears also in not well stratified or disturbed contexts. The appearance of the ***dbn*** instead of other multiples of the Syrian shekel ***s*** is not so common in the Aegean and underlines the international connections of the last palatial phase of Tiryns, visible especially in the workshops[42]. The same is true for the items coming from various points of the Upper Citadel, unfortunately in secondary deposition: if they could be accepted as weights (and this is not evident because of their singular shapes), their tiny masses could recall the Nauplio case and mirror those of more complex series of weights from Ayia Irini, Enkomi and Hala Sultan Tekke in Cyprus, and Ugarit in Siria[43].

Linear B measures for light weights

Even if the Linear B system of measure is fairly well understood, the situation for the lightest units is still unclear[44]. As it has been reconstructed from the texts, the system is different from that of the Linear A but shows some similarities with the Levantine and Mesopotamian ones, with the units having a fixed mathematical relationship to each other (Fig. 22). It must be mentioned that apparently no sign corresponds to the Aegean unit ***x*** of ca 60 g. Instead, the most common fraction of the mina used to measure small quantities is ***P***, that should weight ca 20 g and thus correspond to the unit ***k*** issued from the metrological analysis of the Aegean weights. The importance of the ***P*** unit in the

[42] *E.g.* Brysbaert and Vetters 2013. Another stone sphendonoid weighing a ***dbn*** is recorded in Thebes (First Public School excavations; Alberti and Aravantinos 2006).

[43] Enkomi and Ayia Irini: see discussion in Alberti 2006 and De Benedictis this volume. Hala Sultan Tekke: Fischer and Bürger 2018 and 2023. Ugarit: Bordreuil 2006 and 2023.

[44] For a survey on the Aegean measuring system and the Linear B evidence, see Alberti 2016b; de Fidio 2024.

records matches the diffusion of the ***P/k*** standard among the LB III weights as mentioned before. This unit occurs in various types of texts, but especially, unsurprisingly, in the lists of gold, bronze and saffron.

Linear B	Lin.B Traser.	Talent ratio	*P* ratio	"light" absolute value (g.)	"heavy" absolute value (g.)
AB *118 (talent)	*L*	1		29,088	3,1329.6
*145 (wool unit)	*LANA*	1/10		2,899	3,132.96
*117 (double mina)	*M*	1/30		969.6	1,044.32
*116 (half mina)	*N*	1/120	12	241	261.08
*115	*P*	1/1440	1	20.2	21.75
*114 (?)	*Q*	1/8640	1/6 (?)	3.36	3.62
*114 (?)	*Q*		1/12(?)	1,68	1,81

Fig. 22. Measures of weight in Linear B (modified from Alberti 2011: tab. 4)

It is noteworthy that in the only surviving text registering gold, PY Jo 438, no lesser unit is attested: gold is measured in ***M*** (double mina, 1 kg), ***N*** (half mina, 250 g) and ***P*** (20 g) (Fig. 23). This is possibly due to the circumstances of the registration: important functionaries of various districts of Pylos deliver gold to the central administration, so quantities are substantial. Anyway, the recurrent values of ***P***3 and ***P***6 (corresponding respectively to one and two Aegean unit ***x*** of 60 g) could point to the use of ***x*** in practical weighing (as we see from weights) and possibly its particular connection with gold[45].

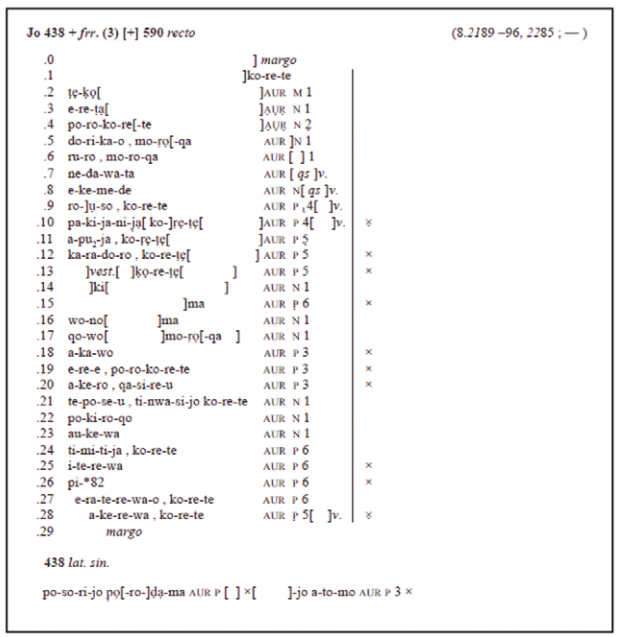


Fig. 23. Transcription of Linear B tablet PY Jo 438 (from Olivier and Del Freo 2020)

[45] Michailidou 2008.

The only document series where even smaller units are attested is the KN Np one, listing saffron quantities. However, the texts are generally short and fragmentary, and most entries are damaged, so that no full picture is available. From the records, we understand that the ***Q/QI*** unit is smaller than ***P***, but the evidence is so meagre that it is impossible to assess the ratio ***P***: ***Q/QI***: the most probable values are 1/6 (ca. 3,5 g) or 1/12 (ca. 1,7 g).

*A LB IIIA-B Aegean shekel **As** (10 g ca)*

As mentioned above, during the 14th and 13th c. BCE, the Aegean involvement in the Mediterranean trade network reached its apex, with a complex system of import/export and contacts extending from Syria to Sardinia. This had to have some impact in the means and measures of exchange and value. As it is clear from the recurrence of Aegean and Levantine weights side by side, the Aegean metrological system was strongly exposed to the Levantine system and reacted to it in turn. It was important to find a quick way to convert between their units.

The Linear B system of measures, possibly embedded in former mainland traditions but also influenced by external examples, was surely more open to foreign influences and more flexible than the Minoan fractional one and had many similarities with the Levantine and Mesopotamian systems. They actually shared the same largest units, such as the talent and the double mina. But for everyday use, and for the weighing of precious imported materials (including ivory and spices, to quote some of the goods mentioned in the tablets), a smaller conversion unit was needed. The wider use of ***k/P*** (ca 20 g) goes in this direction, as it is attested by the Thebes Ivory Workshop weights (Fig. 18). A quicker and more practical solution has been to identify in the half of ***k/P*** (ca. 10 g) a sort of direct equivalent of the Syrian shekel ***s*** (ca. 9,4 g), even with some approximation.

In this sense, this unit of ca 10 g, possibly already present at MM IIB Malia, can be seen as the Aegean shekel ***As***: and it is apparent in the analysed contexts from LM IIIA Crete (Fig. 15)[46]. The proposed ***As*** has to be intended as an artificial means to bridge the two systems, allowing some imprecision, also due to the replication process, as shown by the weights from the Nauplio workshop debris. Incorporation, adaptation and approximation are at play here and suggest that the ***As*** can be identified as a SAQ for a generic «shekel», adapted to circulate both in the Aegean and over the Mediterranean routes (Fig. 24).

Linear B	"light" absolute value (g.)	"heavy" absolute value (g.)	*x* ratio	*P* ratio	*As* ratio	Akrotiri LC I	Mochlos LM IB	Katsambas LM IIIA2	Knossos LM IIIA	Nauplio LH IIIA2	Thebes LH IIIB2	Tiryns disturbed	*s* ratio
*115 *P*	20.2	21.75	1/3	1	2	x	x				x		2
	10,1	10,87	1/6	1/2	1	x	x	x	x			x (9,6)	1 (9,4 g)
	6,73	7,24	1/10	1/3	2/3	x	x					x	7/10
	5,05	5,7	1/12	1/4	1/2			x			x	x	6/10
*114 *Q* *(?)*	3.36	3.62	1/18	1/6 (?)	1/3	x(?)				x			4/10 or 1/3 (3,13 g)
*114 *Q* *(?)*	1,68	1,81		1/12	1/6					x (1,5 g)			2/10 or 1/6 (1,56 g)

Fig. 24. Possible concordance between the lightest Aegean units, the proposed Aegean shekel ***As*** and the Syrian shekel s. The equivalences with the Syrian shekel are here only tentative. For a more detailed and grounded view of the shekel fractions, see De Benedictis this volume and forthcoming and fn. 49 here

[46] For the interpretation of this ca. 10 g value in terms of shekel and fractions, see De Benedictis forthcoming

Out of the Aegean: Lipari and Thapsos (1450-900 BCE)

In the last centuries of the second millennium BCE (locally MBA3, RBA and FBA), the various areas of Sicily are differently involved in the maritime network linking Sardinia with the Aegean, Cyprus and Syria. In the Lipari islands, Mycenaean imports decrease during the Ausonio I (1350-1200 BCE) and Ausonio II (1200-950 BCE) phases. The settlement of Lipari Acropolis yielded some weights from this periods: a sphendonoid and a rectangular ones from Ausonio I and two rectangular ones from Ausonio II[47]. Again on the basis of the data provided by Ialongo and Rahmstorf[48], but with no information on typology and context, the masses of the latter can be plotted together (Fig. 25): they fit quite neatly in a ***k/P*** series, showing some form of permeability with the evolved Mycenaean weighing system.

Mass (g)	Value *x*	Value *k/P*
22,83	1/3	1
216,67	4 (?)	10

Fig. 25. Lipari Acropolis, weights from the Ausonio II layers (FBA). Data from Ialongo *et al.* 2021 supporting information https://www.pnas.org/doi/suppl/10.1073/pnas.2105873118, especially Data Set 01. Analysis M.E. Alberti.

On the other hand, the metrological evidence from Thapsos is seemingly related more to the Eastern Mediterranean than to the Aegean (Fig. 26). This is not surprising: the Thapsos settlement yielded various indicators of contact with the Levant and especially Cyprus, probably linked to its southern location[49]. The recorded balance weights from the site (MBA3-LBA, ca. 1450-1150), always according to the bare data from Ialongo *et al.* 2021, seem to compose a complete series of fractions of the Syrian shekel ***s***[50].

Mass (g)	Value s (9,4 g)
0,8	1/10
1,63	2/10
1,8	2/10
2,28	3/10
3,06	3/10 or 1/3
3,17	1/3
3,2	1/3
4,25	
4,65	1/2
4,92	1/2
5,85	6/10
5,93	6/10
6,31	6 or 7/10 or 2/3
6,7	7/10 or 2/3
6,92	7/10
7,66	8/10

Fig. 26. Balance weights from Thapsos, MBA3-LBA (1450-1150). Data from Ialongo et al. 2021: supporting information https://www.pnas.org/doi/suppl/10.1073/pnas.2105873118, especially Data Set 01. Analysis: M.E. Alberti. The shekel values suggested are only tentative. For a more detailed and grounded view of the shekel fractions, see De Benedictis this volume and forthcoming and fn. 49 here

[47] Ialongo 2019; see also fn. 27.

[48] Ialongo *et al.* 2021: data set published online within the supporting information https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2105873118/-/DCSupplemental , DATA SET 01.I wish to thank Nicola Ialongo and Lorenz Rahmstorf for their feedback on the Lipari weights.

[49] La Rosa 2004; Militello 2005; Alberti, G., 2005; Crispino 2024.

[50] The values suggested in Fig. 24 are only tentative. As recent studies are pointing out, these light values can be better understood as possibly based on the accounting system of grains+shekels attested in some metrological tablets from Ugarit. See De Benedictis, this volume and forthcoming; Bordreuil 2006; Chambon 2006; Marti and Chambon 2019.

Concluding remarks: communicating weighing systems

The economic interconnections of the Bronze Age Mediterranean affected, among other cultural indicators, also the weighing systems of the involved regions: and this is due to the central role of weighing in any economic transaction and trade operation at the time, where weighed metal was the main measure of value. Communication also passed through the use of weighing systems and to their adaptation to the international environment. This is clear for the Aegean, already from the Early Bronze Age in the mainland and the islands, where during the period of most intense contact with Anatolia a weighing system related to the Levantine one is attested[51]; and it is clear for Crete, as we saw, at least from MM IIB. However, the internal organisation of the LM I Minoan weighing series and those of the Linear A counting system, possibly following similar rules of fractionating, seem to have had very little in common with the Levantine systems, based on the shekel and its multiples and fractions – and this despite the recurrence of Levantine weights among LB I Minoan and Cycladic sites. The LB III Mycenaean metric system, on the other hand, seems to have been closer to its Levantine counterpart, as shown both in Linear B texts and in the recovered weighing assemblages, where the local form of approximate «shekel» is common. This presumably was an intentional way to bridge the Mycenaean and Levantine systems, and it is exactly its approximation that allows the conversion and communication. The first Aegean «shekel» of ca. 10 g can be seen possibly as the first of a series of SAQ that take place to facilitate transactions and trade, starting in the Aegean and then moving westwards, as the changing patterns of the Lipari weights seem to suggest. This phenomenon along the Northern route of trade merges with a similar spreading of weighing habits from Levant to Cyprus and possibly to Thapsos, on the Southern route, and together they shape the future LB – IA European weighing habits. Once again, the Aegean seems to have been a «bridge» between the societies of the Near East and those of the central Mediterranean.

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[51] Rahmstrof 2006 and 2016.

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Pre-columbian non scribal writing system: the *khipus* and their presence in the Anthropology and Ethnology Museum of Florence

Giulia Dionisio

Abstract: In pre-columbian Peru no system of writing using conventional shared graphics has been discovered. However, the *khipus* attested a complex system of data registration noting various types of information through a series of combinations. In light of this, the correlative element legitimizing the inclusion of this study in this context is that of «communication», not tied to writing but through an alternative system of social group interrelations.

The *khipus*, indeed, were a strong tool of state power and they register not only numerical data but, probably, also narrative texts, just as stories, laws and ceremonies through large combinatorial structures.

As in the Aegean and Near Eastern worlds, pre-Columbian Peru, distant chronologically and geographically from these, had developed communal aggregative technology and cultural transmission both unique and complex, which makes the khipu the only protagonist of communication, with no other element of symbolic or practical intermediation.

Introduction

This contribution, though far from the cultures of the Aegean Bronze Age and from the Near Eastern and Egypt civilizations, protagonists of this volume, hopes to open a «window» on a faraway world, pre-Columbian Peru, which, we will discover, fits well with this specific area of inquiry.

The primary correlative element legitimizing the inclusion of this study in this context is that of «communication», not tied to writing but through an alternative system of social group interrelations.

Ancient Peru includes a vast tapestry of peoples and cultures that wove together thousands of years of history before the arrival of the Spaniards. Up to the end of the 19th century, the Andean civilizations were primarily of interest to collectors, explorers and travelers whose knowledge was limited to the descriptions and narratives of chroniclers who heard tell of the Inka.

However, starting in the 20th century, peruvian archaeology began to consolidate, and its progress brings to us today much informations concerning the material culture, relations and organizational models of the ancient peoples of Peru.

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Khipus: communication through cords, knots and colors

In pre-Columbian Peru no system of writing has been discovered to date as we interpret the term: a system using conventional shared graphics[1]. Yet, the indications left us by the Spanish chroniclers and gathered from archaeological sites point to the presence of a form of writing, which were the *khipus*, that it uses a method of data registration both complex and articulate, noting various types of information through a series of combinations[2].

The word «khipu» comes from the quechua language, translated as «knot».

Khipus are artifacts made from camelid wool and/or cotton and crafted, generally, along a single central cord from which secondary (pendant) cords branch off in variable numbers, splitting up, in turn, with tertiary cords and possibly further branches[3] (Fig. 1).

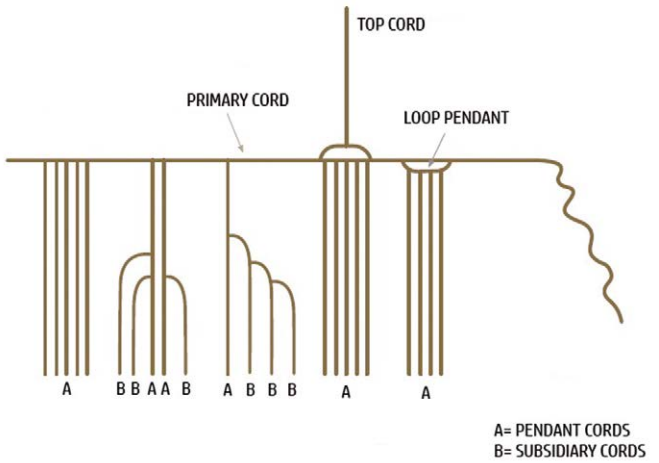


Fig. 1. Schematic structure of the *khipus* (readapted by J.L. Meyerson in Setlak *et al.* 2020: 293)

The cords, of various colors, bear a series of knots in varying number and size as well as shape (Fig. 2).

From Inka times, *khipus* were carried and kept with the main cord wound in a spiral position[4]: they are not fragile, they weigh little and they can be easily compressed, flexed or rolled[5].

This unique form of «writing» has no counterpart in the European sphere and deeply challenged the Spanish chroniclers, who found themselves unable to fully comprehend the characteristics, the function and the use, notwithstanding their admiration for the craft and complexity[6].

Moreover, it must be underscored that, distinct from the areas of the Aegean and the Levant, in which non-scribal communication was made with symbols using identifying marks on objects (for instance seals and sealings or potter's marks) as well as with

[1] Aimi 2018: 146.
[2] Kulmar 2008: 138.
[3] Salomon 2013: 16; Hyland *et al.* 2021: 401.
4 Salomon 2013: 32.
[5] Salomon 2013: 31; Schmidt and dos Santos 2017: 616.
[6] For more information, please see Setlak 2020: 55-57; Laurencich Minelli 2004.

transactions or measurements, in this case there is no support for the communication, but rather it is the object itself, the *khipu*, that is the vehicle of information through its particular characteristics and structure[7].



Fig. 2. Example of a *khipu* conserved at the Fundación Museo Amano (Lima, Peru). Provenance unknown (Setlak *et al.* 2020: 320, n. cat. 13)

Mention of the use of the *khipus* dates to the Middle Horizon (500-900 A.D.) pertaining to the Wari empire, which made a series of conquests and united a vast area of the central Andes[8].

Later, the *khipus* were also used in the Inka empire[9] (Late Horizon: 1440-1532 A.D.) and many instances were recorded, as late as the colonial era and up to the republican period[10].

The *khipus* were a strong tool of state power. It is noteworthy that they were used as a form of data registration by the two major empires of the Peruvian Andes prior to the arrival of the Spaniards. This is easily explained in light of the fact that an empire, a large territorial and political organism, cannot depend solely on military control, but also needs rapid registration and punctual communication of information, which creates relationships and branches of the organization at various social levels.

[7] Some parallels between the Aegean and Near East, from this point of view, can be found in the use of copper ingots in the shape of an ox-hide (ox-hide ingots), elements linking the island of Cyprus and various other areas of the Mediterranean. In this case as well, though the objects themselves have different characteristics and meaning from *khipus*, they are the protagonist and vehicle of information, independent of other forms of support.

[8] Salomon 2013: 21; Arellano Hoffman 2020: 20; Setlak 2020: 57.

[9] *Khipus* from the Wari period and *khipus* from the Inka period differ in their structure: in the first case the suspended cords are wrapped in multicolor bands. Most of the artifacts do not have knots and when they are present on the suspended cords, they are always simple knots. The Inka *khipus*, however, do not have multicolor bands wrapped around them and the type of knot seen on the suspended cords is variable (Setlak 2020: 59).

[10] Arellano Hoffmann 2020: 21. For further information see Salomon 2004, 2008, 2013; Hyland 2017, 2020; Hyland *et al.* 2021.

Most *khipus* were recovered as loot from sacking excursions and only rarely through documented archaeology[11]. Many come from the coastal regions, due to the fact that the dry climatic conditions are ideal for the conservation of these artifacts over time[12].

At the end of the 19th century, Max Uhle, an archaeologist of world renown concerning pre-Columbian civilizations, concentrated on the meaning of the *khipus*, but it was the study of Leland Locke, during the 20th century, that first offered a detailed understanding of their function[13]. However, these artifacts still contain information yet to be decoded and understood.

The *khipus* register not only numerical data but also narrative, just as described by some Spanish chroniclers that speak of stories, laws, and ceremonies. According to Setlak and other scholars[14], they could indicate sacred places, offerings, sacrifices, biographies, missives and calendars, they noted information concerning sowing and reaping and agricultural cycles as well as observations of the sky. They also registered population of various communities, tribute collected, and other information concerning accounts.

The function of the *khipus* appears virtually unlimited.

The codification of information occurs through visual and tactile signals, arranged to transmit significance.

Numerical *khipus* (those related to accounting) as presented by Locke, have knots with well-defined meaning: their position on the pendant cords confers a value of a decimal system (units based on ten, one hundred and so on)[15]. The numbers were visually and symbolically representative of articles accounted for[16].

Three types of knots have been identified: one sort of figure eight, multiple and simple. According to some researchers[17], the knots forming an «8» were used to indicate a single unit (the number 1); multiple knots indicated units from 2 to 9, according to how many times they were wrapped, while single knots were used to mark on the *khipu* the value of tens, hundreds, or thousands (Fig. 3).

There remain many question marks concerning the color of the various cords and the information associated with this[18]. Some hypotheses have been formulated, attributing the value of the color to the element or the activity being registered[19], or associating patterns (groups of cords all of the same color and groups containing sequences of repeated colors) to registrations of individual data or aggregated data[20]. However, interesting studies have been recently conducted on *khipu* dyes to enhance the understanding of meaningful *khipu* colours[21].

[11] The few artifacts from archaeological excavations come from the work of Tello at Pachacamac and Puruchuco. For more information, please see Adawi *et al.* 2011. The most recent archaeological investigation was conducted at Lunahuanà and Huaycàn de Cieneguilla: Urton and Chu 2015; Ramos 2015.

[12] The coast of Peru is characterized by a dry desert climate with high temperatures. Such conditions are optimal for the conservation of organic material, which has lasted over centuries.

[13] Locke 1923.

[14] See Salomon 2013; Setlak 2020; Hyland 2014, 2017, 2020; Hyland *et al.* 2021; Mililllo *et al.* 2023.

[15] Salomon 2013; Schmidt and dos Santos 2017: 616.

[16] Moscovich 2020: 151.

[17] Moscovich 2020: 153-154; Laurencich Minelli 2004: 110.

[18] Hyland 2020: 219; Mililllo *et al.* 2023.

[19] Schmidt and dos Santos 2017.

[20] Hyland 2017. For further information, see the studies of Ascher 1983; Urton 2017; Radicati 1964.

[21] For an in-depth discussion, please see Mililllo *et al.* 2023.

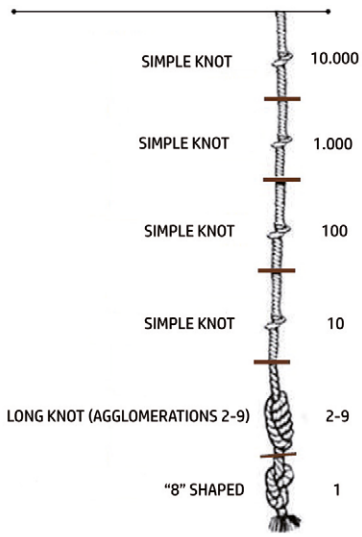


Fig. 3. Types of knots on *khipus* and their numerical value (adapted by Moscovich 2020: 154)

The khipus in the Anthropology and Ethnology Museum of Florence

On 30 December 1883, in the Report of the 98th Reunion of the Italian Society of Anthropology and Ethnology (*Rendiconti della 98ª Adunanza della Società Italiana di Antropologia e Etnologia*), Paolo Mantegazza reports «*on the Peruvian antiquities donated by Commander Prof. Ernesto Mazzei to the National Museum of Anthropology*»[22].

Ernesto Mazzei was a Florentine ophthalmologist who, between 1875 and 1884, had collected in Peru a large quantity of pre-Columbian artifacts of anthropological and ethnological interest, which he donated piece by piece over time to his friend, the director of the museum Paolo Mantegazza[23]. Among these, there were two *khipus* defined by Mantegazza as «*the most precious artifacts of the ethnologic collection*», acquired by the museum between 1883 and 1884. Though it is not possible to exactly identify the provenance for lack of detailed information, we know that all material, gathered by Mazzei, comes from *huacas* (burials) situated near Lima and Cuzco, as affirms Cipriani[24]:

> «the area […] is, unfortunately, not precisely noted […] what we know with surety is that they were found by Mazzei on ancient Peruvian mummies. Since, therefore, all the mummies collected by him are from the huacas near Lima and Cuzco, it is not arbitrary to infer that they are from this area […]».

Therefore, they were among goods from a burial context.

At the time, possession of such artifacts was very rare for museums. Thus, the definition that Mantegazza attributes:

[22] Mantegazza 1884: 405.

[23] For further information on the figure of the opthamologist Ernesto Mazzei see Dionisio and Bigoni 2021.

[24] Cipriani 1928: 480.

> «The khipus were writings, the books of the Peruvians. The appearance is that of fringes, formed of fine colored cotton cords, with knots; but the Peruvian had found way to express their thoughts with this medium. Nor should it seem far-fetched that it should be so, if dots and dashes of the telegraphic alphabet are sufficient for us. The different colors, the different length of cords, and above all the number and position of the knots, are sufficient to represent the sounds of the voice. This writing was knowledge reserved for the priesthood and nobility and thus, couriers carried quantities of khipus from the center of the vast empire to the furthest provinces, in the plain sight of all, since none apart from the authorities were able to interpret the orders and news concentrated into these fringes. With such text the Peruvians had written the histories of their extensive empire, sustained, it must be recognized, with much political acumen; but those precious histories entirely destroyed by the hands of the same Peruvians when their spirits were driven to hatred and despair by the stupid ferocity of the Spanish conquistadors».

In the course of the same conference, Enrico Hyllier Giglioli, zoologist and naturalist of world fame, speaking of the Florentine *khipus*, added that it was doubtful if one of the two was as such identifiable (catalogue n. 3888), while the other (catalogue n. 3887) was, in his opinion, identifiable as an authentic *khipu* and considered very different from those he had seen in Lima, due to the greater number of colors[25].

The first specific study dedicated to the Florentine khipus was the work of Lidio Cipriani, traveler and naturalist, student of Aldobrandino Mochi, assistant at the Anthropology and Ethnology Museum of Florence (1923) and later professor of Anthropology (1926) and successor of Nello Puccioni as director of the museum (1939).

In 1926 he presented, on the occasion of the XXII Congresso Internazionale degli Americanisti, a work entitled «*On the two Khipus of the National Museum of Anthropology and Ethnology of Florence*», which was published in 1928, describing the two artifacts and their characteristics in detail.

Following is the current description of the two *khipus*, including an interpretive hypothesis of catalogue n. 3887 in light of the studies that have been conducted, and in line with the most recent researches.

Catalogue n. 3887

This *khipu* with six attached cords is 35 cm long and 32 cm wide, extremely interesting due to the varying color of the cords, each bearing a series of knots (Fig. 4). On the basis of analysis of the material used, it is possible to further identify the provenance. As rightly observed by Laurencich Minelli[26], since it was made of alpaca and vicuna wool, it is likely that the location of production is the high plateaus of Peru, and not in the coastal regions[27]. The dating of the artifact is between the Inka period and the colonial era (1472-1572 A.D.).

[25] Giglioli 1884: 410.

[26] Laurencich Minelli 2004: 114.

[27] In the high planes and valleys of the Sierra, where the nocturnal temperatures are freezing, camelids (domestic llama, alpaca, wild vicunas and guanache) offer abundant prime materials while on the coast cotton was used.



Fig. 4. The *khipu* catalogue n. 3887 stored in the Anthropology and Ethnology Museum of Florence. Mazzei collection

It is in a satisfactory state of conservation, considering the numerous unbraidings and for the lack of the main cord, substituted prior to 1926 by string which was already included in the description by Cipriani[28].

No subsidiary cords are present and there are no composite knots, but there are some eyelet knots formed from the same cord wound around itself and secured with the knot. The meaning of this is uncertain. The cords show, in places, a variation in their width and an increase of thickness due to the doubling up of the cord between one knot and the next. Table 1 lists a detailed description of each single cord:

Pendent	Color	Simple Knots	Eyelet Knots	Total Knots	Woolen tufts
Pendent I	yellow-grey	8	-	8	1 (eighth knot)
Pendent II	red	7	1 (seventh knot)	8	3 (fifth, sixth and eighth knot)
Pendent III	yellow-grey	7	1 (fourth knot)	8	3 (fifth, seventh and eighth knot)
Pendent IV	dark green	4	-	4	2 (first and fourth knot)
Pendent V	red	6	4 (first, second, third, fourth knot)	10	-
Pendent VI	dark yellow	7	-	7	2 (fifth and seventh knot)

Tab. 1. Description of the structure of the *khipu* n. catalogue 3887

According to the interpretation of Laurencich Minelli, it is an ordinal numeric *khipu*. As described by the Jesuit chronicler Blas Valera in 1618[29], the *khipus* of this type

[28] Laurencich Minelli 2004: 115.

[29] In the document *Exsul Immeritus Populo Suo* (1618).

permitted not only to register data, but above all to describe the location of the counted items on the land[30]. Therefore, it is an ordinal-topographic account, an inventory of herds divided into six groups (six cords) with a selection of 11 of these highlighted by the camelid woolen tufts (tufts of raw vicuna fiber)[31] situated within the knots (indicating subjects).

Further considerations can be formulated on the basis of a close correspondence with two similar artifacts studied by Sabine Hyland[32], dating to 18th century and conserved in the indigenous village of San Juan de Collata, province of Huarochiri- Peru.

According to the statements, the two artifacts were produced by the community chiefs after violent revolts attested in 1700 A.D., restoring power to local sovereigns in place of the colonial officials, with the object of affirming cultural legitimacy.

They have a structure similar to the Inka counterparts, they are made of camelid fiber and consist of a master cord to which pendant cords are attached. However, they do not present knots and they have 95 different pendant combinations. Therefore, they do not express number values but a narrative, probably using a logosyllabic system of writing[33].

What is of particular interest is the use of color, which differentiates the patterns typically present in numerical *khipus* and presents a greater variety of combinations. This characteristic finds confirmation in the testimony of chronicler Martin de Murùa, according to whom the khipus made of animal fiber had a range of vivid colors and could record narrative information[34].

This establishes an analogy with the Florentine artifact, also characterized by vivid colors distributed in a non-serial manner: one pendant light brown, two red, one green, then red and finally a light brown[35].

In 2018 the *khipu* was shown in the exhibition «Aztec Maya, Inca and the cultures of Ancient America», organized by MIC (Museo Internazionale delle Ceramiche in Faenza).

Catalogue n. 3888

This artifact is unusual in that it is composed of a single long cord, 125 cm. This makes it uncertain that it falls within this category and its interpretation is dubious. We therefore give a limited description without being able to enter further into its «reading».

The *khipu* consists of five woolen cords twined together of a light brown color. At irregular intervals there are knots. All knots, except the first two, present a red thread within. From the knots come out pendent strips of the tie (Fig. 5). The 33 total knots are distributed at equal distances from each other: at the start, they are small and simple, then a eyelet knots appear alternating with the simple knots[36] There is a simple knot wrapped only one time for each section, apart from a single case in which, from the primary knot there is a departure with knots at intervals, four more times for a total of five simple knots.

[30] Laurencich Minelli 2004: 110.
[31] Hyland and Lee 2021: 421.
[32] Hyland 2017.
[33] Hyland 2017: 412.
[34] Murúa 1987: 373.
[35] Hyland 2017: 417.
[36] Radicati di Primeglio 2006: 87-89.

In my opinion, this is also a form of data registration which it is not currently possible to define with greater detail but in which both the red color of the cord and the presence of knots, including multiple types, are surely examples of a certain type of information.



Fig. 5. The *khipu* catalogue n. 3888 stored in the Anthropology and Ethnology Museum of Florence. Mazzei collection

Conclusions

The studies undertaken in recent years on this fascinating and still mysterious system of non-scribal writing have shed light on many aspects of the use and function of the *khipus* in the ancient empires of pre-Columbian Peru.

Many hypotheses have been made, not only concerning the type and significance of the knots, but also of the color, an aspect that even now requires investigation both for symbolism and attribution which continue to present numerous doubts.

Many more steps need to be taken before we can hope for a precise and exhaustive understanding of the variety of data included within the cords and knots of this recording system. Surely, an interdisciplinary study is the optimal path to follow to complete an objective of full codification.

The two artifacts conserved and exhibited in the Anthropology and Ethnology Museum of Florence constitute an important and precious testimony that allows us to formulate a series of reflections on the administration of daily life in the ancient Andean cultures.

In light of the elements delineated in this study, the *khipus* can certainly be considered a form of communication different from writing.

As in the Aegean and Near Eastern worlds, pre-Columbian Peru, distant chronologically and geographically from these, had developed communal aggregative technology and cultural transmission both unique and complex, which makes this specific case, the object itself, the protagonist of communication, with no other element of symbolic or practical intermediation.

Any culture with a social hierarchy is characterized by an economic, political and religious power that needs to administer its domains through forms of communication that facilitate the distribution of power at all social and structural levels of the community.

We understand, therefore, that there is a common thread that ties the various societies over time and space that go beyond writing, which permits a methodical registration of data that governs relations among ethnic groups and becomes an instrument of relations and power.

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Summary Tables

Early Bronze Age

CHRON.	AEGEAN GENERAL	CYPRUS	NEAR EAST GENERAL	LOW MESOPOT.	HIGH MESOPOT.	LEVANT	ANATOLIA	EGYPT	ITALY GENER.
3650	EBI	Chalcolith.	"urban revolution"	Late Uruk 3300-3100	Late Chalcol., Uruk colonies	Late Chalcol., Uruk colonies	Late Chalcol., Uruk colonies	Naqada II	
3000-2900			EB I	Gemdet Nasr 3100-2900	Ninive 5			Early Dynastic I	
2750	EBII A		EB II	ED I		Amuq G		II	
				ED II		Amuq H		Old Kingdom III 2650	
2500		ECyp	EB III	ED III 2600-2350		Ebla 2500- 2300 Amuq I		IV 2570 V 2450	
2300	EB II B			Akkad 2350-2200	Ukish and Nawat	Sakkanakku of Mari		VI 2300	EB
2200				Gutei 2200-2120		Amuq J			
2150				Ur III 2120-2000				First Intermediate Period 2150-2100	
	EBIII		Intermediate period AB/MB					XI 2100-1955	
2000	MBI early	MCyp	MB	Amorites Isin 2017-1794 Larsa 2025-1763	Amorites Palaeo-Assyrian kingdom 1950-1750	Amorites		Middle Kingdom 1955-1750	
1900									

Tab. 1a. Compared Bronze Age chronology of Central - East Mediterranean: Early Bronze Age. From: Liverani 1988 (Near East), Donadoni Roveri 2001 (Egypt), Cardarelli 2018 (Italy), Jung 2005 (Aegean and Italy), D'Agata and Girella 2023, low chronology (Aegean)

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Middle and Late Bronze Age

CHRON	AEGEAN GENERAL	CYPRUS	NEAR EAST GENERAL	LOW MESOPOT.	HIGH MESOPOTAM.	LEVANT	ANATOLIA	EGYPT	ITALY GENER.
1900	MB Early	MCyp	MB	Isin	Old Assyrian Kingdom (until 1750)	Mari 1850-1750	Assyrian colonies 1900-1750	Middle Kingdom XII	EB 2150-1650
1700	MB Full and advanced			Larsa	"Dark Age" 1750-1550	Yamkhad 1800-1600		Second Intermediate Period 1750-1540	
1630				Babylon (1894-1595)		Alalkh VII		XIII-XIV XV-XVII	
(1700) 1640/30-1600	MB Final				Khana	"Hyksos"	Old hittite Kingdom 1650-1550		
1600 (1550)	LB I Early	LCyp IA	1550	Cassiti 1600-1150					MB 1 1650-1550
1480±			LB		Mitanni 1550-1360	Influence from Egypt and Mitanni 1550-1370	Middle-Hittite period Kizzuwatna 1550-1370	New Kingdom 1540-1070 XVIII 1540-1295 Thutmosi III 1479-1425	MB 2 1550-1450
(1500) 1480± 1450 1425 (W-H)	LB I-II	LCyp IB							
1450-1400	LB II	LCyp IIA							MB 3 1450 – 1325/1300
1400-1375	LBIII A1							Amenofi III 1390-1352	
1375-1360 1325	LBIIIA2					Influnce from Egypt and Hatti 1370-1190	Hittite Empire 1370-1190		
1325 1300	LB IIIB	LCyp IIB			Middle-Assyrian Kingdom 1360-1050			Amenofi IV 1352-1336 XIX 1295-1190 Ramesse II 1279-1213 XX 1190-1070 Ramesse III 1186-1155	RB 1 1325/1300-1225/1200
-1200 / 1190-	LBIIIC Early	LCyp IIC	IA I			"Sea People"			RB 2 1225/1200 - 1150
1150	Developed	LCyp III A		Isin II 1150-1025		Neo-hittites Arameans 1100-720	Neo-hittites 1100- 720		FB 1150 – 950/900
1100	Advanced								
1050 ca	Late	B							
1000	Submic.								

Tab. 1b. Compared Bronze Age chronology of Central - East Mediterranean: Middle and Late Bronze Age. From: Liverani 1988 (Near East), Donadoni Roveri 2001 (Egypt), Cardarelli 2018 (Italy), Jung 2005 (Aegean and Italy), D'Agata and Girella 2023, low chronology (Aegean)

<table>
<tr><th>Aegean</th><th>Cyprus</th><th>Italy</th></tr>
<tr><td rowspan="2">Middle Bronze Age
2100/2050-1600 BCE</td><td>Middle Bronze Age
(2000 – 1680 BCE)</td><td>Early Bronze Age
2150-1650 BCE</td></tr>
<tr><td rowspan="4">Late Bronze I
(1680 – 1430 BCE)</td><td>Middle Bronze Age 1
1650-1550 BCE</td></tr>
<tr><td>Late Bronze IA (LM IA = LH I)
1600 - 1520 BCE</td><td>Middle Bronze Age 2A
1550-1500 BCE</td></tr>
<tr><td>Late Bronze IB (LM IB = LH IIA)
1520 -1480 BCE</td><td rowspan="2">Middle Bronze Age 2B
1500-1450 BCE</td></tr>
<tr><td>Late Bronze II (TM II = LH IIB)
1480 – 1430 BCE</td></tr>
<tr><td rowspan="2">Late Bronze IIIA
1430 – 1300 BCE</td><td rowspan="2">Late Bronze IIA-B
(1430 – 1300 BCE)</td><td>Middle Bronze Age 3A
1450-1400 BCE</td></tr>
<tr><td>Middle Bronze Age 3B
1400-1325/1300 BCE</td></tr>
<tr><td>Late Bronze IIIB
1300 - 1200/1190BC</td><td>Late Bronze II C
(1300 – 1200 BCE)</td><td>Recent Bronze Age 1
1325/1300-1225/1200 BCE</td></tr>
<tr><td rowspan="3">Late Helladic IIIC
and Submyceanean
1200/1190-1050/1025 BC</td><td>Late Bronze IIIA
(1200 – 1100 BCE)</td><td>Recent Bronze Age 2
1225/1200-1150 BCE</td></tr>
<tr><td>Late Bronze IIIB
(1100 – 1025 BCE)</td><td rowspan="2">Final Bronze Age
1150-950/900 BCE</td></tr>
<tr><td>Proto-Geometric
1050/25-900 BC</td><td>Geometric I
(1025 – 900 BCE)</td></tr>
</table>

Tab. II. Compared detailed chronology of Aegean, Cyprus and Italy for the Late Bronze Age. From: Sabatini and Alberti 2021, table 1; D'Agata and Girella 2023, low chronology; Bombardieri and Graziadio 2019; Cardarelli 2018

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Meaningful practices

Non-scribal Communication in the Aegean and the Near East during the Bronze Age

The volume explores some aspects of the non-scribal communication systems used by the Aegean and Eastern Mediterranean societies in the Bronze Age, ranging from seals, tokens, potter's marks, weight and capacity systems, and marks on loom weights. The chronological span goes from the 4th millennium to the entire 2nd millennium BC, through the presentation of several case studies and methodological considerations. In these societies, writing is used, especially in official and administrative contexts, but nevertheless a wide range of other parallel communication codes is present. It is therefore necessary to investigate the semantic and social space occupied by these "other" codes and their importance also in a scribal context. This is a type of documentation that is rarely analysed as a whole and in a comparative way: and this is precisely the strength of the volume.

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