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aus / from

Archäologischer Anzeiger

Ausgabe / Issue
Seite / Page **1–18**
https://publications.dainst.org/journals/aa/2025/6624 • urn:nbn:de:0048-journals.aa-2017-1-p1-18-v6624.0

Verantwortliche Redaktion / Publishing editor
Redaktion der Zentrale | Deutsches Archäologisches Institut
Weitere Informationen unter / For further information see **https://publications.dainst.org/journals/aa**
ISSN der Online-Ausgabe / ISSN of the online edition **2510-4713**
ISSN der gedruckten Ausgabe / ISSN of the printed edition
Verlag / Publisher **Ernst Wasmuth Verlag GmbH & Co. Tübingen**

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Overview on LM I Administrative Devices

The focus of the present contribution is on the function of a specific type of clay sealing, called hanging nodule, during the Neopalatial Period, and its possible relationship with records written on tablets, since that is as yet a matter of dispute. They dated chiefly to the LM IB period, which corresponds to roughly the first half of the 15th century on the traditional low chronology, or the 16th century B.C. on the high chronology, based on radiocarbon analyses. Since they were part of a wider administrative system aimed at controlling the mobilization of resources and goods, before entering the topic, I will briefly present the other major documents involved in the Neopalatial administrative practices, starting with the records written in Linear A on clay tablets.

Clay tablets are generally small, with a width that varies from about 3.50 cm to about 8 cm and length from about 5.50 cm to about 11 cm. They record a few transactions of different products, indicated by logograms followed by numerals. Most of the syllabic groups that precede logograms are probably place and/or personal names, i. e. senders and/or recipients of the recorded products. Since Linear A has not been deciphered, our capacity to understand the content of the administrative records depends almost entirely on the interpretation of the logograms. While the meaning of some logograms is totally unknown, these do not constitute the bulk of the evidence at our disposal. The majority of recorded products are represented by logograms whose general meaning is self-evident due to their shape (for example, logograms for people and vessels) or whose resemblance to Linear B, both in shape and context of use, is close enough to assume that they had the same meaning. This is the case with certain logograms for staples, livestock, wool and cloth.

As regards the main concerns of the records written on clay tablets, we generally distinguish between records of miscellaneous commodities and specialised records. In the first category, different products are recorded together in the same tablet, especially wheat, barley, olives, figs, olive oil, wine, vessels, wool, textiles, animals, as well as other products indicated by unknown logograms. The second category covers records of a single product: for example wheat, or a single type of resource, for example animals, or lists of personnel followed by regular amounts of foodstuff. In general, Linear A tablets seem to have been suitable for temporary records of a few, basic resources[1].Therefore it is safe to say that the documentary evidence, so far as it makes such matters accessible to us, confirms the view that the role of the Neopalatial centres was to control basic economic commodities, since the Linear A tablets deal with relatively small-scale operations in this immediate environment, although tablets recording hundreds or even thousands of items, for example people or

This study is part of a wider research project, which I am currently carrying out at the Institute for Classical Archaeology of the University of Heidelberg, thanks to the generous support of the Alexander von Humboldt Foundation. It is my pleasant duty to thank Prof D. Panagiotopoulos and Dr M. Anastasiadou, who kindly facilitated my study of the silicone casts housed in the CMS archive and spent time discussing with me about the Minoan sealings. I am also grateful to Dr G. Rethemiotakis and Dr S. Mandalaki (Archaeological Museum of Heraklion), to Prof F. Di Gennaro (Prehistoric and Ethnographic Museum ›L. Pigorini‹ of Rome), and to Dr G. C. Cianferoni (Archaeological Museum of Florence) for the permission to study and reproduce imagines of Minoan nodules housed there. Finally I am indebted to Dr O. Krzyszkowska for her valuable corrections, comments, and advice. Any residual errors or omissions are my responsibility.

1 Olivier 1987, 233–235; Olivier 1990, 72–75.

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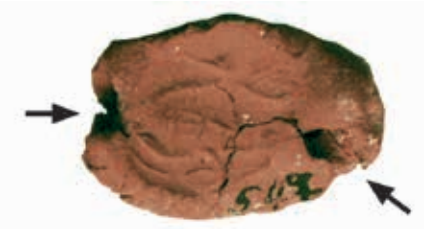

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Hagia Triada

Fig. 1 S-H hanging nodule with a Linear A sign, the arrow indicates the hole. Museo Nazionale Preistorico Etnografico ›L. Pigorini‹ di Roma inv. 71969 = CMS II.6 no. 140, GORILA II Wa1108

Fig. 2 T-H hanging nodule, arrows indicate the holes. Archaeological Museum of Heraklion, HMs 547 = CMS II.6 no. 118

vessels, also exist (e. g. tablet HT 31 recording thousands of vessels; HT 105 recording 469 people; and TY 2 recording thousands of an unknown/not clear commodity). The extremely large numbers on such few tablets prove that what we might call macroeconomic activities were indeed being conducted. For example, large scale agricultural production is reflected on HT 116, a document which records 100 units of barley, 17 of olive oil, 5 of olives, and 15 of another agricultural commodity indicated by sign A 304, and makes reference to 6 different entities, whether individuals, groups of persons, institutions or toponyms.

On the other hand, we have a great variety of sealings, which are small clay lumps impressed one or more times with a seal and at times inscribed with Linear A signs. They are numerous and widespread, both on Crete and some Aegean islands. This means that they played an even more important role than tablets in the Linear A administrative system. In fact, for the Neopalatial period, there exists great typological variety among sealings and their patterns of use, in addition to evidence for sophisticated intra- and perhaps inter-regional communication via perishable documents to which some kind(s) of sealings might have been attached. Sealings have been grouped in four main types, conventionally called roundels, *noduli*, flat-based (or packet-)nodules and hanging (or string-)nodules[2]. The latter are in turn divided in two- and single-hole hanging nodules (hereafter T-H and S-H nodules; Figs. 1. 2).

A roundel is a clay disk with one or more seal impressions along the edge, usually, but not always being inscribed on one or both faces, and lacking traces of being attached to anything else. A nodulus is a small clay lump bearing from one to three seal impressions, at times inscribed; like the roundel, it was never fastened to anything. The link between these two types of sealings and the tablets is demonstrated by (a) some associations in the same find-spot, and (b) overlapping logograms and syllabic groups (for example logograms for livestock, personnel, vessels and cloth).The seal-impressed nature of the roundel indicates that it may have functioned as the direct authorizing record of the transaction, as opposed to the tablets which may have recorded the results or the expectation of the transactions without directly participating in the process[3]. Therefore roundels and *noduli* are autonomous sealed documents, which are kinds of receipts for outgoing and incoming items or services, parallels for which may be found in contemporary or slightly earlier Mesopotamia[4].

The so-called flat-based nodules (hereafter F-B) are little clay lumps of about 2 cm × 1.5 cm, whose main characteristic is the negative impression on

2 For the main types of Neopalatial sealed documents and their sub-types see Hallager 1996, vol. I, 21–24 fig. 2.
3 For a complete analysis and discussion of the roundels see Hallager 1996, vol. I, 79–120.
4 For roundels see Hallager 1990, especially 133 with references in n. 71. For *noduli* see Weingarten 1986b; Weingarten 1987; Weingarten 1990b and Hallager 1996, vol. I, 121–133.

Fig. 3 Hagia Triada, hanging nodule with two holes (scale 2 : 1), previously classified as S-H, arrows indicate the holes, above details of the two holes. Archaeological Museum of Heraklion, HMs 557 = CMS II.6 no. 011

their reverse (or base), which shows traces of fine threads. They have been interpreted as sealings placed upon small folded pieces of thin and lightly worked leather, presumably written documents, around which was wound the thread[5].

We can now move to our concern: the hanging nodules. My goal here is to re-evaluate the evidence at our disposal, by giving importance to the fact that 1) having the right data is usually better than having more data, and 2) data have no value or meaning in isolation, because they only exist within a knowledge infrastructure[6].

Definition and Distribution of the Hanging Nodules in LM I

Hanging nodules are also small clay lumps, about 2 cm in length, characterized by string holes which show that this type of nodule was fastened to a string or cord, hanging from something. So far two types of hanging nodules have been recognised, based on the presence of one or two holes on their external surface. Therefore, they are called single- and two-hole hanging nodules (hereafter S-H and T-H), respectively. In S-H nodules the single hole was created by the ›free‹ end of a string, with the nodule enclosing the other end; they are termed ›Schnurendplomben‹ (string-end nodules) in the CMS. The two holes of T-H nodules result from the fact that these were fashioned around a length of cord; these are termed ›Schnurplomben‹ (string-nodules) in the CMS. In any case, all hanging nodules which have a single aperture at one end should be regarded as S-H, while those with a hole running through the long axis of the nodule are T-H. Nevertheless, about 150 complete hanging nodules from Hagia Triada are classified as S-H, despite the fact that they show a second much smaller hole, because they are interpreted as single-hole variety in disguise, with the second hole caused by careless knotting (Fig. 3). These nodules are defined ›Schnurendplomben mit offenem Ende‹ (string-end-nodules with open end) in the CMS[7]. By contrast, all hanging nodules with two holes from Zakros and Khania are classified as ›T-H/Schnurplomben‹[8].

5 Weingarten 1983a; Weingarten 1983b, 38–44; Hallager 1996, vol. I, 135–145; CMS II 6, 349–356.
6 Borgman 2015.
7 CMS II 6, 346 f. and 460–465.
8 For these nodules, I follow the classification of Hallager 1996, vol. II, 243–245; CMS II 7 and V Suppl. 1A, with the updated online database (<http://arachne.uni-koeln.de> [26.07.2017]).

Site	T-H	S-H	S-H with two open ends	Chronology
Hagia Triada	2–5[ii] or 11[iii]	799	150	LM IB
Khania[i]	6	18	–	LM I
Knossos	3	17[iv]	1?[v]	MM III–LM IA
Tylissos	0	1	–	LM IB
Zakros	51	6	–	LM IB
Akrotiri (Thera)	1	1	–	LC IA

Tab. 1 Distribution of S-H and T-H nodules in the Neopalatial period according to Hallager 1996, vol. II and the CMS.
i: Data from CMS online database (<http://arachne.uni-koeln.de>).
ii: CMS II 6, 478: HMs 546/1 is complete and classified as »Schnurplombe?«; HMs 547 is complete and classified as »Schnurplombe mit gewölbter Rückseite?«; HMs 1657 and 1687 are fragments and classified as »Schnurplomben mit gewölbter Rückseite«; finally HMs 1667 is a fragment classified as »Schnurplombe oder Schnurendplombe?«.
iii: Hallager 1996, vol. II, 243.
iv: Hallager 1996, vol. II, 289 and CMS II 8 nos. 267 and 687.
v: CMS II 8 no. 194: »Schnurplombe […] möglicherweise eine Schnurendplombe mit offenem Ende«. Uncertain chronology.

S-H may assume different shapes, which have been divided into five categories by E. Hallager: pendant, pyramid, cone, dome, and pear[9]. Although there are pieces which are between two categories, it is safe to say that the vast majority have a prismatic shape resembling a pendant[10]. They have two flat sides, the one with the seal impression and the other quite often written with one or two Linear A signs, and a third convex back side that is blank. All S-H hanging nodules with a second hole have this shape. The second most attested shape is the pyramid, which has a triangular base and three flat faces, one with the seal impression, another with the inscription and the third blank. Then come the cones, which have a flat base with the seal impression (one Linear A sign is often incised on the side), and finally the domes[11], which have a flat face with the seal impression and a gable/dome-shaped reverse side, often inscribed. A very few S-H nodules from Knossos and Phaistos are described as pear-shaped by E. Hallager[12].

T-H nodules may assume either a prismatic shape, which corresponds to the pendants, or a more regular gable shape, which corresponds to the domes, or, when they bear two seal impressions, a disk shape[13], which finds no correspondence among the S-H. It must be stressed that a complete prismatic (pendant) S-H hanging nodule with a second hole and a complete prismatic T-H hanging nodule share the same shape. Therefore, in this case, the distinction between T-H and S-H nodules with open ends is problematic.

As a consequence, we must be careful when we consider the available data about the distribution of the two types in LM I period (table 1). The S-H nodule appears to be the most attested sealing type of Neopalatial Period, with nearly 1000 specimens in total[14]. By contrast, the T-H nodule is the least common of the main sealing types, with about 70 specimens in total, if we exclude most nodules with two holes from Hagia Triada as being S-H with a second »not meaningful« hole. In any case, we must take into consideration that the vast majority of S-H come from the same site, Hagia Triada, while Zakros is the only LM I site in which the number of T-H nodules exceeds the S-H nodules. Finally, it is also important to stress that only nodules with string-hole passing all the way through the long axis continue to be used also in Mycenaean times, while S-H nodules were not used after the collapse of the Neopalatial administrative system.

To sum up, we can keep this general and formal classification of the hanging nodules in two categories, S-H and T-H, based on the presence of one or two holes, provided that we avoid an interpretation (that is always subjective) at this initial stage of data collection. This means that we should call all complete hanging nodules with two apertures T-H.

9 Hallager 1996, vol. I, 23 fig. 2.
10 In CMS II 6 prismatic nodules are divided into »Schnurendplomben mit gewölbter Rückseite« and »Schnurendplomben mit pyramidenförmiger Rückseite«.
11 These nodules are termed »Schnurendplomben mit giebelförmiger Rückseite« in CMS II 6.
12 Hallager 1996, vol. II, 289.
13 CMS II 7, 275 (Scheibe).
14 According to Hallager 1996, vol. II and the CMS.

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Fig. 4 Hagia Triada, silicone cast of the inner side of a S-H hanging nodule, which was formed over a single knotted end of a string. HMs 451/5, CMS archive, Institut für Klassische Archäologie, Universität Heidelberg (scale 2 : 1)

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Fig. 5 Zakros, silicone cast of the inner side of a T-H hanging nodule, which was formed over the length of a single knotted string. HMs 1143, CMS archive, Institut für Klassische Archäologie, Universität Heidelberg (scale 2 : 1)

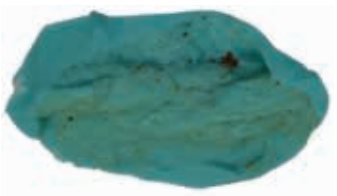

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Fig. 6 Hagia Triada, silicone cast of the inner side of a T-H hanging nodule, which was formed over the two loose ends of a string. HMs 546/1, CMS archive, Institut für Klassische Archäologie, Universität Heidelberg (scale 2 : 1)

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Fig. 7 Hagia Triada, silicone cast of the inner side of a T-H hanging nodule, which was formed over the two twisted ends of a string. HMs 1657, CMS archive, Institut für Klassische Archäologie, Universität Heidelberg (scale 2 : 1)

String Impressions, Seal Impressions, and Inscriptions

A classification of the hanging nodules based on the presence of one or two holes on their external surface does not provide us with information about their use and function. For this we must look very carefully at the inner surface of broken examples, which shows the impressions left by the string which ran through the clay nodule. Different types of string impressions were produced by the different ways in which the nodules were fastened to the strings. Silicone casts of the inner sides of Neopalatial broken hanging nodules kept in the CMS archive show at least four different cases: 1) the nodule was formed over a single knotted end of a string (Fig. 4); 2) the nodule was formed over the length of a single (at times knotted) string (Fig. 5); 3) the nodule was formed over the two loose ends of a string (Fig. 6); 4) the nodule was formed over the two twisted ends of a single string (Fig. 7). Perhaps the nodule could also have been pressed against the two knotted ends of a string, as it might be the case for the T-H from Zakros HMs 1159 (CMS II 7 no. 254), but the traces left in the clay of this nodule are not clear. It is important to stress that only in the first case is the result a nodule with a single aperture (Fig. 8), while in the second, third, and fourth instances nodules turn out to have two holes, as shown by the trials reproduced at Figures. 9–11. On the other hand, in the first and second cases the nodules had the same function, i. e. to label the thing to which the

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Fig. 8 Trial of a clay nodule formed over a single knotted end of a string (scale 1 : 1)

Fig. 9 Trial of a clay nodule formed over the length of a single knotted string (scale 1 : 1)

Fig. 10 Trial of a clay nodule formed over the two ends of a single string (scale 1 : 1)

Fig. 11 Trial of a clay nodule formed over the two twisted ends of a single string (scale 1 : 1)

string was tied (Figs. 8. 9), while in the third and fourth instances, nodules serve both to secure the cord and to label (Figs. 10. 11). This means that we can take for granted that nodules with one single aperture functioned as labels or tags and that the string-end was knotted to prevent the string-threads from loosing and the clay from slipping (case no. 1, Fig. 8). But when we have a complete nodule with a string hole going all the way through the long axis, we cannot be sure whether it labelled a single piece of cord, which at times was knotted just to prevent the clay from slipping (case no. 2, Fig. 9)[15], or was formed over the two ends of a string in order to secure them together (cases no. 3 and 4, Figs. 10 and 11)[16].

Moving to the seal impressions, the vast majority of hanging nodules bear a single seal impression, but the T-H from Zakros normally bear two or three different seal impressions, and three S-H from the Palace of Knossos also bear two different seal impressions (CMS II 8, 2 nos. 158 and 473, 492 and 593). One more S-H from Knossos was impressed twice by the same seal face (CMS II 8, 1 no. 95). The same seal face occurs at times on both S-H and T-H. This is the case, for example, for CMS V Suppl. 1A no. 153, and CMS II 6 nos. 11, 133, 134.

Hanging nodules frequently bear one Linear A sign, while a few are inscribed with two signs on one or two faces, generally kept from a restricted repertoire of signs (examples in Figs. 1, 3, and 12). It is generally claimed that S-H are frequently inscribed, while T-H are never or very rarely[17]. Nevertheless, only at three sites – Hagia Triada, Zakros and Khania – is the number of hanging nodules statistically relevant. If we regard the hanging nodules from Hagia Triada that actually show two holes as T-H, it is more accurate to say

15 Krzyszkowska 2005, 160.
16 Hallager 1996, vol. I, 161.
17 According to Hallager 1996, vol. II, 343, we have only two inscribed T-H from HagiaTriada (Wa 1143 = CMS II 6 no. 64, and 1617 = CMS II 6 no. 39) and two from Khania (Wa 1003 and 1004 = CMS V Suppl. 1A no. 153).

Fig. 12 Hagia Triada, S-H hanging nodule with a seal impression on one side (left), and a Linear A sign on another side (right). Museo Archeologico Nazionale di Firenze Inv. 94760 = CMS II 2 no. 117, GORILA II Wa 1558

Sign	Attestations	Sites	Nodule type
*301	229	HT	S-H
	3	KH	
	1	ZA	
*81 (KU)	149	HT	S-H
*44 (KA)	147	HT	S-H + T-H
*41 (SI)	93	HT	S-H
	1	ZA	F-B
*02(RO)	88+2	HT	S-H+F-B
	1	ZA	S-H
*74 (ZE)	40	HT	S-H + T-H
	6	KH	
*28 (I)	25	HT	S-H
*04 (TE)	24	HT	S-H
	1	KH	S-H
*54 (TA)	12	HT	S-H

Tab. 2 Frequency of the most attested single signs on Neopalatial nodules (S-H with both ends open are considered T-H)

that the T-H from Zakros are never inscribed. All in all it seems to me that, in general, there is no great difference between a S-H and a T-H nodule at Hagia Triada. Rather there is a meaningful difference between the T-H hanging nodules from Hagia Triada and Khania, on the one hand, and those from Zakros, on the other, as far as the shape, size, and number of seal impressions and inscriptions are concerned.

Table 2 shows the frequency of the most attested single signs on hanging nodules. Signs *41 and *02, which in Linear B are read si and ro, are also found on flat-based nodules, which are very rarely inscribed. Some of them often occur on the tablets as ›transaction signs‹, others as abbreviations for names of commodities, but it is very hard to reach a conclusion on the meaning of such signs on the nodules from the evidence at our disposal[18]. It is even possible that they served as symbols rather than as true legible syllables. Moreover, on five hanging nodules from Hagia Triada we find also five single signs which are never otherwise attested: *365 on Wa 1849, *366 on Wa 1850, *367 on Wa 1851, *369 on Wa 1853, and *370 on Wa 1854. Since they are attested only once, it is likely that they had an ideographic (or possibly just symbolic) value.

Archaeological Contexts

Besides the formal and textual characteristics, any attempt to establish the use and function of the hanging nodules must consider the archaeological contexts in which they were found. The main problem is that most of the documents were not found *in situ* (this is the case for all the examples from Khania). In

18 Hallager 2000.

any case, hanging nodules chiefly come from deposits in central buildings or in buildings that could be in some way related to central buildings. Under the label ›central building‹ we group both palaces, for example at Knossos and Zakros, and the so-called villas.

The precise archaeological contexts and chronology of the documents from Knossos are very uncertain. Since the Palace did not suffer a fire destruction at the end of the LM IB period, no sealings found there can be securely dated to this period. The most remarkable deposit is the one found in the Temple Repositories. The exact number of the sealings, as well as their chronology (MM III or LM IA) are uncertain[19]. However, it includes one tablet (KN 1), seven roundels, 30 F-B nodules, six S-H nodules, 44 *noduli*, and at least one direct object sealing. Also worth mentioning are: one LM I S-H from the Arsenal with the impression of a EM seal (CMS II 8, 1 no. 31)[20], one fragmentary inscribed S-H (CMS II 8, 1 no. 95, KN Wa 33) found on the floor of the Sixth Magazine in the NE House, possibly dated to the LM IA[21], and one, possibly two LM I S-H possibly found in the Domestic Quarter in the East Wing (CMS II 8, 1 no. 279)[22].

Only five sealings and thirty tablets, in large part fragmentary, come from the LM IB Palace of Zakros, but more may have been lost due to water damage[23]. The majority of tablets was found in Room XVI, in part from the three small receptacles in its southern part, which is considered the archive room of the Palace[24]. This archive was adjacent to a shrine (room XXIII)[25] and directly connected with storeroom XXII[26]. One *nodulus* CMS II 7 no. 39 and, perhaps, a T-H nodule (CMS II 7 no. 250) also come from the same archive room, while two F-B nodules (CMS II 7 nos. 55. 107 and CMS II 7 no. 216) come from the ›Treasury‹ (XXV), a room provided with eight mudbrick chests which contained chalices, a rock crystal rhyton, Egyptian stone vases, and faience objects, located behind the central shrine[27]. Finally, one more *nodulus* comes from the Ceremonial Hall XXVIII (CMS II 7 no. 6), where three tablets were also found (ZA 7, 9, 10)[28].

The main deposit of sealings from Zakros was found in the settlement some 200 metres from the Palace. In Room VII of the House A, 1 roundel (Wc 2), 1 Linear A tablet recording 42.5 units of figs and 47 units of wheat (ZA 1), and 554 nodules were found. The nodules, among which we recognize 50 T-H and 6 S-H, were under a mass of burnt brick, close together with large bronze pieces of agricultural implements (2 heads of mattocks, several pointed blades) and at the entrance to the storage room VIII, which contained 5 large storage jars and 9 amphorae[29]. In this case, the administrative documents might have been fallen from above.

At Hagia Triada, clay tablets were found both in the central building, the ›Villa Reale‹, and in the house called ›Casa del Lebete‹, but nodules were found only in the Villa. Only in a few cases the precise spots where the sealings were found are known. This partly due to the fact that the site was excavated at the beginning of the 20th century, when field documentation and detailed publication did not meet today's standards, and that sealings were discovered when the plan of the Villa was not yet clear and its rooms had not yet received their definitive numeration. Furthermore, at the time, no typology of nodules had been established (i. e. distinguishing between hanging, flat-based and *noduli*) and, as a result, the terminology used both in field notes and publications is usually generic and variable. In any case, the great majority of the sealings, mostly S-H nodules, were thought to have fallen down from an archive housed on the first floor of the Villa, while a few might have had different locations, especially storerooms[30].

19 Hallager 1996, vol. II, 54–56; Hallager 2010, 209.
20 Hallager 2010, 206.
21 Hallager 1996, vol. II, 58.
22 Hallager 2010, 206.
23 Platon – Brice 1975, 26 f. 35.
24 Platon 1985, 148–154.
25 Platon – Brice 1975, 21.
26 Platon – Brice 1975, 22.
27 Platon 1974, 117–130; Platon 1985, 133–148.
28 Platon – Brice 1975, 32.
29 Hogarth 1900/1901, 131–133; Hogarth 1902, 76–93.
30 Halbherr 1903, 21; Paribeni 1903, 327. 330.

Houses in sites without central buildings, which may be peculiar either for size or for architectural features and finds other than administrative documents, such as House A at Tylissos, and House Δ at Akrotiri, have also yielded hanging nodules (1 S-H at Tylissos[31], and 1 S-H and 1 T-H at Akrotiri[32]). In such buildings they have been found along with other document types, including tablets, in deposits close to storerooms[33].

One hanging nodule has been recently brought to light in a storeroom of the palace at Gournia, along with one flat-based nodule, one roundel and one tablet fragment (LM IB)[34].

To sum up, in Palaces a few hanging nodules have been found in archives and storerooms linked to shrines, while in other buildings they seem to be connected both to storerooms and archives or offices.

Due to their small size and the fact that they were unbaked, these sealings were considered very fragile and, as a consequence, not suitable for long-distance travelling. Moreover clay characteristics were said to confirm that they were locally produced[35]. After the discovery of the sealings deposit at Akrotiri this view has been completely changed. The clay of the S-H from Akrotiri shows, in fact, to have a Cretan origin, just like all the other F-B with which it was found together[36]. To this evidence we can also add at least one doubtful case: the inscribed S-H from Zakros HMs 94 (CMS II 7 no. 45, ZA Wa 36). Its clay is apparently the same as in the sealings from Hagia Triada, and the seal face impressed on it is the same that attested on three S-H nodules from Hagia Triada (CMS II 6 no 68). As a consequence, this nodule would prove that S-H nodules travelled from one site to another, at least within Crete. The possibility, suggested in CMS II 7 no. 45, that nodule HMs 94 was also found at Hagia Triada, but stored by mistake with material from Zakros in the Archaeological Museum of Heraklion, can be neither ruled out or proved. It is worth remembering, however, that F. Halbherr mentions three sealings with this seal motif from his excavation of the Villa in 1902[37], and D. Levi, in its catalogue of the seal impressions from Hagia Triada, only two[38].

Use and Function

We are now moving from the analysis to the synthesis and evaluation of the data. The main question is »from what did such nodules hang?«. We have two possibilities: the first is that they were fastened, by a cord, to documents in perishable materials, the second that they were fastened, again by a cord, to containers and/or objects. Due to the high level of uncertainty, I will discuss below several possible scenarios, showing arguments in favour and in opposition to each of them.

Hypothesis 1: Nodules Hanging from Documents in Perishable Material

The strongest evidence for the hypothesis that these nodules hung from documents in perishable material comes from possible traces of papyrus on S-H Wa 32 from Phaistos[39]. In this scenario, a possibility is that different kind of matters were recorded on different types of supports: the tablets would have recorded transactions of low economic profile, and papyrus or leather documents, authenticated by fastening or tying a string with a nodule, would have dealt with either legal or economic issues of high profile. Moreover, E. Hallager has suggested that two different S-H nodules were fastened to the same string, one to each end, in order to represent the two parties involved in a bilateral contract[40]. The practice of authenticating documents through

31 CMS II 6 no. 276.
32 CMS V Suppl. 3, 2 no. 401.
33 Two *noduli*, one S-H nodule, two roundels and two tablets were found in room 5 of House A at Tylissos (Hazzidakis 1921, 45 f.; Hazzidakis 1934, 15). For the documents from Akrotiri (Thera) see Karnava 2008 and Karnava forthcoming.
34 Watrous et al. 2015, 437.
35 Hallager 1996, vol. I, 165. 220.
36 Müller 2005, 789.
37 Halbherr 1903, 36 no. 13 pl. 5, 4, 1.
38 Levi 1925/1926, 108 no. 76. It is possible that D. Levi recognised this seal face with certainty only on two nodules, because the seal impression on HMs 1715 is not clear, since also F. Halbherr, in his (unpublished) field note of 1902, 35 no. 16, had suggested that these three sealings from Hagia Triada (CMS II 6 no. 68) were perhaps not impressed by the same seal, but by two similar seals.
39 Fiandra 1994, 17.
40 Hallager 1996, vol. I, 224; Hallager 2000, 254. 259; Hallager 2010, 211 f.

sealings attached to strings or thongs is extremely widespread over time and space, well documented from ancient Egypt[41] to the Hellenistic and Roman world[42] to Medieval Europe[43], and beyond. A general survey reveals that the most common sealed documents are legal documents (such as contracts and receipts) and letters; and that legal documents often bear at least one impression from an institutional or official seal.

Three observations tend to lessen the hypothesis that S-H served for authenticating legal documents or securing letters. First, the string with the sealing could have been removed too easily. Second, at Hagia Triada, which has yielded the overwhelmingly majority of extant S-H, only three of the most-frequently attested seal impressions on hanging nodules were produced by high-quality seals, which might be attributed to high ranking administrators, while many of the most active seals are of mediocre or even poor quality. Third, the archaeological contexts suggest that these nodules may have been archived, but they were also occasionally found in storerooms. Therefore, if one accepts as a working hypothesis that nodules hung from documents in perishable materials, one could imagine that T-H securing nodules, which are extremely rare, authenticated and prevented from tampering legal documents or letters, whereas tag nodules (S-H and/or T-H) hung from not so much important documents, such as lists or accounts. These hypothetical accounts written on authenticated documents might deal with those macroeconomic activities, whose existence filters from the tablets, as we have explained in the introductive section.

Nevertheless I would reject the hypothesis of a multi-level archiving process, in which the Neopalatial functionaries would have written records on the tablets based on the information derived from *noduli* and roundels, and then would have copied it again onto documents in perishable material, which were labelled by clay hanging nodules[44]. Established and daily economic relationships may have been maintained on a regular basis on clay tablets, while written records came onto play only for periodic and/or more valuable transactions. However, in my opinion, it is unlikely that records of little value, such as those messily written on clay tablets, were then copied onto more expensive materials such as parchment[45] or papyrus[46], or even on cloth[47].

Moreover, we must pay also attention to the diachronic perspective. The largest deposit of Protopalatial direct sealings, which are clay lumps directly pressed to objects, impressed multiple times by seals, and never inscribed, comes from the archive of the First Palace at Phaistos, 2 km far from Hagia Triada; they are dated to MM II, about two centuries earlier than the period which concerns us[48]. Only three S-H hanging nodules, among which one inscribed (Wa 52), were found there[49]. One more inscribed S-H from the Phaistos Palace was found in room 10 and dated to the MM IIIA (Wa 32)[50]. By contrast, in the Neopalatial Villa at Hagia Triada, where the greatest use of S-H is attested, we have at most three or four direct object sealings: HMs 1686 (CMS II 6 no. 35), 1717/Bk (Wg 3021), and possibly 1721 (CMS II 6 no 289), and T 129.1 (Wb 2001). Therefore, as far as the sealings are concerned, a radical change happened from Protopalatial Phaistos to Neopalatial Hagia Triada. It has been suggested that this is a change in emphasis from sealings used for the practical action of closing to sealings which labelled and authenticated[51]. At any rate, from both sites the number of Linear A records written on tablets is sufficient to say that the two administrations used clay tablets in an analogous way and for the same purposes. Therefore, we have no evidence for the occurrence of a new need of copying them on perishable materials, and explain in this way the massive increase of S-H nodules in the new administration centre (the Hagia Triada Villa).

41 Smith 1990, 201 pls. 35 h; 36 b. c.
42 Berges 1996, 341–347 pls. 67. 68; Vandorpe 1996.
43 Ewald 1975, 164–171 pls. 6. 8. 9.
44 Militello 1992, 414; Schoep 2002, 193–197.
45 The oldest attestations for the use of leather as written material come from Egypt. Of particular interest is the reign of Tuthmosis III (ca. 1504–1450 B.C.), during which records and legal material were committed to hides (Vlassopoulou-Karydi 2009, 91 with previous references).
46 On the use of papyrus in Egypt and traces of papyrus in Late Bronze Age Aegean, see Vlassopoulou-Karydi 2009 with previous references.
47 As for example the *libri lintei* mentioned in Plin. nat. 13, 11, 21.
48 Levi 1957/1958. The direct object sealings from the First Palace of Phaistos were used on a very elementary functional level: a small percentage to secure goods like jars and baskets, the overwhelming number sealing wooden pommels or cylindrical pegs to control access to the doors of storerooms or chests within them. The broken sealings were stored, apparently as a kind of check on persons and frequent activities in the storage area (Fiandra 1968). Based on Near-Eastern examples, written documents on clay tablets supported and integrated the legal value of direct object sealings by describing the bookkeeping operation (Ferioli – Fiandra 1990, especially 225).
49 Hallager 1995, 12 f.; Hallager 1996, vol. I, 64 f.; vol. II, 289.
50 Hallager 1996, vol. II, 289; Militello 2014, 162.
51 Weingarten 1986a; Weingarten 1990a. Also in the Mycenaean period we have a few examples of direct object sealings, mostly sealed stirrup jar mouth stoppers (Palaima 1990, 90).

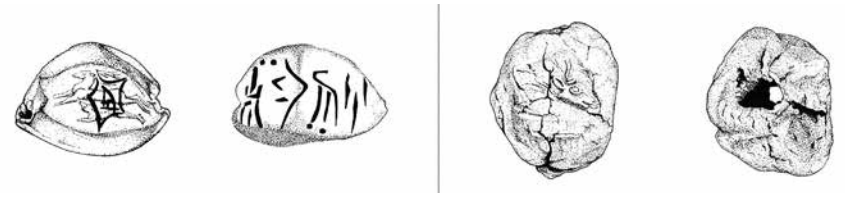

Fig. 13 Mycenaean regular and irregular hanging nodules (after Panagiotopoulos 2014)

Furthermore we can recall the resemblance between Neopalatial S-H hanging nodules and Hittite hanging *bullae*, which are lumps of clay that were pressed around the knots of strings or straps, and then sealed[52]. They may have either a prismatic or conical shape and bear one or more seal impressions. Whether they had served to seal packages or written documents made of perishable materials is matter of dispute, but the accumulation of some 200 of them in one place in Building D on Büyükkale, and more than 3000 in the so-called *Westbau* in the Upper City at Boğazköy (Ḫattuša), indicates that they were collected and kept for a period. Some scholars suggest that they hung from written wooden and/or clay tablets[53], other that they were removed from the items they originally sealed and stored separately, as »silent witnesses of past transactions«[54].

Hypothesis 2: Nodules Hanging from Containers and Commodities

The alternative hypothesis is that S-H and/or T-H were labels hanging from containers (such as jars, baskets, boxes, or sacks) and/or directly from certain commodities[55]. In this case, a two-stage system might be suggested: hanging nodules would have been used in storerooms and then removed by loosening or cutting the cords and transferred to offices or archives, in order to preserve the memory of past transactions (i. e. in order to know, for example, who had been responsible for them and how many times). We can now try to compare, on the one hand, Neopalatial and Protopalatial hanging nodules and, on the other, Minoan and Mycenaean hanging nodules.

The most-attested type of hanging nodule in Protopalatial Period is the crescent-shaped nodule. This is much larger than the S-H and T-H, and carries impressions from one or more seals on one side, and longer inscriptions in the Hieroglyphic script on the other one or two sides. They are thought to have been in some way fastened to commodities[56]. Crescents are confined to north-central and north-eastern Crete (Knossos, Mallia, Petras), while a few S-H and T-H are known from MM II and III at Knossos and Phaistos[57]. Particularly interesting are the two inscribed S-H nodules from the Palace of Phaistos. The first, PH Wa 52, was found under the floor of room 25 and dated to the MM II period[58]. It bears the logogram for wine, which is often incised on pithoi (KE Zb 5, KN Zb<27>, 34, <36–38>, THE Zb 13, and ZA Zb 3). Thus one can suggest that Wa 52 functioned as label fastened to a jar filled with wine. The second, PH Wa 32, was found in room 10 and dated to MM IIIA[59]. On this nodule we read a place name also known in Linear B, *su-ki-ri-ta*. Although, as we have already said, traces of papyrus are said to be visible on its surface[60], it is meaningful that the Linear A syllabic sequence *su-ki-ri-te-i-ja* is also attested on a pithos (HT Zb 158b). Thus Wa 32 might have been a label for commodities received from or to be sent to this village.

Mycenaean string nodules are divided into regular and irregular varieties (Fig. 13). The first type, also called gable-shaped hanging nodule, is very similar in shape to the Minoan prismatic hanging nodule (both T-H and S-H with two open ends), being formed over a single knotted string, which ran all the

52 Güterbock 1975, 53–56; Herbordt 2005.
53 Marazzi 2000, 82–93; Herbordt 2005, 26. 36–38 fig. 18 a.
54 Van den Hout 2012, 52–54 (citation from p. 53), with previous references.
55 Weingarten 1987, 21–24. 33–37; Weingarten 1990a, 108; CMS II 6, 340–343; Müller 2005, 789.
56 Krzyszkowska 2005, 101.
57 Hallager 1996, vol. I, 36.
58 Hallager 1995, 13 fig. 6.
59 Militello 2014, 162.
60 Fiandra 1994, 17.

way through the long axis. The Mycenaean hanging nodule is, however, larger and often have larger holes, because the string was thicker[61]. Irregular string nodules (also called irregular hanging nodules) were formed over the two ends of a thick cord or even of two different cords, in order to secure them[62]. Minoan hanging nodules which show the impressions left by two ends of one string (or possibly also by two different strings) can be therefore compared to this second category (Figs. 10. 11). However, Mycenaean hanging nodules never bear more than one seal impression; thus, in this respect, they resemble more the S-H than the T-H from Zakros, which usually bear two or three seal impressions. There is a general agreement in thinking that Mycenaean string nodules hung from commodities, either as labels or tags (regular type), or as securing devices (irregular type)[63]. It is important to stress that Mycenaean regular string nodules are usually inscribed and always show the identity of the certifying authority, usually indicated by the seal impression, and often the commodity, indicated by a logogram inscribed over the seal impression, and a place or personal name indicating who sent or would have received the commodity[64]. Moreover, the logograms attested on such sealings are more or less the same as we find also on the Linear B tablets; it has been thoroughly argued that they served as the basis for the records on tablets[65]. Although inscriptions on Mycenaean regular string nodules are generally much more informative than those written on the Neopalatial ancestors, which, as we have seen above, are almost always made up by a single sign, we have also examples of very minimal texts, comprising a single logogram (e. g. PY Wr 1358 and 1361 bear only the logogram for wine inscribed *supra sigillum*), or by a number (PY Wr 1329 is inscribed merely with number »20«), or by a syllabic sequence of two signs (on PY Wr 1330 and 1333 occurs the economic term *o-pa*,» work done« *vel sim*.)[66].

Concluding Remarks

It seems to me that we still need to agree on an unambiguous, and consistent system of classification and nomenclature, as informative and easy to use as possible, for the hanging nodules designated ›single-hole‹ and ›two-hole‹ by E. Hallager, but which the CMS terms ›Schnurendplomben‹ (string-end-nodules) and ›Schnurplomben‹ (string-nodules). The advantage of the first general subdivision into single-hole hanging nodules and two-hole hanging nodules, based on the presence of one or two holes on their external surface, is that it allows us to group complete nodules in an objective way, when we do not know how the string was treated and where exactly the nodule was located on it. Since, at this primary stage of data collection, we should avoid mixing data and interpretations, we should call ›S-H‹ all the hanging nodules which show only one aperture at one end, and ›T-H‹ all the hanging nodules which show two apertures at the two opposite ends. On the other hand, the distinction between ›Schnurendplomben‹ (string-end-nodules) and ›Schnurplomben‹ fits better the material from Zakros, where the difference between these two categories is clear even when the noduels are complete, and is more informative.

The next step is the shape. As for the nodules under consideration, I would suggest five shapes: cone, pyramid, dome, disk and prism. The last category includes pieces which do not clearly display one of the previous shapes, being roughly gable- or pendant-shaped, regardless of the precise shape of the individual nodule. In fact, nodules, are not all fashioned with the same level of precision and this shows that different prismatic shapes depend, at least in part,

61 CMS II 8, 54 f. fig. 15; Hallager 2005, 254–258; Krzyszkowska 2005, 218 f. 280; Panagiotopoulos 2014, 108. 109 fig. 40; 111 fig. 44; 119.
62 CMS II 8, 58 fig. 19; Krzyszkowska 2005, 219 f.; Panagiotopoulos 2014, 119 f.
63 Recently Panagiotopoulos 2014, 119.
64 Palaima 1996; Flouda 2000.
65 Younger 2010.
66 For *o-pa* see Melena 1983 and Montecchi 2010, with previous references.

on the skills and accuracy of the person who fashioned the clay lump, as well as on the number and size of seal impressions, location of them on the nodule, and possible presence of the inscription, while it remains unclear if they also encode a different message[67]. Then, when possible, we must add information about the string-hole, by identifying the correct one among the following six possibilities: knotted string-end, knotted string-length, loose string-length, two loose string-ends, two twisted string-ends, two knotted string-ends. This is the most important source of information for the location of the nodule on the string and its possible function. Given that the impression of a seal always implies a certain intention of certifying, the possibilities are reduced to two basic functions: simply labelling or labelling and securing the two ends of the string.

Obviously it is not always possible to classify all pieces with the same degree of precision, in case of doubt we can express this uncertainty through a question mark, or leave the corresponding cell blank. This is the method I am currently following in order to classify the nodules from Hagia Triada and to organise the information in a data base, as shown by the following example:

Inv. No.	Type	Sup-type	Shape	String-hole	Function
HMs 451/5	Hanging nodule	S-H	prism	knotted string-end	labelling
HMs 546/1	Hanging nodule	T-H	prism	two loose string-ends	labelling and securing
HMs 557	Hanging nodule	T-H[68]	prism	knotted string-length	labelling
HMs 1657	Hanging nodule	T-H	prism	two twisted string-ends	labelling and securing

Needless to say, this table needs to be expanded with further columns for state of preservation, size of holes (only for T-H: »equal« and »not equal«, the latter meaning that one is larger than the other), inscription, seal impression(s), clay characteristics, archaeological context, etc. All this information may help to better define the function(s) of the nodules, although, in the current stage of our knowledge, it is not possible to prove definitively whether they hung from documents in perishable materials, and/or from containers and commodities. In the first case, it is possible that those T-H nodules that secured the two ends of a string were used to authenticate and prevent from tampering legal documents, and/or that the hanging nodules used as tags were fastened to lists and accounts, although it seems unlikely that documents in perishable material were used for copying the messy records, which were written, apparently without any chronological order, on poor clay tablets. In the second case, keeping in mind all the evidence shown above and recalling that the records on Linear A tablets show different formats, which should relate to different types of transactions and/or administrative procedures, one might suggest that certain tablets recording single commodities, especially in whole units, were filled out based on the information derived from the accounting of either the *noduli* or the roundels, while certain mixed commodity records were filled out based on the accounting of the hanging nodules, which possibly hung from commodities. This hypothesis is suggested by the variety of commodities recorded on individual tablets, which makes it unlikely that they were written up in the storerooms at the moment of the transactions. Instead such records (recording for example cereals along with textiles and animals) may have been written in an office, based on nodules gathered up and brought there. We can suppose

67 Montecchi 2015, 57 f.
68 »Schnurendplombe mit offenem Ende« in CMS II 6 no. 011.

that, when some kind of transaction was concluded, the hanging nodules were removed from the objects, then collected and counted. The accounting of the nodules might have served as the basis for the drawing-up of certain types of records on tablets. Nevertheless, this hypothesis is diminished by the fact that the inscriptions on nodules are not safely comparable with those on Linear A tablets. Therefore, it is equally possible that hanging nodules hung from commodities other than those recorded on clay tablets.

In any case, as we have already said, the vast majority of the extant hanging nodules (both S-H and T-H) served as labels or tags, being fashioned over the single end or length of a string. Consequently, the string could be tied and untied many times without breaking the nodule. By contrast, a few extant T-H nodules show that they were formed over the two (either knotted, or twisted or loose) ends of a string. In this case, they sealed together the two ends of the string, thus it was necessary either to cut it or break the sealing in order to open it. This may explain why they are few, suggesting that in the Neopalatial period they were used to seal important documents or precious goods, or at least more important or more precious than those simply labelled by the hanging nodules, both S-H and T-H, which were fashioned around a string in order to serve as tags.

Abstract

Barbara Montecchi, Classification, Use, and Function of Hanging Nodules in the Neopalatial Administrative Practices (Minoan Crete)

Clay sealings are administrative devices well attested in the Aegean during the entire Bronze Age. Their shapes, characteristics and function change through time and, at least until the last phase of the Late Bronze Age, are in part still poorly defined. As for the Neopalatial period, almost all the available material dates to LM I (approximately 1580–1450 B.C. on the traditional low chronology, or 1700–1460 B.C. on the high chronology) and is grouped in four main types, conventionally called *noduli*, roundels, flat-based nodules and hanging nodules. The aim of the present paper is to discuss the case of the hanging nodules, which are in turn divided into ›single-hole‹ and ›two-hole‹ by E. Hallager, but which the CMS terms ›Schnurendplomben‹ (string-end nodules) and ›Schnurplomben‹ (string nodules). Since the evidence at our disposal is inconsistent, its interpretation largely depends on the way in which the data have been collected. My goal here is to suggest some adjustments in the classification methodology (since having the right data is usually better than having more data), and possible relationships among different types of documents according to the archaeological contexts (because data have no value or meaning in isolation, but only exist within a knowledge infrastructure).

Keywords
Crete and the Cyclades • Neopalatial Period • administrative practices • seals and sealings

Sources of illustrations
Fig. 1: Photograph taken by Dr. G. Dionisio of nodule inv. 71969, from Hagia Triada, kept in the Museo Nazionale Preistorico Etnografico ›L. Pigorini‹, Roma. Reproduction permission granted by the former director of the Museum • Fig. 2: Photograph taken by the Author of nodule HMs 547, from Hagia Triada, kept in the Archaeological Museum of Heraklion. Reproduction permission granted by the director of the Museum • Fig. 3: Photograph taken by the Author of nodule HMs 557, from Hagia Triada, kept in the Archaeological Museum of Heraklion. Reproduction permission granted by the director of the Museum • Fig. 4: Photograph taken by the Author of the silicone cast of nodule HMs 451/5 from Hagia Triada, kept in the CMS archive, Institut für Klassische Archäologie, Universität Heidelberg • Fig. 5: Photograph taken by the Author of the silicone cast of nodule HMs 1143 from Zakros, kept in the CMS archive, Institut für Klassische Archäologie, Universität Heidelberg • Fig. 6: Photograph taken by the Author of the silicone cast of nodule HMs 546/1 from Hagia Triada, kept in the CMS archive, Institut für Klassische Archäologie, Universität Heidelberg • Fig. 7: Photograph taken by the Author of the silicone cast of nodule HMs 1657 from Hagia Triada, kept in the CMS archive, Institut für Klassische Archäologie, Universität Heidelberg • Figs. 8–11: Photograph taken by the Author of the reconstruction made by the Author herself of a clay nodule • Fig. 12: Photograph taken by the Author of nodule inv. 94760 from Hagia Triada, kept in Museo Archeologico Nazionale di Firenze. Reproduction permission granted by the former director of the Museum • Fig. 13: Panagiotopoulos 2014, fig. 40. Reproduction permission granted by the author of the book

Abbreviations

F-B • Flat-based
HT • HagiaTriada
KE • Kea
KH • Khania
KN • Knossos
LM • Late Minoan
MM • Middle Minoan
PH • Phaistos
S-H • Single-hole
T-H • Two-hole
THE • Thera
TY • Tylissos
ZA • Zakros

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