

ORIGIN, DEVELOPMENT, TRANSITION AND TRANSFORMATION : THE PURPOSES AND TECHNIQUES OF ADMINISTRATION IN MINOAN AND MYCENAEAN SOCIETY *

The purpose of this paper is to speak directly to the complex developments in Minoan and Mycenaean sealings and administration which took place over the course of at least 650 years (beginning in MM II to the end of LH III B), which is not even to consider the traces of antecedents to the earliest forms of Minoan proto-palatial administration : for example, the clay sealing from outside the entrance to Room 29, Period II (EM II B), at Myrtos, and the so-called "Arkhanes" script appearing on seals in EM III-MM I A ¹. With such an intimidating chronological span facing us, we should perhaps feel grateful to whatever combination of causes brought the fully evolved Mycenaean script and record-keeping system to an abrupt and absolute end at the close of the 13th century B.C. At least we do not have to worry about its *Fortleben*.

Since Judith Weingarten will concentrate on radical changes in Minoan sealing administration, my chosen task is to focus on the evidence for written administration, while not entirely neglecting sealing administration, which is its quasi-complementary, quasi-supplementary and quasi-independent partner, throughout at least three successive, undoubtedly in some measure distinctive, phases of palatially oriented economic organization on the island of Crete. There are radical changes in the techniques and applications of written administration, too; and we shall perhaps be able to identify similarities in the specific kinds of changes, the factors that might have influenced them, and the results to which they led. I shall focus on economy and economic conditions for one ineluctable reason : in all periods, so far as we can

* In this paper I use the following abbreviations :

SSMC I : J. WEINGARTEN, "The Sealing Structures of Minoan Crete. Part I", *OJA* 5 (1986) 279-298;

SSMC II : J. WEINGARTEN, "The Sealing Structures of Minoan Crete. Part II", *OJA* 7 (1988) 1-25.

I have taken illustrations for this paper from the following standard publications :

SM I, 163, 166, 167, 170, 176, 179 (hieroglyphic sealings, bars, medallions and tablet from Knossos and Phaistos);

GORILA vol. 1, pp. 188, 190, 294, 296, 300, 304; vol. 2, pp. 2, 95; vol. 3, pp. 116, 118, 125; vol. 5, p. 51 (Linear A bar, tablets and roundels from Gournia, Hagia Triada, Khania, Mallia and Phaistos);

Quartier Mu I : J.-Cl. POURSAT, L. GODART and J.-P. OLIVIER, *Le Quartier Mu I* (*ÉtCrét* 23, Paris 1978) 71 (hieroglyphic perforated leaf tablet from Mallia);

E.L. BENNETT, Jr. (ed.), *The Pylos Tablets. Texts of Inscriptions Found, 1939-1954* (Princeton 1955) 15, 80 (Linear B tablet and label from Pylos);

1 P. WARREN, *Myrtos* (Oxford 1972) 40-41, fig. 97, plate 77C. P. YULE, *Early Cretan Seals : A Study of Chronology* (Mainz 1980) 170, plate 30, motif 56, 1-2 : 15 known seals of this style dating to EM III-MM I A.

tell, the inscribed documents are first and foremost economic records ². Only in the Mycenaean period, when we can actually read and interpret full texts, do they provide us with information about other aspects of Aegean palatial culture : social and political structure, ethnic composition, religious practices. Consequently, if we want to be able to trace developments and make comparisons from the earliest through the latest periods, we must make sure we have and can discuss *comparanda*. Focusing on economy allows us to do this.

Let me anticipate an objection, which is undoubtedly in the minds, if not on the lips, of many of the specialists gathered for this conference. This objection, which I shall raise rhetorically, has to do with skewed data. It is a well known fact that the written records in Cretan hieroglyphic, Linear A, and Linear B are wildly imbalanced in number and length of texts, not to mention our ability to interpret them. How can we possibly compare Mycenaean watermelons and cantaloupes, with Minoan neo-palatial apples and oranges, with Minoan proto-palatial grapes and raisins ? We have for Cretan hieroglyphic 270 actual documents bearing 1537 total signs (or a mere 5.692 signs per text). Of this number, however, only 107 (+ 3 new fragments) are inscribed clay economic documents, the rest being some 150 seals or seal impressions and a mere baker's dozen inscriptions on stone or pottery. Of the clearly economic inscriptions, the clay medallions, 36 in number, contain between 2 and 20 non-numerical signs, the upper limit being reached when they are inscribed on both faces. The 43 clay tablets and bars range upward from 2 to some 30 non-numerical signs. The 26 inscribed sealings can have as many as 10 signs. Even the relative epigraphical fullness of the bars, medallions and sealings derives from their being able to be inscribed on more than one side or facet ³. For Linear A, we have 1338 economic-archival documents (tablets, nodules, roundels, functional *scellés*) containing a total of 6579 signs (approximately 4.92 signs per document). The tablets average far more signs than this, since the brief inscriptions on the 882 inscribed nodules (generally no more than a single-sign countermark) distort the average. However, we still have only 318 tablets total ⁴. In extreme contrast, the Linear B inscribed tablets, sealings and labels now number over 4800 ⁵. These contain over 66,300 signs or an average of at least 13.81 signs per text. 137 of the Linear B texts contain over 50 non-numerical signs; and, of these, 8 texts are so extraordinarily outspoken as to need over 250 signs to communicate their messages. To put matters into perspective, the 137 tablets from Knossos, Pylos and Mycenae

2 The minor exception, of course, is the group of Linear A "religious" inscriptions on pins, miniature double axes and libation tables, and now the inscribed bone rod from Zakro of unknown purpose (the sign-groups do not match those on either "religious" or economic texts) : K. KOPAKA, "Une nouvelle inscription en linéaire A de Zakros", *Kadmos* 28 (1989) 7-13. These inscriptions constitute an extremely low percentage (ca. 3%) even of the Linear A corpus. See T.G. PALAIMA, "Comments on Mycenaean Literacy", in J.T. KILLEN, J.L. MELENA, J.-P. OLIVIER (eds.), *Studies in Mycenaean and Classical Greek Presented to John Chadwick* (Minos 20-22, Salamanca 1987) 507. I acknowledge here the general validity of the fine distinction made by Marvin Powell that the Minoan-Mycenaean clay inscriptions (tablets, labels, and various categories of sealings) should be treated as "records" as opposed to official "documents", often sealed, of the Near Eastern type. No matter what terms one chooses, however, Socratic ambiguities arise, here primarily because of the typological range of the Minoan-Mycenaean linear inscriptions. Tablets of recension and summary stored in formal archives certainly approach the status of "documents" even if unsealed, while nodules with single and monotonously repeated countermarks are very minimal "records", perhaps the equivalent of modern paper cash-register receipts.

3 For some of these statistics on Cretan hieroglyphs, see J.-P. OLIVIER, "Cretan Writing in the Second Millennium B.C.", *World Archaeology* 17:3 (1986) 382-384, and now in this volume. There are now 3 additional fragments of perforated leaf tablets probably from Quartier Mu : A. FARNOUX and J.-P. OLIVIER, "Trois tablettes hiéroglyphiques à Malia", *BCH* 113 (1989) 97-100.

4 See J.-P. OLIVIER, "Le linéaire A : quelques approches quantitatives", in *Tractata Mycenaea*, 237-240.

5 Supplementing the statistics in A. BARTONĚK, "The Linear B Series and Their Quantitative Evaluation", in *Res Mycenaea*, 15-27, and OLIVIER (*supra* n. 3) to include the 55 inscribed sealings from Thebes discovered in 1982.

in the second-last group contain more lexical information than all Linear A inscriptions, archival or not, massed together ⁶. The Linear B tablets of the last category, 7 from Pylos and 1 from Knossos, contain about 25% more signs than all the hieroglyphic material, including vases, seals and seal impressions.

Nonetheless, it is possible to arrive at a comparative understanding of this material, if we are not overly impressed by the mere size of the fruit. To make our opening analogy more exact, we should add pears, peaches, nectarines, and tangerines to the Linear A bushel, and cherries, strawberries, blueberries, and maybe even a few prunes to the Cretan hieroglyphic fruit basket. There is something to be said for typological variety on the administrative dining table. Also we should not forget that these fruits, although different in size, shape, and taste, do have ingredients in common : fructose, water, seeds, and so on. We can compare and contrast the basic economic contents, and consequently even the purposes, of the texts surviving from different stages of development. We can also keep in mind what other contemporary cultures used in their diets. Finally, it is also valuable to follow what I think of, correctly or not, as John Cherry's dictum, and concentrate on what is *not* there at each stage. The Minoans and Mycenaeans doubtless had real reasons for restricting or expanding their administrative diets in different periods : they were undoubtedly constantly responding to new circumstances and devising new systems of organization and administration; the tools for record-keeping must have changed accordingly. We should especially take a close look at the full Mycenaean administrative records and decide what subjects and economic transactions would likely be transferable to the earlier Minoan periods. Then, of course, our question must be how the Minoans of the proto- and neo-palatial periods handled these matters other than through clay administrative records. Of course, it is also germane to compare the Mycenaean evidence with the Near Eastern in the same way.

These last points in particular compel us to examine all the data pertinent to economic record-keeping, written or sphragistic, in its general, dare we say historical, environment. It requires that we look at the very structures of Minoan and Mycenaean economy through time and that we consider whether the changes we are observing in the administrative records correspond to changes in the archaeological record. Naturally this involves us in drawing conclusions and suggesting interpretations about both the general archaeological picture of Minoan and Mycenaean societies and the place of written documents within them. We shall not always be able to keep the evidence for these two subjects separate, because our view of the particular affects our view of the general, and vice versa. Still, encouraged by the range of experts present, and following the original mandate of this conference, I shall ask questions and offer interpretations which I hope will lead to discussion.

Let us start at the beginning : this means the Minoan proto-palatial economic system and its genesis; for Judith Weingarten has correctly emphasized the surprising absence of any evidence, from the pre-palatial period, of sealing use comparable to that of the House of the Tiles at Lerna. She applies this observation with proper emphasis to Vasiliki, certainly an economically complex community, where the earliest practical sphragistic applications of sealings, as markers and protectors of property and storerooms, are surprisingly absent. I would be inclined to give more weight to the lone exception, the Myrtos sealing, simply because it conforms to the type of the practical Phaistos vases 25 sealings, and because it is hard to imagine that the individual who had the impulse to guarantee the integrity of a storage room in one instance would not repeat this process on some other occasion. Nonetheless, even if this singleton were reasonably multiplied, it would not advance us beyond the stage of possibly idiosyncratic and sporadic local practices. There is nothing like the relatively uniform sealing

6 7362 total signs : OLIVIER (*supra* n. 3) 237.

systems that are attested in the the proto-palatial period. Of course, there is no writing *per se* either : even the "Arkhanes" script is confined to hieroglyphic-like characters on seals.

In the MM II period we have our first definite evidence for a functioning system of palatial administration which combines already a wide typological variety of applications of seals for sphragistic purposes with inscribed clay documents in both hieroglyphic script and in the earliest attested form of Linear A. Must we posit antecedents ? I am content with remembering that archaeological periods and sub-periods consist of a good number of years, and that the evidence for any of these temporal increments comes from the end of them. Thus there is sufficient time within the proto-palatial period for these sealing and writing mechanisms to have evolved to their attested levels of sophistication, particularly at the accelerated pace which social and economic changes usually inspire.

Leaving aside the chronologically problematical hieroglyphic deposits from Knossos and Mallia, which are better discussed by specialists like Pini, Poursat, and Olivier, the MM II hieroglyphic texts come from Mallia Quartier Mu : 1 clay bar, 6 thin leaf tablets (and 3 recently discovered fragments) perforated for suspension, 12 medallions likewise perforated, 2 cones—as well as many pot marks conforming to characters of hieroglyphic script ⁷, and from the palace at Phaistos : 1 flat page tablet ⁸ unfortunately of unknown context. Of this tablet (Pl. VIII, top) Olivier remarks that some would like to classify it as a Linear A text. However, the format, the style of the signs, the casual and practically motivated *boustrophedon* on the lower right all declare that it is a hieroglyphic text. The Linear A documents of this period come from Phaistos : from vano 25, where ca. 6500 clay sealings were discovered ⁹, 18 tablets ¹⁰, including at least four flat page tablets (PH 7, 8, 11, 28)—two of which (PH 8a, 11) show ruling—and many thin leaf tablets, very fragmentary, but at least one (PH 9) is perforated for suspension like the 6 Quartier Mu hieroglyphic tablets. There are no clay bars, but we should note that 12 of the tablets are inscribed on recto and verso and 2 of these (PH 12, 13) on the sides as well. A two-thirds proportion of two-sided inscriptions is much greater than the proportion of double-sided Linear A inscriptions in later periods, where, however, the practice is not uncommon. Only in the Linear B period does the recto assume such overwhelming importance that it is normally assiduously prepared, to the neglect of the rarely used verso. I would propose that the tendency toward multi-sided writing, particularly the impulse to use three-sides of the leaf texts, results from the influence of hieroglyphic clay bars and medallions where the practice is frequent. Also from vano 25 at Phaistos come one scellé (PH Wb 36) and five roundels (PH Wc 42-46). We should stress this contextual association of written clay documents, purely impressed clay sealings, and inscribed sealings as our earliest manifestation of the potential for writing and sealing systems to overlap and interact as the complexity of economic activities increased during the creation and growth of the new palaces. Additional Linear A inscriptions come from different, even disputed, phases of the MM II palace at Phaistos :

vano 51 : three scellés (Wb 33-35) and five roundels (Wc 37-41);
 space XXVII : PH 6 found at the bottom of a Kamares style hydria;
 between spaces LIII and LV : PH 25;
 "vano iota" at Hagia Photini : PH 30.

7 *Quartier Mu* I, 40-41, 69-79; FARNOUX and OLIVIER (*supra* n. 3).

8 *SM* I, 148, P. 121.

9 *SSMC* I, 280.

10 This is the final number after joins : F. VANDENABEELE, "La chronologie des documents en linéaire A", *BCH* 109 (1985) 12-15, for which also the discussion of find-spots. *GORILA* 1, 294-315.

What are we to make of this material, certainly complex and hybrid in form and style, relatively terse textually even if we limit our comparison to the Phaistos MM II tablets and the later, normally quite lengthy Linear A tablets from LM I B Hagia Triada, Khania, and Zakro? What is the general context in which it must be interpreted?

Keith Branigan, expanding on arguments by Halstead and O'Shea, has recently advanced forceful arguments for viewing the development of the proto-palatial system as an attempt to achieve a kind of economic social security system¹¹. On a purely regional basis, the early palaces (Knossos, Phaistos, Mallia) functioned both as places for the storage of surplus foodstuffs—witness the koulouras at Phaistos and Knossos—and as organizers and facilitators of the exchange of foodstuffs and other goods—one imagines at first purely essential goods—between various regions. The "strategies and mechanisms to cope with the uncertainty of supply brought about by the localised diversity of Crete's climate and productivity"¹² required the development of the bureaucratic devices and methods necessary to administer them and make them effective. This regional perspective makes very good sense to me in explaining some of the characteristics of economic organization and administration in later periods, even in Mycenaean-controlled LM III Crete¹³. What one should emphasize in the present discussion is that this interpretation places the emphasis in the proto-palatial period heavily on essential economic products. Insuring the steady supply of basic sustenance for the general population becomes, at least at the outset and as a motivating force, the mandate of the earliest palaces. Their primary focus then is a natural expansion of the territorial concerns of a site like EM II Myrtos, whose agricultural economy depended, so far as animal and plant remains indicate, on cultivation of olives, grapes, barley and wheat and the breeding of sheep for wool, milk products and meat¹⁴. It requires a quantum leap in organization simply to build such a regional system to the point of immunity from seasonal fluctuations and disasters.

According to this view, the next phase is reached when the central regional administration converts the system more and more to its own advantage in terms of the use and consumption of raw materials, manpower, manufactured goods, and accelerated social stratification¹⁵. This conversion in Minoan prehistory would be equated with the later stages of the proto-palatial period and the neo-palatial period. We would expect to see here yet another series of responses in the devices and methods of economic record-keeping. These responses would be required by increased demand for the kind of control over the economy necessitated by increases in productivity, by specialization of labor which brings into existence entirely new chains of transactions and levels of bureaucracy, and by economic diversification which, if nothing else, expands the list of raw materials and manufactured products to be monitored. All these developments are materially visible in the monumental architecture, the increase in imported artefacts and costly raw materials, and the Minoanization of the southern Aegean in MM III - LM I¹⁶.

Before we discuss how the evidence of the administrative records of proto- and neo-palatial Crete fits in with this view, we should comment on whether a fundamentally regional

11 K. BRANIGAN, "Social Security and the State in Middle Bronze Age Crete", *Aegaeum* 2 (1988) 11-16, citing P. HALSTEAD, "From Determinism to Uncertainty: Social Storage and the Rise of the Minoan Palace", in A. SHERIDAN and G. BAILEY (eds.), *Economic Archaeology* (1981).

12 BRANIGAN (*supra* n. 11) 13.

13 T.G. PALAIMA, "Inscribed Stirrup Jars and Regionalism in Linear B Crete", *SMEA* 25 (1984) 189-203.

14 Appendices on plant and faunal remains by Jane M. RENFREW, *Myrtos* (*supra* n. 1) 315-320.

15 J. CHERRY, "Generalisation and the Archaeology of the State", in D. GREEN *et al.* (eds.), *Social Organisation and Settlement* (1978) 426-429.

16 See K. BRANIGAN, "Minoan Colonialism", *BSA* 76 (1981) 23-33; and, for a thorough treatment of alternative views of Minoan influence on the greater Aegean and E. Mediterranean world in MM III - LM I, M. MELAS, "Minoans Overseas: Alternative Models of Interpretation", *Aegaeum* 2 (1988) 47-70.

focus in the later period still makes sense. Must all Crete be unified during this period under the central control of the largest palace center, Knossos, in order to explain its relative cultural homogeneity (including the uniform writing and sealing systems of LM I B) and its remarkable impact on the wider Aegean area, especially the intensive Minoan influence visible in the region Manolis Melas calls zone 1, encompassing Keos, Thera, Melos, Kythera, southern Laconia, and Messenia—all places where Minoan writing and sealing practices are manifest directly or indirectly¹⁷? To answer this question in the negative, I would like to call upon two important analogies from the archaic Greek world. First, in regard to the Minoan thalassocracy, whether it has to do with intensive trade contacts, emigration, or the "Versailles effect", one should not forget the tremendous cultural impact wrought by Greek colonization, during the 8th and 7th centuries B.C., an impact felt everywhere in the greater Mediterranean world, from the remote shores of the Euxine or Black Sea in the east to Italy, Sicily and southern France in the west. In an amount of time more limited than that of the Minoan heyday, a handful of politically distinct Greek city-states, led by Chalcis, Eretria and Corinth, brought about a virtual cultural revolution on the shores of the Aegean basin, relying upon the manpower and resources of territories certainly no richer than those of the separate Cretan neo-palatial centers¹⁸.

This first analogy led me to think about another which is directly pertinent to the writing and sealing systems of the neo-palatial period. Might the example of the Greek alphabet be used to argue that only under the control of a single center could so homogeneous a writing and sealing system have been achieved in MM III - LM I Crete or the hieroglyphic script of the proto-palatial period show the uniformity noted by Olivier in this volume? The epichoric archaic scripts do show a considerable diversity that somehow corresponds to the essential independence of the Greek *poleis* within generally defined Hellenic culture. For a time, therefore, I was anxious. Ultimately though I concluded that this second analogy harmonizes very well with the view of regionally focused neo-palatial (and even proto-palatial) centers. We must simply make a few adjustments in our view of the alphabetic evidence. First, the Greek alphabet is a newly borrowed and adapted script in the period of our earliest documentation¹⁹, a period when communities had just been soundly reestablished in Greece²⁰. Moreover, the alphabet had only recently been transmitted among the widely scattered Greek *poleis*, which themselves had had very different histories of formation and differed from one another significantly in their political structures, regional economic resources, and the ethnic

17 See T.G. PALAIMA, "Linear A in the Cyclades : The Trade and Travel of a Script", *TUAS* 7 (1982) 15-22. Weingarten's rather controversial suggestion in her paper in this volume that the neo-palatial island was organized into four administrative districts and functioning centers of control : north (Knossos), south (Hagia Triada), east (Zakro) and west (Khania) does not address the problem of whether any one of these centers had overarching control.

18 See A.J. GRAHAM, "The Colonial Expansion of Greece", *CAH*² III, 3 (1982) 83-162. For an appraisal of the size of settlement of the colonial powers of Eretria and Chalcis, see J.N. COLDSTREAM, *Geometric Greece* (London 1977) 199 and references on p. 378.

19 A comprehensive and, in my opinion, decisive critique of the evidence for the date of introduction of the alphabet is presented by R. WACHTER, "Zur Vorgeschichte des griechischen Alphabets", *Kadmos* 18:1 (1989) 69-76. Wachter demonstrates that the method of formal comparison used by Semitists in arguing for a date as far back as 1100 B.C. is unconvincing because there are no signs in the Greek alphabet which cannot be reasonably explained as deriving from forms of Semitic letters in the period around 800-750 B.C. Since Wachter's conclusions harmonize well with the earliest Greek epigraphical data, it is perverse to claim that such a view is a mere *argumentum ex silentio* and that the Greeks, in a relatively undeveloped and regressive period, adapted and used an alphabetic script for as long as 300 years without leaving a single trace.

20 For this and the preceding period, see COLDSTREAM (*supra* n. 18); and C.G. STARR, *The Economic and Social Growth of Early Greece* (Oxford 1977) 21-78, especially 24-40, 60-76.

composition of their populations ²¹. By contrast, the Linear A script and Minoan sealing systems of the LM I B period are the end products of a four hundred year evolution—independently produced so far as script is concerned—in a restricted and limited geographical area, marked, so far as we can tell, by relatively uniform economic and political development and ethnic composition. Even without political unification, the movement toward overarching cultural homogeneity in Greece of the historical period was such that a uniform script was being used virtually throughout the greater Greek world by the fourth century. The Linear B writing system and Mycenaean sealing systems of the III A:2 to III B period likewise exhibit a uniformity which almost defies what we know of the origins of the Mycenaean centers within their separate palatial territories.

Secondly the diversity we see in the epichoric scripts is confined in actuality to a small percentage of signs : the absence, presence and values of the supplemental signs Φ, X, Ψ ²²; the retention or abandonment of the Semitic equivalents for Greek signs *xi*, *qoppa*, and *san* ²³; the local invention of a few odd shapes, like Corinthian *beta*; and the accidental ambiguities caused by the resemblance of forms for *iota* and *sigma* ²⁴. In fact, these variations can be considered no more significant or problematical than the regional palaeographical differences discernible in both the Linear A and Linear B material ²⁵. And, since Kirchhoff's pioneering investigation, it has been canonical that the epichoric scripts do cluster regionally in groups with similar styles ²⁶. Melos, Thera and Crete form the Southern Aegean group ²⁷. Such is the power of frequent cultural contacts and geographical proximity to produce epigraphical homogeneity. Finally, it should be mentioned that the later Greek colonial powers planted, as *metropoleis*, not only colonies but also versions of their mother-scripts in their colonial regions : the best examples being the Euboean colonies who spread Kirchhoff's red alphabet in southern Italy, and Corcyra which followed the prototype of Corinth so closely that its script is not considered separately by Jeffery ²⁸. Is this not what the Minoans did, although perhaps less directly, in Melos, Thera, and Keos ? Where Minoan influence was fainter, as in Cyprus, the result was a script of a general Aegean linear appearance, but no exact copy ²⁹. All in all I can see no impediments, from my epigraphical perspective, to Branigan's particular vision of the process of evolution of Minoan palatial culture.

Now let us revert to our proto-palatial evidence. The sealing evidence is entirely consistent with the emphasis in this earliest period upon storage of basic commodities and control of that storage. The Phaistos sealings are being used on a very elementary functional level : a small percentage to secure goods like jars or matting, 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

21 Points well and succinctly made by R. SEALEY, *A History of the Greek City-States 700-338 B.C.* (Berkeley 1976) 15-37.

22 Barry B. POWELL, "The Origin of the Puzzling Supplementals", *TAPA* 117 (1987) 1-20.

23 POWELL (*supra* n. 22) 9-10.

24 See Powell's convenient chart of sign variants : POWELL (*supra* n. 22) 19, table III.

25 J.-P. OLIVIER, *Les scribes de Cnossos* (Rome 1967); T.G. PALAIMA, *The Scribes of Pylos* (Rome 1988); A. SACCONI, *Corpus delle iscrizioni in lineare B di Micene* (Rome 1974); *GORILA* 5.

26 A. KIRCHHOFF, *Studien zur Geschichte des griechischen Alphabets*⁴ (1887) Karte.

27 L.H. JEFFERY, *Local Scripts of Archaic Greece* (1961) 308-324.

28 JEFFERY (*supra* n. 27) 114-132.

29 On Cypro-Minoan and its relationship to Minoan-Mycenaean scripts, see T.G. PALAIMA, "Cypro-Minoan Scripts : Problems of Historical Context", in Y. DUHOUX, T.G. PALAIMA and J. BENNET (eds.), *Problems in Decipherment (BCILL 49 1989)* 121-187, and "Ideograms and Supplementals and Regional Interaction among Aegean and Cypriote Scripts", *Minos* 24 (1989) forthcoming.

frequent activities in the storage area³⁰. This is an administrative application of sealings on the most fundamental level. Judith Weingarten, in fact, has stressed the demise of this kind of seal in the neo-palatial period, in which period more sophisticated varieties of nodules appear and flourish. She speculates, I think correctly, that this is a change in emphasis from sealings which prove simply that a storeroom or container is intact to sealings which authenticate and have to do, in some cases demonstrably, with written documents³¹. This trend continues into the Mycenaean period when there remain few examples of sealings used merely for the practical action of closing: I know of sealed stirrup jar mouth stoppers from the House of the Oil Merchant and House of the Wine Merchant at Mycenae, a clay rim seal from the House of the Sphinxes harkening back in type to the *scellé de pithos* from the hieroglyphic deposit in Quartier Mu³², and a Theban stamped clay disk found associated with stoppers and stirrup jars³³.

In the first period access to stored goods and materials was controlled rather primitively. Everyone going in or out had to leave confirmation of his activity, either by means of his own seal impressions—and, of course, the breaking of the preceding sealing—or through the application of the seal of the official overseeing his entrance and exit. As the palatial system grows complex, and the bureaucracy and bureaucratic mechanisms along with it—Weingarten's complex system of nodules and Hallager's transactional roundels fit in here—the very idea of an unauthorized party being able to gain access to an internal storeroom, unattended, becomes absurd. I can describe an analogous progression partly from my own personal experience: from (a) the simply locked house of my childhood in Broadview Hts., Ohio (proto-palatial storeroom of relatively easy access); to (b) the security alarmed and triple locked apartment within a building which itself was protected by double locked doors and a human sentry during my 3 years in Manhattan (neo-palatial storeroom of more remote access); to (c) the elaborately secured and protected White House in Washington, D.C. (Mycenaean storeroom: unauthorized access out of the question), a place where I have never been, but which, with our recent elections, has come closer now than ever to the total ruin which eventually overtook the Mycenaean palaces³⁴.

Branigan remarks of the Middle Minoan proto-palatial period that we cannot expect to find documentary evidence of regional exchange in Crete, dealing with short-falls and surpluses in basic foodstuffs, such as he does cite from the 14th century A.D.³⁵. Certainly we cannot have *verbatim* testimony, because we cannot yet read the hieroglyphic or Linear A script. But we can

30 E. FIANDRA, "A che cosa servivano le cretule di Festòs", *Πεπραγμένα τοῦ Β' Διεθνoῦς Κρητολογικοῦ Συνεδρίου* (1968) 385-391.

31 SSMC I, 281. Whether, as Weingarten suggests in this volume, the sealings and sealing systems of the proto-palatial period are direct borrowings from the Near East and the transition from the proto- to the neo-palatial period represents a radical and conscious disruption in the development of Minoan sealing and administrative practices are certainly debatable points. Hallager in this volume stresses the nearly invariable association of roundels with other written administrative records.

32 B. DETOURNAY, J.-C. POURSAT, F. VANDENABEELE, *Le Quartier Mu II* (*ÉtCrét* XXVI 1980) 199-210, no. 286.

33 T.G. PALAIMA, "Mycenaean Seals and Sealings in Their Economic and Administrative Contexts", in *Tractata Mycenaea*, 257-258.

34 It is surprising that among the many explanations for the demise of Mycenaean palatial civilization, including internal social revolution and general economic breakdown, the hypothesis of leaders ultimately incompetent to direct the complicated Mycenaean economic system and insensitive to the economic and social needs of the Mycenaean underclass has never been advanced. Yet this is merely an extension of the theory which sees signs of dissolution, disorder and division in the social fabric of Mycenaean culture. It assigns responsibility to those in control of the steeply pyramidal systems rather than to any inherent lack of manageability in the systems themselves. Rarely have more obvious contemporary historical parallels presented themselves to the prehistorian than those in American politics in the last decade.

35 BRANIGAN (*supra* n. 11) 13.

look at the contents of the textual material which I surveyed above, determined entirely on the basis of ideograms which do develop clearly from hieroglyphic through Linear A into Linear B :

at Phaistos :

Linear A :

in vano 25 :

tablets : PH 7b.3 (Pl. VIII) (A131c = wine ? ³⁶; amounts on face .b are a single unit and fractional quantities; we should notice that A131c appears before the numerical entry only in line .3, so that it seems that another commodity, or at least another variety of A131c, was listed in the preceding lines); PH 8a (Pl. VIII) (A417^{VAS}, A418^{VAS}, both qualified by adjoined fractional signs perhaps indicating capacity; the numbers inscribed are 7 and 1 respectively; 16 of an indeterminate item precedes A418^{VAS} on line .3); PH 9b (AB131a = VIN; 1 + fractional units; face .a may record a fractional quantity of another commodity); PH 11 (rote tabulation); PH 12a, 15a (AB120 = GRA : on PH 12a [Pl. IX] : 10 + fractional [?] units; PH 15a [Pl. IX] : 11+ units); PH 14a, PH 16a (AB 30 = figs : no numbers preserved). Tablets PH 12b and PH 13 preserve fractional units standing separately, but mostly after breaks.

roundels : Wc 42, 43 (AB131a = wine; without any numerals—but see Wc 41 below which has 1 and a fractional unit).

in vano LI : 3 simple *scellés* and 5 **roundels**, one of which (Wc 41 : Pl. IX) has AB 131a = wine in 1 J units; the other roundels are inscribed with four different sign sequences, two having a cross on the verso; one has character A 320.

between spaces LIII and LV : PH 25 (AB 131 = wine in 2[units).

space XXVIII in the Kamares ware vase : the unusual tablet PH 6 (completely lexical).

Hieroglyphic :

unknown provenience : P.121 (Pl. VIII) : 2 entries of 20-28 units of 4 commodities : GRA (grain), OLE (oil), OLIV (olives), NI (figs).

at Mallia :

Hieroglyphic : extremely simple inscriptions on perforated leaf tablets and medallions; only the large number 7000 surprises on HM 1679 (Pl. IX); and the numbers 270 and 890 on HM 1667.

In all discernible cases in this material, we are dealing with fundamental foodstuffs, or with containers the fractional adjuncts to which indicate that capacity may have been their most crucial characteristic in these contexts. From Phaistos vano 25 the amounts preserved of the commodities wine and wheat are relatively modest ³⁷, as are the number of vases recorded.

36 R. PALMER, *Wine in the Mycenaean Palace Economy* (Ph.D. Diss. Cincinnati 1989) 13-36, examines the development of ideograms pertinent to wine.

37 If the largest Minoan increment of measure in Linear A, i.e., the ideogram itself, had the same value as the equivalent Mycenaean ideogram, then the largest quantity of wheat on these Linear A texts would be

These records then have the appearance of registering single—although perhaps not personal (see the calculation of 1056+(?) liters of wheat in n. 37)—small-scale distributions or collections (we have no way of knowing the direction of the transaction) of vessels and foodstuffs from or to a storage area. Two roundels record wine without any numerical designation. Perhaps the quantity is standard and needs only be recorded when deviating therefrom. Better still is the explanation put forth by Eric Hallager in this volume : the number of impressions on the perimeter of the roundel indicates the number of units involved in the transaction. If Hallager's explanation is correct, then because of their very physical limitations, the use of roundels, particularly in connection with essential commodities like foodstuffs, livestock, implements etc., would necessarily be restricted to transactions at the lower end of the scale, up to 15 units in the neo-palatial period, determined by seal impressions, being so far attested. Of course, I mean the lower end of the relative scale : roundels could not accommodate such amounts as 130, 132.5, 500 or 10,300-10,900 (!)³⁸ units of GRA listed on later Linear B texts from Knossos (E 849, E 850, F 853 + 5947 + 6035, and F 852 + FR VI-100) nor even the 46 to 70 units of a particular kind of olive registered on similar tablets (F 851, F 852 + FR VI-100). The proto-palatial roundels from Phaistos list a maximum of 1 plus a fractional unit of any one commodity : in this case, wine. Unfortunately no neo-palatial roundels list this commodity, but a roundel from Khania does record 6 units of GRA, which as Hallager points out might be a considerable quantity (perhaps 576 liters)³⁹. The sealed nature of the roundel indicates that it may function as the direct authorizing record of the transaction, as opposed to the tablets which may record the results or the expectation of the transactions without directly participating in the process. The *scellés* and roundels from vano LI confirm this pattern of small-scale transactions involving stored commodities. Here again we must cite Wc 41 on which the quantity of wine is designated, perhaps because it has to do with a fractional increment which cannot be expressed by means of the seal impressions on the outer edge of the roundels.

As soon as we turn to the unprovenanced hieroglyphic page-like tablet from Phaistos (Pl. VIII, top), we move up in scale at least of quantity and diversity. Four commodities are listed in two linearly divided entries and the varying amounts recorded of wheat, oil, olives and figs are much larger than those found in the storeroom texts : 20-28 units. Unfortunately again the absolute values in the Minoan system are unknown because Mycenaean Linear B uses a system of fixed sub-unit measures (equivalent to our ounces, pounds, tons; teaspoons, tablespoons, cups, pints, quarts, etc.) whereas the Minoan employs fractional combinations of a whole unit (the aliquot system). Still Ruth Palmer in a forthcoming *Minos* article has convincingly demonstrated that Chadwick's values for the Mycenaean measures of capacity are likely to approximate the truth. The quantity in the Mycenaean system indicated by the commodity ideogram itself is 96 liters. If the Mycenaean system was built for some practical reasons from the top down, but based upon the Minoan standard, we might posit a rough equivalence for the Minoan largest measure. In such a case, the Phaistos hieroglyphic tablet would be dealing with 1920 to 2688 liters of each commodity. This is speculation, pure and simple, but it may give us

1056+(?) liters (PH 15a) and the largest quantity of wine ca. 57.6 liters (PH 25). But see note 39 for extenuating factors.

38 For the new reading of the largest quantity of GRA (at least 98,800 liters), see J. DRIESSEN *et al.*, "107 raccords et quasi-raccords dans CoMIK I et II", *BCH* 112 (1988) 68.

39 We must consider it at least a reasonable hypothesis that, given the pattern of smaller scale transactions on roundels, the 6 units in question here are not equal to the standard Mycenaean GRA quantity, but some other units of measure such as smaller jars (cf. the vases with fractional adjuncts on Linear A tablets : the best example is the clay bar from MM III Mallia : MA 10 [see Pl. XII] in *GORILA* 5, 50-53 and J.-P. OLIVIER, O. PELON, F. VANDENABEELE, "Un nouveau document en linéaire A de Malia", *BCH* 103 [1979] 3-27) or even individual ration allotments.

figures which are not too far from true. Whether the large numbers at Mallia are linked to such foodstuffs or to other items is impossible to say.

We can, however, compare the specific subject interests in the Knossian hieroglyphic material from Evans's *SM I*. Again the focus is on basic agricultural commodities. On plain and functional clay sealings we find : **GRA** : P.50c; P.52c (Pl. IX); P.62c; P.65c; and **OLIV** : P.54c (Pl. IX); P.57b. No numbers are recorded. The commodity signs are simply present along with series of incised hieroglyphic signs. In some cases one finds that even the act of impressing a seal on the sealing is omitted (P.76 and P.77) implying that the very act of closure and writing a labeling inscription was sufficient.

On clay medallions we find : **GRA** : P.82b (3 units) (Pl. X); P.85b (32 units) (Pl. X). **NI (?)** : P.80b (300+) a medallion divided on face .b into two sections each with numerical entry. This same arrangement is found on P.83b with the same hieroglyphic sign-sequence in the left field as on P.80b and a quantity of 426.

On clay bars we find : **NI** : P.112c (Pl. X); P.113b (in both cases followed by fractional signs); **VIN** : P.114 (Pl. X) and perhaps P. 113b, the former with a small numerical entry (2). Other bars have some extremely large numerical entries : P.100 (6400, 20, 300, 40, 2660 on the four faces : Pl. XI); P.101 (170 with the "grain jar" sign; 160, 22); P.103 (80, 42, 20, 80, 50, 1540); P.104b (440?); P. 105 (60, 40, 290, 710); P.109b (1240); etc.

It is safe to say then that the documentary evidence, so far as it makes such matters accessible to us, confirms the view that the role of the protopalatial centers was to control basic economic commodities with a view to insuring the supplies necessary for regional communities to subsist. The storeroom documents from vano 25 at Phaistos have to do with relatively small-scale operations in this immediate environment. This seems especially true of the roundels found therein. With actual tablets at Phaistos and Mallia, we get an indication of the larger scale concerns of the palace administration. The extremely large numbers on the two Mallia tablet inscriptions proves that what we might call macroeconomic activities, reflected convincingly in texts on the clay bars and certain medallions from Knossos, were being conducted. Commodities and materials, perhaps even individuals, were being dealt with in bulk, whether the dealing had to do with shipment, supplies, storage, or even production estimates.

In the neopalatial period we begin to get the greater typological variety and patterns of application of sealings and evidence for sophisticated intra- and perhaps inter-regional communication via ephemeral documents to which sealings were attached. This is a natural response to the complicated relationships among sites of various levels, traditionally called palaces, towns, villas, country houses, in the Cretan economic system. We have literally a proliferation of the data that need to be recorded. Weingarten's multiple sealing system (MSS) at Zakro is no doubt the illiterate—and I use the word without its modern pejorative connotations—administrative response, reflecting more elaborate controls used to authenticate economic activities. At the same time the Minoans eventually arrive at a greater sophistication in written documents, especially in terms of formatting and arrangement. I say eventually because a MM III document like MA 10 (Pl. XII), written in Linear A, but on a carefully manufactured clay bar of hieroglyphic type, indicates how the hieroglyphic document types would have resisted their inevitable extinction. By the LM I B period, clay bars, pierced thin leaf tablets, and clay medallions have been replaced. The clay bar (inspired one may suppose by the shapes of four-sided hieroglyphic seals) disappeared, undoubtedly because the amount of information and number of entries now required by the day-to-day economic system revealed its inefficiency both for recording and for subsequently storing and accessing information. The sort of information found on both the bars and the medallions (recall the extremely large quantities found on texts of these classes at Knossos) may have been transferred to tablets or even to ephemeral documents of the kind to which certain nodules were attached.

I have dealt with the contemporary development in neo-palatial textual formatting and recording procedures in great detail in the *Studies Bennett* ⁴⁰, and I have no intention of repeating myself here. I would like to stress, however, that this development in the graphic and archival system is a necessary response to these further complications in palatial economic activities. No longer are the written documents confined to simple and limited entries of fundamental economic items, although even a look at the *GORILA* tables of Linear A signs will indicate that the ideographic focus is still primarily on basic agricultural commodities. There are long lexically dominated lists without ideograms (HT 122a : Pl. XIII) while the lists with ideograms have multiple entries, mixtures of commodities, and various amounts of commodities. It is not too daring to say that with texts like HT 115a and b (Pl. XIII), HT 116 and HT 117, we have reached a level of economic transaction that will now be maintained in palatial economic life both in Crete and on the mainland until the end of the Bronze Age.

On HT 115 there are at least 13 different entries and at least four different quantities of AB120 GRA recorded on the two sides of the tablet—the number of different quantities increases to six, if we assume that the fractional signs which are adjoined to AB120 in the ideographic headings on each side of the tablet define a different standard amount, multiples of which the numbers and fractions associated with each entry then stipulate. Tablet HT 116 records 100 units of GRA, 17 of OLE, 5 of OLIV, and 15 of another undoubtedly agricultural commodity (sign A 304). The first two commodities (GRA and OLE) and A 304 are actually totalled on the verso. The GRA is listed in six separate quantities ranging from GRA 5 to GRA 40, and the OLE in five separate quantities (OLE 1 to OLE 6) with three different phonetic adjuncts. The grand total for GRA is fairly large : ca. 9600 liters or over 2/3 ton, and the entries are listed against six individual sign groups (one a ligature). The tablet heading consists of one sign group and a single "transactional" sign. Tablet HT 117a lists 15 different word groups followed by the number 1. It is similar to the lists of personnel found in Linear B texts. These three tablets alone attest to the range of daily economic concerns of an LM I B regional center : large scale agricultural production reflected in a document which has reference to six different entities, whether individuals, groups of persons, institutions or toponyms (HT 116) ⁴¹; smaller scale transactions concerning agricultural produce—the most obvious parallels in Linear B tablets for such amounts would be rations or offerings—and at least 11 entries with different sign groups (HT 115); and a possible list of personnel (HT 117). I think in fact that the necessity to record numerous place names, personal names, qualifications of products, and the subtler distinctions of economic vocabulary was a major factor in Cretan hieroglyphic giving way to Linear A. Certainly the status of the linear script increased tremendously and whatever messages used to be imparted by impressions of sign sequences from seals were now easily taken care of by a few quickly inscribed linear signs. The complexity of the economic entries in

40 T.G. PALAIMA, "The Development of the Mycenaean Writing System", in J.-P. OLIVIER and T.G. PALAIMA (eds.), *Texts, Tablets and Scribes : Studies in Mycenaean Epigraphy and Economy Offered to Emmett L. Bennett, Jr.* (Minos Suppl. 10 : Salamanca 1988) especially 309-317.

41 We can rule out the possibility that the sign groups simply modify the commodities, particularly GRA, since that would have been done by means of ligatures or adjuncts. We should also keep in mind that Hagia Triada might be the important regional site of *da-wo* in the Linear B tablets which is clearly attested as a major agricultural center : J. BENNETT, "The Structure of the Linear B Administration at Knossos", *AJA* 89 (1985) 247. A convenient summary of the economic concerns of *da-wo* in the Linear B tablets can be found in J.K. McARTHUR, "A Tentative Lexicon of Mycenaean Place-Names", *Minos* 19 (1985) Anexo 23-25. These include: significant numbers of herdsmen and flocks of sheep; worker oxen; raw wool; female cloth workers; textiles; enormous quantities of grains and other foodstuffs; saffron; and the aromatic *pistacia terebinthus*. The archaeological evidence confirms the switch from Phaistos to Hagia Triada in the Minoan neo-palatial period. See especially F. CARINCI, "The 'III Fase Protopalaziale' at Phaistos. Some Observations", in R. LAFFINEUR (ed.), *Transition. Le monde égéen du bronze moyen au Bronze récent. Aegaeum* 3 (1989) 79-80.

the large archives of Linear A tablets and nodules at LM I B Hagia Triada fits what we now know of the shift of focus in this area away from Phaistos to Hagia Triada in the neo-palatial period. Hagia Triada is a major economic center in the Linear B tablets from Knossos (= *da-wo* according to Bennet's identification, cf. n. 41) and undoubtedly organized the wool and cloth production industry of the Mesara, and supplied workers in this region with grain and other rations, in the Minoan period as well (see the possible ideogram TELA on the roundel HT Wc 3019 and the same TELA ideogram with ligatures on tablet HT 38).

So far as inscriptional evidence and sealing use is concerned, we can trace some interesting patterns. Roundels really come into their own in LM I B, the height of Minoan neopalatial economy; 141 are known from this period. They are closely associated with tablets and nodules at Zakro, Hagia Triada and Khania⁴². Of the 93 legible KH roundels, the inscriptions—almost always on a single side—consist primarily of single ideograms (perhaps as many as 14 different ones : those which are identifiable being the tripod (19x : e.g., KH Wc 2012 : Pl. XIV), ligatured person ideogram (6x : A 568 = AB 100/102 + AB 77 [ka] : e.g., KH Wc 2030 : Pl. XIV), and a basket or conical vessel (2x : e.g., KH Wc 2006 : Pl. XIV). 9 have single potentially phonetic signs inscribed. One (KH Wc 2100) has a 3-sign phonetic sequence. By contrast, of the 21 complete Hagia Triada roundels, 12 are inscribed on both faces, 2 on the edge (in both cases with single fractional signs), and the inscriptions consist of sequences of up to 5 phonetic characters. The Gournia roundel (GO Wc 1 [LM I A] : Pl. XIV) has 6 characters incised in three rows on face .a and the character AB 23^m, later the Mycenaean ideogram for male ox, incised with the number 5 on the verso. Livestock references are relative rarities in the Linear A texts, and absolutely undetectable in the hieroglyphic texts. This perhaps reflects the fact that the methods for managing distant and scattered flocks in this period were not as highly centralized as in the later Mycenaean period, and might have relied on traditional forms of control, such as seals and sealings, operating at local and regional centers to document such relationships as existed between owners and shepherds or other herdsmen. The Zakro roundel Wc 2 likewise has two lines of lexical information, but no clear ideographic entry. It was found, like Weingarten's 525 nodules and a single Linear A tablet in house A, Room VII. The tablet shows again the focus on agricultural produce, here in bulk : 42 and a fraction units of figs (over 4000 liters), 47 units of wheat (over 4500 liters), again assuming conversion according to Mycenaean conventions and amounts. The nodules were found 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. It is interesting to note that this house on the outskirts of the palace has such important evidence for sophisticated sealing transactions as well as written documentation for fairly large-scale agricultural concerns⁴³. Might the two be linked ? The Zakro nodules, of Weingarten's

42 Zakro : roundel Wc 2 and tablet ZA 1 both from House A, Room 7, SW border, in deposits ("tombés de l'étage") of sealings. Hagia Triada : roundels Wc 3002, 3005, 3007, 3009, 3010 and tablets HT 1-5 from the central part of the villa (L. PERNIER and L. BANTI, *Guida degli scavi italiani in Creta* [Rome 1947] spaces 4, 12-14)—these roundels share Levi seal imprint 31 with roundels Wc 3001, 3003, 3004, 3006, 3008, 3011, 3012 from the SW angle of hall 13 (= SE angle of portico 11), where other roundels, some 700 inscribed nodules and 15 or so tablets also were found. Khania : most roundels from Odos Katré where tablets KH 5 ff. and nodules Wa 1001 ff. also were found. See now HALLAGER in this volume for further information and references.

43 The quantities on tablet ZA 1 are large enough to refute those who, despite production surveys of Crete in relatively recent times, wish to see Zakro as a site deprived of any agricultural hinterland and totally dependent on trade in important foreign raw materials and luxury goods. We should note that figs and wheat occur as the two principal food items on Linear B ration texts (cf. Pylos Aa and Ab series) and that, again assuming values equivalent to those in Linear B (cf. nn. 37 and 39), the amounts listed on this *single* Linear A tablet from *one* room of House A are enough to sustain a force of over 200 working women for a

complex MSS, are all uninscribed and hint at the way in which established economic relationships may have been maintained on a regular basis, written records coming into play only periodically or for larger-scale items.

Nodules elsewhere have inscriptions. It is equally interesting to observe that these inscriptions are minimalist. Among the nearly 900 inscribed nodules at Khania and Hagia Triada, so far as I know, all bearing single seal impressions, a single incised countermark sign is the rule. Only six nodules, all at Khania, bear as many as 4 signs. A small percentage bear two signs. Of the entire total, only 11 contain even potentially ideographic characters (KH 1003-1112; HT Wa <1021 bis>—these are unfortunately of unknown meaning—and 4 have fractional signs (HT Wa 1020-1021; 1023-1024). The mystery then is what the repetitive (11 signs are used to mark all but 17 of the 854 legible HT inscribed nodules) and simple single signs of the phonetic signary represent. Are they substitutes for the second seal impressions in the Zakro MSS? Do they stand as phonetic abbreviations and substitutes for ideograms, as one finds well-attested in Linear B documents? There are undoubtedly other suitable hypotheses.

The transition to Mycenaean administration, the documentation of which is available on the mainland after a 200-250 year gap and on Crete at Knossos after a gap of at least 75-100 years⁴⁴, brings about a radical transformation in typology and methods of written administration. Again I have dealt with this aspect of the Cretan evidence in fuller detail elsewhere⁴⁵. To be brief: in the Mycenaean period we have different forms of records and sealing devices. There are no roundels. There are no inscribed *scellés*, and in fact, as we mentioned above, merely sealed molded clay closing pieces are nearly non-existent, although Weingarten has recently detected several more from LM III Knossos⁴⁶. Among the nodules, Weingarten's most typical Minoan forms Class VI types A and B are the only ones in prevalent use on the mainland, although again Weingarten has noticed some interesting survivals of forms resembling the related Class VIII at Knossos and the creation, perhaps for expediency, of a shape called molars, which were nodules pressed directly over stout cords or reed bundles⁴⁷. She has also identified 2 kinds of hybrid—or dare we call them, with a direct view to the Knossian dating controversy—intermediate experiments: Class VI nodules and molars which were pressed against wickerwork and wood respectively⁴⁸.

The inscribed nodules are no longer merely phonetically countermarked. Instead they contain often an ideographic countermark over the seal impression—this differs too from the Linear A nodules where the seal impression is generally not marred by the inscription which is placed elsewhere on the sealing—and then a supplementary text on one or two of the other faces furnishing fuller information. The apex of such a development is reached among the Thebes sealings (see Aravantinos in this volume). On them information is written about the nature of the transactions taking place: technical economic vocabulary stipulating the nature of

month. For the items found in Rooms VII-VIII, see D.G. HOGARTH, "Excavations at Zakro, Crete", *BSA* 7 (1900-1901) 131-133.

44 The Linear B material from mainland Greece is all LH III B:1-2. For a recent discursive essay on the broader implications of the dating of the Knossos tablets, see M. POPHAM, "The Historical Implications of the Linear B Archive at Knossos Dating to Either c. 1400 BC or 1200 BC", *Cretan Studies* 1 (1988) 217-227. I accept, without immutable conviction, the LM III A:1 to early III A:2 date. See PALAIMA (*supra* n. 40) 274-275 for discussion and bibliography.

45 T.G. PALAIMA, "Preliminary Comparative Textual Evidence for Palatial Control of Economic Activity in Minoan and Mycenaean Crete", in R. HÄGG and N. MARINATOS (eds.), *The Function of the Minoan Palaces* (Stockholm 1987) 301-306.

46 *SSMC* II, 6.

47 *SSMC* II, 6-7.

48 *SSMC* II, 6-7. The sealing material from the Room of the Chariot Tablets also seems to mix earlier and later features to such a degree that WEINGARTEN, *SSMC* II, 10-11, would like to see them as LM II or early LM III A:1.

obligations connecting the palace center with individuals or communities (*o-pa*, *qe-te-o*, *a-pu-do-ke*); personal and place names, the latter sometimes in the allative form (e.g., *te-qa-de*); qualifiers of the articles or commodities which form the subjects of the transactions; references even to religious institutions. Here we have another illustration of the hazards of discovery (cf. the debate about the site of Lerna and the antecedents to the Minoan proto-palatial administrative and sealing systems). For, to maintain a balanced view, we see in many sealings from other sites a much simpler level of information. Among the 23 Pylos inscribed sealings are the following minimal texts: Wr 1329 merely the number "20"; Wr 1330 and 1333 simply the economic term *o-pa*; Wr 1331, 1332, 1457 economic terms *o-pa* and *a-pu-do-si* in conjunction with ideograms for male sheep (or wethers) and hides (represented alternatively by ideogram and phonetic abbreviation). One wonders how all the fuller important information of the Thebes sealings was kept track of in the neo- and proto-palatial periods, and even how the subjects pertinent to the merely countermarked nodules were known.

In the mainland Mycenaean palace period, the very number of nodules found at any site is also much reduced. For example, ca. 150 nodules (23 inscribed) were found at the major Messenian center of Pylos, a fully functioning Mycenaean palace of the latest phase of administrative evolution. The palace of Pylos was destroyed throughout its extent by an intensive fire which would have preserved almost all such clay objects. Moreover the palace underwent no subsequent rebuilding of the kind which destroyed evidence at the constantly reoccupied major Cretan palace sites (see Wiener closing commentary). Contrast the ca. 1043 nodules (861 countermarked) from Hagia Triada and the 525 nodules from Zakro House A. Is this extreme difference determined by differences in the types of sites excavated or by the overall systems in operation in these different periods and locations? The Linear B tablets show the great expansion of information referred to at the outset. The page-shaped tablet (e.g., Ep 704: Pl. XV) with sophisticated linear format is ideally suited to holding much larger amounts of data. The clay label (e.g., Wa 114: Pl. XV) is invented to help in transporting or filing coherent sets of records. It has wicker marks on its verso. One wonders whether Weingarten's 11 Class XII type A nodules⁴⁹ from various areas of the palace of Knossos might not have had a similar function in a transitional period or in non-archival settings when or where information about the parties responsible for particular baskets of records would have been required and given by means of a seal impression.

There is probably no single clean and simple answer. The sealings from the Palace of Nestor proper come mainly from areas and rooms of the palace building associated with work or storage activities of the kind which would have involved regular transactions: e.g., deliveries or withdrawals from oil storage rooms 24 and 32. Otherwise most of the sealings come from separate industrial or large-scale storage buildings in the immediate excavated vicinity of the palace: the Northeast Workshop and the Wine Magazine. The inscribed sealings refer to raw materials for leatherworking and wine in these respective buildings⁵⁰. It is possible then that if more of the town settlement at Pylos were excavated, we would find caches of sealings equivalent to: the multiple-sealed nodules associated with agricultural implements at the entrance to a storage room in House A at Zakro; the livestock sealings from the nine square meter industrial (leather working?) storage or work room in a narrow rectangular building close to the fortification walls—and, one would think, well removed from the central palace area—at Thebes⁵¹; the sealings connected with pottery shipments clustered in Room 1 of the House of the Sphinxes outside of the walls of the citadel at Mycenae; and even the single sealing inscribed

49 Tabulated from *SSMC* II, 18-25.

50 For the Pylos sealings, see *PALAIMA* (*supra* n. 25) 141-169, 179, and *PALAIMA* (*supra* n. 33) 261-262.

51 V. ARAVANTINOS, "The Use of Seals in the Administration of Mycenaean Palaces", *PCA*, 47.

with ideogram *190 from the Citadel House within these same walls, but quite apart from the palace halls ⁵².

On the other hand, it is equally possible that the mainland finds give us a true picture of a highly evolved literate administration—at palace centers at least—that has come, by the final stages of Aegean palatial culture, to rely less and less on the ancillary seals and sealing systems to control and organize economic transactions. Almost any economic information considered worth knowing by the authorities of the principal mainland palace centers might have been closely monitored by central or locally based officials (e.g., persons holding the title of *e-qe-ta*, *ko-re-te*, *po-ro-ko-re-te*, or *qa-si-re-u* ⁵³, or having the status of "collector") and eventually recorded on clay tablets. This would be one way of explaining the tremendous proliferation of written information at these sites in the LH III B period.

I have intentionally avoided discussing the place of Mycenaean Knossos in this picture. Weingarten has made clear that, in terms of sealing practices, the evidence from the destruction level of the Palace of Minos shows similarities to both the earlier evidence from Minoan Phaistos and the later mainland evidence (reduction in number of sealing shapes; non-intensive pattern of seal use) ⁵⁴. The spread of sealings and written administrative records throughout almost all areas of the palace center at Knossos also stands in contrast to the later mainland evidence, at least the fullest evidence available, that from Mycenaean Pylos ⁵⁵. If one also takes into account the peculiar "transitional" Class XII sealings from Knossos, an argument could be made that the evidence from Knossos at the time of its destruction is chronologically transitional *in toto*, not simply in the Room of the Chariot Tablets which has mixed features compatible with an LM II or LM III A:1 date ⁵⁶. This would support the limited palaeographical clues for placing the Linear B material from Knossos earlier than the mainland evidence ⁵⁷.

However, many of the peculiar features of Mycenaean administration at Knossos may also be attributable purely to regional factors, i.e., to the special circumstances involved in imposing Mycenaean control on an originally Minoan population and economic system, as opposed to the organic development of systems of administration in the Mycenaean populated regions of the Greek mainland. There is also the matter of scale. If, as Weingarten astutely observes, the quantity 10,000+ used to record ca. 100,000 liters of grain at the site of *da-wo* (= Hagia Triada) for the Mycenaean administrators at Knossos is unattested in Linear A ⁵⁸, it is also unattested at the mainland Mycenaean centers, where the largest number is still the assessment of 1239 units of flax (which, along with an authorized concession of 457 units, gives a total projection of 1696 units) from the Hither Province of Messenia ⁵⁹. My point is that the Mycenaeans at Knossos were monitoring economic activities over a greater geographical area, regional industries of greater complexity, and goods, materials and personnel in greater quantities than any of the mainland palaces. This must certainly have necessitated adjustments in

52 PALAIMA (*supra* n. 33) 261; ARAVANTINOS (*supra* n. 51) 46.

53 For discussion of these terms, see M. LINDGREN, *The People of Pylos II* (Uppsala 1973) 46-48, 84-86, 122-123, 126-130.

54 SSMC II, 1, 13-14.

55 PALAIMA (*supra* n. 33) 262-264.

56 SSMC II, 10-11. See now the full treatment of all the finds, including the sealings, from the Room of the Chariot Tablets in J.M. DRIESSEN, *The Room of the Chariot Tablets at Knossos. Interdisciplinary Approach to the Study of a Linear B Deposit* (Diss. Katholieke Universiteit Leuven 1989) I, 32-36. Most significant is the discovery, for the first time, of flat-based leather-pocket sealings in conjunction with Linear B tablets.

57 PALAIMA (*supra* n. 25) 111-113, 171-172, and "Evidence for the Influence of the Knossian Graphic Tradition at Pylos", *Concilium Eirene XVI. Proceedings of the 16th International Eirene Congress, Prague, 31.8-4.9 1982* (Prague 1983) 80-84, plates I-II.

58 SSMC II, 16 n. 15. It is dangerous to conclude from this—even taking the sealing evidence into account—that Hagia Triada was operating merely as an estate-based system in LM I B (SSMC II, 12-13). For some counter-arguments, see PALAIMA (*supra* n. 40) 327 n. 83.

59 Tablet Ng 319. For general discussion of documents of this kind, see *Docs*², 298-301.

procedures and methods of organization and record-keeping. As a sober reminder of the hazards of discovery, we should recall that at Knossos and Phaistos, individual Cretan hieroglyphic documents recorded totals of over 9400 (KN P.100) and 7000 (PH HM 1679) items respectively.

If we place the development of Linear B in LH II and the destruction of the Palace of Minos in LM III A:2, which I think best fits the available palaeographical, archival and historical evidence ⁶⁰, then Knossos would become the ultimate focus of this entire paper and I would hope of future research. It might have been the place where Mycenaean administrative systems *originated* under Minoan tutelage. It certainly is the place where the Linear B script and sealing system would have been forced to *develop* rapidly under the pressures of controlling large subject territories. It is definitely a point of *transition*, at least in a typological, if not a chronological sense, for both written and sealing administration. Finally, its administrative practices are *transformed* into those attested at the mainland centers at the end of LH III B.

Continuing work on the sealings from Knossos, on the information of the Knossos Linear B records and their general archaeological setting, on the palaeography and find-contexts of the Knossos tablets, and one hopes eventually on the prosopography of the Knossos texts—a glaring lacuna in Linear B scholarship—should enable us to form a clearer picture of this critical juncture in Aegean record-keeping administration.

Thomas G. PALAIMA

60 PALAIMA (*supra* n. 40) 331-342. Summary in *BICS* 35 (1988) 166-167.

Response by Jean-Pierre OLIVIER

The title of this paper is a challenge by itself : to cope with its subject, covering the whole field of our studies, would require at least a whole book.

His dictis, I agree with most of the general ideas expressed by Tom Palaima :

— even if not strictly readable, the economic documents written in the hieroglyphic and Linear A scripts can be compared with the Linear B ones in order to give us some idea of the transactions (both their specific nature and the very volume of transactions), given the fact that some ideograms are the same and that the numbers are readable (even if it is not always possible to establish the exact quantities involved);

— the “evolution” of the supports of the script through time gives us good clues to look for their origins in the economic changes of the Minoan society; the more or less parallel changes in the use of seals and sealings is certainly an indication that we are on the right track. The problems lie in the exact relationship between these two techniques of administration, the “sealed” one and the “written” one. And this is true from the *very beginning* of Minoan times.

Of course, it is impossible to uphold, as L. Godart did some years ago ¹, that the hieroglyphic script was transferred from the seals to the clay by “les artistes qui écrivent l'hieroglyphique sur les sceaux [et] éprouvent à leur tour le besoin d'écrire des documents comptables” : these seal-makers (who were probably illiterate!), were certainly not at the head of so important a business that they needed a special kind of bookkeeping for their own use!

But it is obviously true that there is some fundamental relationship between the hieroglyphic carved on seals and the hieroglyphic written on clay archives, not only at the level of the *script* itself (which is the same) or at the level of at least some of its *sign-groups* (this is the subject of my own paper), but also at the level of the *supports themselves*, even if the material (stone and clay) is entirely different. Tom Palaima supposes that the clay bar was inspired by the shapes of the four-sided hieroglyphic seals and he is perhaps not wrong. Personally, I am still more struck by the analogy with the three-sided prismatic bars. These are very rare : only one at Knossos [P.119] and only one at Mallia [L.2] ²) which are really not functional at all but strongly resemble, of course, the extremely frequent shape no. 22 of P. Yule ³ “the three-sided prisms”, the largest class of early Cretan seals ⁴.

These two supports were destined for extinction, given the level of sophistication (thus of writing space) required by the late Minoan and the Mycenaean administrations (perhaps not for the same reasons, but this is not at issue here).

1 In H. VAN EFFENTERRE, *Le palais de Mallia et la cité minoenne* II (1980) 598.

2 At Mallia the inscription is obviously in linear A; at Knossos we must admit *we do not know* : there are ideograms (‘animal hides’ ?) on the bar, which are exactly the same as on the linear A tablets MA 4 and MA 6 : a fact which is really puzzling ! Whatever the solution, this kind of support can only be a very rare survival.

3 P. YULE, *Early Cretan Seals : A Study of Chronology* (Mainz 1980) 66-69.

4 459 out of a total of 2173; the four-sided prisms are far less numerous (43 all together, but 18 of the 27 made from hard stone bear signs of the hieroglyphic script : YULE [*supra* n. 3] 65-66).

But no kind of registration (by means of seal[ing]s and/or written archives) can be properly understood if the whole history of Cretan administration (examined through the extremely poor remains which we have, unfortunately) is not—at every moment—taken into consideration, both under its diachronic and under its practical aspect.

And this was obviously the main aim of Palaima's paper, and I think he made the things very clear.

Discussion

Blasingham :

A cautionary comment about using the House of the Tiles at Lerna as a standard for seals and sealings in the rest of the Early Bronze Age Aegean. While the House of the Tiles may not be unique architecturally, the sealing deposit is anomalous. Thus it is not very sound to use the deposit from the House of the Tiles as a standard. We certainly cannot dismiss the evidence from the House of the Tiles, but it is perhaps wiser to treat it as a unique instance until we have more data about sealing use from the rest of the Aegean.

Kopcke :

On Crete we have a rather large number of seals in EM II from the Mesara and also from Arkhanes. Both these regions are economically very active in this period. I personally would suggest that we not concentrate exclusively on sealings, but also consider the presence of seals, because they are important and perhaps equivalent evidence for the procedures of economic organization. By accidents of preservation, we may have sealings in one place, seals in another place. Seals and sealings should not be separated *a priori*.

Blasingham :

But one problem is that we cannot be sure that the seals from the Mesara and those from Arkhanes were used in precisely the same way as the sealings from the House of the Tiles. I would not treat the Lerna sealings and the Cretan seals as equivalent evidence.

Palaima :

No one is proposing that the House of the Tiles should be used as a standard model for interpretation. It now stands as an exceptional occurrence that leaves in question whether other idiosyncratic experiments could have been taking place simultaneously and what kind of economic conditions brought this particular use of sealings into existence. We do not have any parallels. The House of the Tiles raises the possibility that, under similar economic conditions, something comparable might have developed elsewhere.

Pini :

I just want to add that we have widespread evidence of seals during this early period from almost everywhere on the mainland, not exclusively from the Argolid : from Corinth, from Akovitika in the southern Peloponnese, and even now a group of unpublished sealings from a cave on a Cycladic island.

Younger :

Yes, and the connection of this material with the Cretan material is very clear.

Shelmerdine :

Can I ask whether the Akovitika material is from one of the two houses ?

Pini :

I have never seen it unfortunately because the local museum suffered heavily from the recent earthquake.

Shelmerdine :

So this might provide us with another example of a sealing associated with buildings very much like the House of the Tiles. That would be important.

Younger :

One last comment on the tenuous nature of our evidence. In the early 70's a notice appeared in the Greek newspaper *Kathemerini* about the discovery of an EH house "of the House of the Tiles type" filled with sealings. None of this material was ever published. But these sealings from the mainland, which I think are now stored inaccessibly in the Brauron Museum, might prove that the House of the Tiles is not anomalous.

Magness-Gardiner :

I know little about how the Aegean system works, but it seems to me that in the earliest part of the Minoan sealing system there are, just as in the Near East, both primary documents and secondary documents. Can you trace the transaction that is produced on a medallion to a secondary document ?

Palaima :

My instinct, formed by projecting practices that are clear from the Mycenaean period back into the Minoan period *mutatis mutandis*, is that there was a sort of two- or even three-tiered system. In the Mycenaean period, the sealings themselves functioned as authorizing devices involved in actual transactions. Leaf-shaped tablets were then used to record individual items and individual transactions of direct concern to the record-keeping administration. The information they record might be derived directly from the participants in the transactions or secondarily from the minimalistic information provided by sealings. The sealings, if inscribed, might be considered primary documents. The leaf-shaped tablets could be classified as primary or secondary documents, depending on the means by which they acquired their information. Page-shaped tablets, which are generally stored in central archives, represent a third tier, since they can be used to compile and summarize the information stored on leaf-shaped tablets for further administrative purposes. This is a simple explanation of the structure of Mycenaean record-keeping based on typology and function. But the earlier Minoan hieroglyphic and Linear A material has a much greater typological variety. At Zakro there is not only a much more complicated multiple sealing system, but also a tablet in House A that gives fairly large quantities of agricultural commodities (figs and grain) on its recto and verso.

Magness-Gardiner :

It seems that the Minoans are compiling this material for some purpose.

Palaima :

In the Linear B period, there are sealings that are obviously being used in workshops and storerooms. In the Linear A period, we have large collections in clusters and groups at Hagia Triada, Zakro and Khania. But the typological variety in the Minoan sealings is something Weingarten should discuss in connection with their literate reflex. I think we must study the literate devices and the illiterate devices in relation to one another—and I use the word "illiterate" with no pejorative connotations. For the different kinds of tablets, medallions, roundels, inscribed and uninscribed sealings are all working, together or independently, within the same overall systems.

Magness-Gardiner :

In the Near East at the outset, seals dominate as items that indicate individual or corporate accountability. This function diminishes over time. For example, seals are used less and less on closures until in the end they virtually disappear, at least in Syria, where we have none from the later period. Seals are used mostly in a legal context rather than in an administrative context, because writing has changed this aspect of accountability. Now, as far as I can see, the quality of the information on Minoan hieroglyphic and even Linear A tablets is not so complex that you could actually identify the responsible individual on these tablets or seals ?

Palaima :

By the time of developed Linear A, there are longer lists, but they are very bare-boned : headings of three to four words which are followed by single lexical items, ideograms and numbers in various combinations. These lexical items are undoubtedly something like the personal or place names found in similar positions in the later Linear B texts. But they might in some cases be qualifiers of the commodity listed up in the heading. I think that when this increase in the number and complexity of economic transactions took place, the hieroglyphic script was not flexible enough to accommodate it. Take, for example, the phonetic recording of strange personal names and technical vocabulary. The Minoans were coming into greater contact with foreigners and experiencing an influx of foreign goods, materials and undoubtedly techniques and skills. Similarly in the Mycenaean texts we can identify some Hittite names, some Semitic names and loan words, and, especially on the Knossos tablets, a good number of non-Greek names that are probably Minoan. Writing systems must adapt to represent these items.

Magness-Gardiner :

It seems to me that the very earliest phase of the Minoan system required information rather than accountability. For example, the administrators wanted to know what goods were coming in over the course of a specific period so that they could be distributed properly. This does not require that individuals be accountable for such materials. In the later phases of Minoan and Mycenaean administration with their more complex and hierarchical systems of recording, it seems that individuals were accountable.

Palaima :

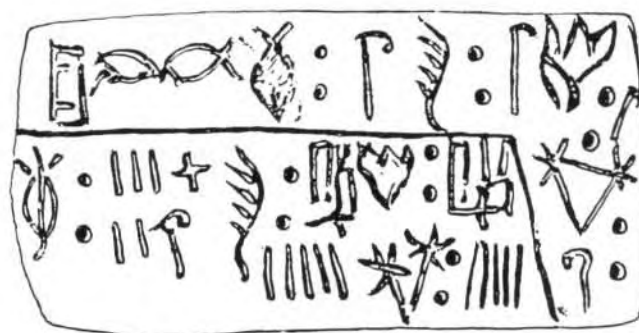
It is my guess that personal accountability is important at all stages, but that in the more primitive stages accountability was maintained by traditional relationships and procedures which did not require actual recording of names on tablets. Simple seal impressions and mere commodity lists sufficed at the hieroglyphic stage. With the growing sophistication of Minoan society and economy, the central authorities were faced with an overwhelming increase in the number of individuals involved in transactions at all levels, with a greater range of transactions, and with different degrees of responsibility and accountability. These economic and social changes are reflected in the increased sophistication of the documents, written and sealed. But, so far as we know, the Minoans and Mycenaeans never reached the stage of needing sealed legal documents to validate transactual relationships.

J. Davis :

I have a few remarks on patterns of settlement in the Argolid and Corinthia which may be relevant here. Palaima has tried to look at the material evidence for reasons for the emergence of more complicated systems for processing information, especially the new-palace expansion of the settlement, the country-house phenomenon on Crete, and so on. On the mainland in the southern Corinthia and the northern Argolid, right around Mycenae, three archaeological field projects are now concerned with documenting the history of settlement for these areas : one at Nemea (J. Davis, Cherry, Mantzourani and Wright), one at Berbati and Limnes (Wells, Runnels and Zangger), and one in the Argive plain itself (Weishaar and Kilian). Here we observe some common patterns. First, within the MH period, settlements seem to have been highly centralized. There are very few settlements, and those that exist are large and very compact. We have not found in the MH period smaller settlements dispersed from these larger settlements. This pattern holds true until the very end of the MH period when we begin to find a dispersion of settlement, but settlement continues to be by villages, and villages of some size. I put into this category places like Tzoungiza or Zygyouries or Phlious. These all seem to be new foundations.

But something else happened, which may bear upon some of the arguments that Palaima developed in his *Studies Bennett* paper where it was urged that we "focus on the mainland

centers and try to determine when their activities would have reached the point when their administrators could no longer function or function effectively without the assistance of written records". During the transition between LH II and LH III A:1, another tier in the settlement hierarchy begins to form beneath these villages. The landscape begins to fill out with smaller and smaller settlements, some of which must be mere clusters of several families, if that. The period LH II/III A:1 then witnesses the dispersion of far more agricultural production units in rural settings. It might be argued that such dispersion reflects attempts to increase agricultural production by the foundation of smaller (and perhaps subsidiary) habitations. But the dispersion of many more production units within a given territory under the control of a center like Mycenae might have required in and of itself much more bureaucratic refinement just to negotiate and regulate normal activities. In the typical Early and Middle Bronze Age settlement, virtually everyone would have been living together. It would have been much easier to regulate economic activities in a community of that sort. By LH III A:2/III B:1 decentralization of residence would have made centralized control by an elite more difficult. Did it also ultimately promote the creation of more systematic central bureaucracies (and thus administrative complexity of the sort represented by the practice of sealing and the use of Linear B) ?



P. 121

P.121 : Hieroglyphic Tablet from Phaistos: commodity signs for grain, oil, olives, figs.

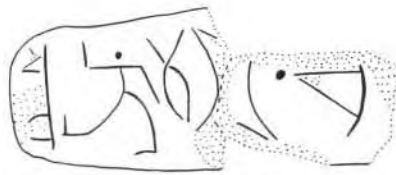


PH 7b : Linear A Tablet from Phaistos:
first sign on third line perhaps is
commodity sign for wine.



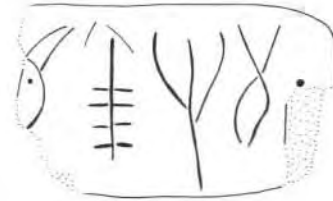
HM 1503 - [3,20] x [4,70] x 1.00cm.

PH 8a : Linear A Tablet from Phaistos:
ideographic signs for vases with
fractional signs adjoined before
numerical quantities (7 and 1) on
preserved lines 1 and 3.



HM 1513 + 1524 - [5,10] x 2,20 x 0,60 cm.

PH 12a : Linear A Tablet from Phaistos: commodity sign for grain and dot signifying quantity 10, followed by a possible fractional sign.



PH 15a : Linear A Tablet from Phaistos : commodity sign for grain and number 11+.

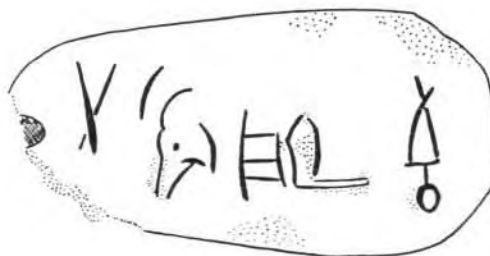


HM 1530 - 2,00 x 2,10 x 1,00 cm.

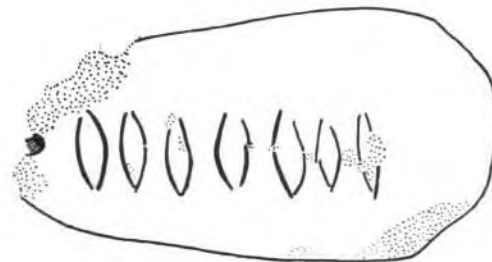
PH Wc 41 : Linear A Roundel from Phaistos : commodity sign for wine and quantity 1 + a fractional unit.



P.52c : Hieroglyphic Clay Sealing from Knossos with grain ideogram inscribed on face c.



a



b

HM 1679 : Hieroglyphic Perforated Leaf Tablet from Mallia : large quantity 7000 written on side b.



P. 54 c

P.54c : Hieroglyphic Clay Sealing from Knossos : ideogram for olives inscribed (leftmost sign on face c).



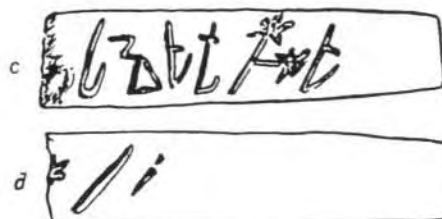
P.82b

P.82b : Hieroglyphic Clay Medallion from Knossos : grain ideogram and 3 units.



P.85b

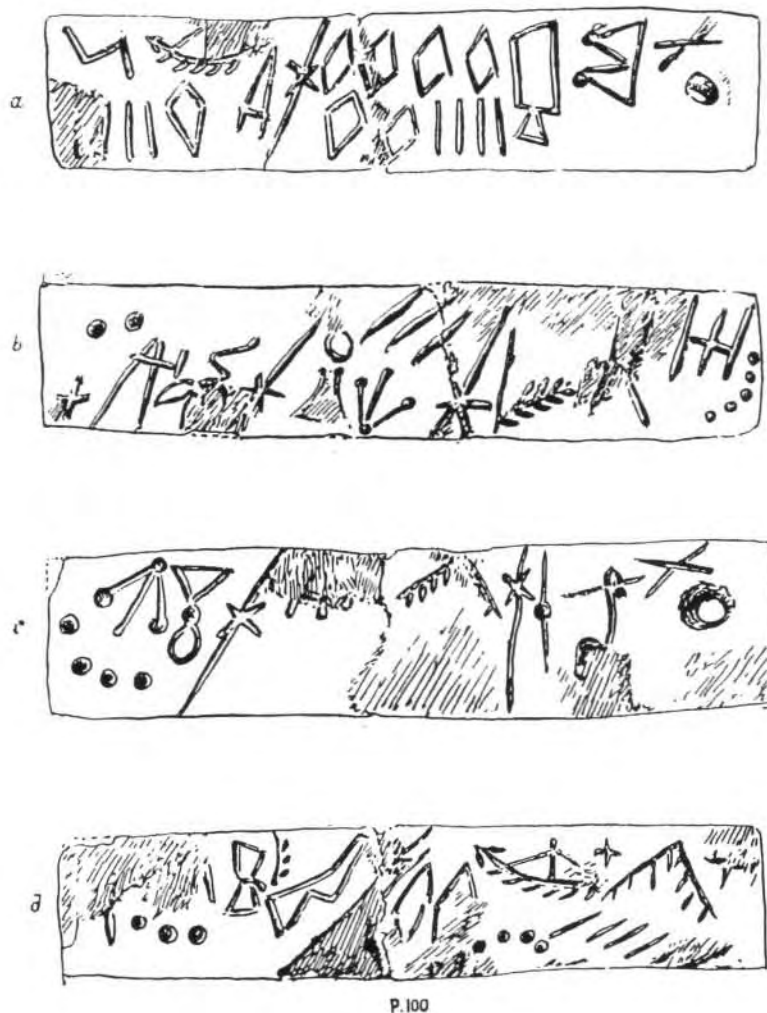
P.85b : Hieroglyphic Clay Medallion from Knossos : grain ideogram and 32 units listed in lower register.



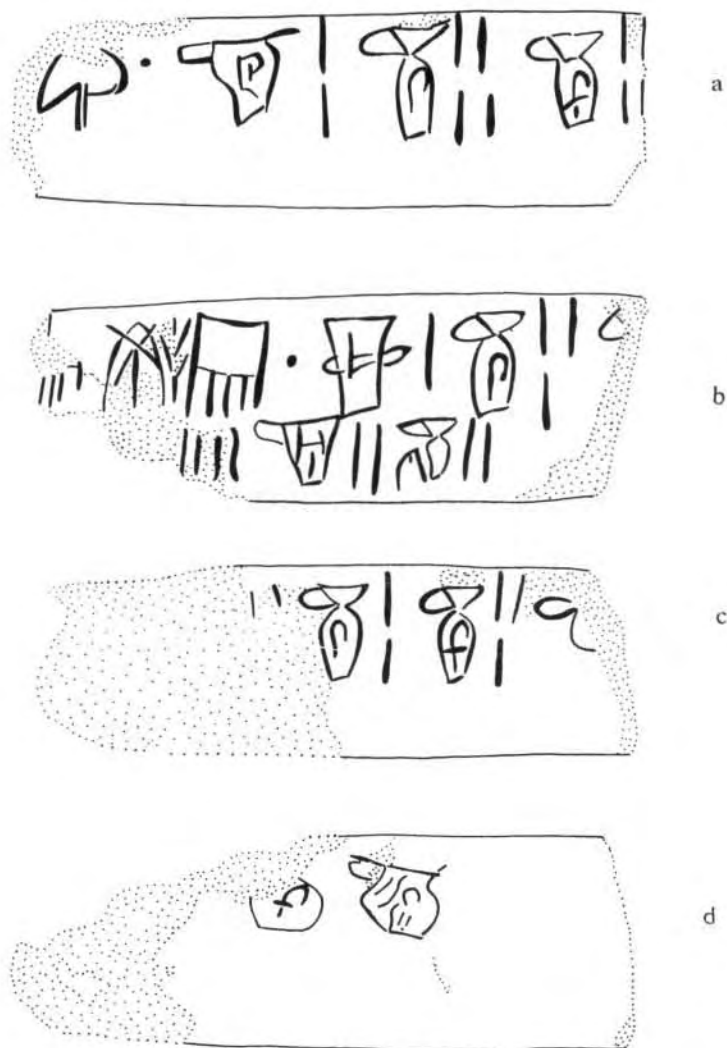
P.112c : Hieroglyphic Clay Bar from Knossos : commodity sign for figs inscribed (second sign from right) to left of fractional sign on face c.



P.114 : Hieroglyphic Clay Bar from Knossos: Ideogram for wine inscribed (rightmost sign) on face b to the right of two digit-strokes.



P.100 : Hieroglyphic Clay Bar from Knossos with extremely large numerical quantities listed on each face : face a has one entry of 6400; face b 300; face d 2660.

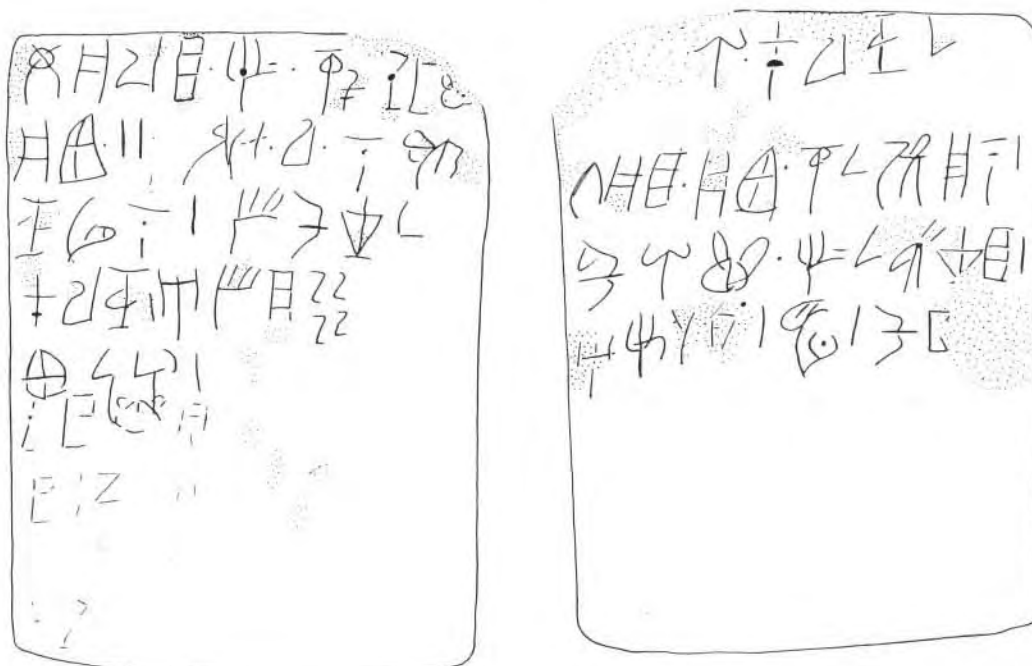


MA 10 : Clay Bar from Mallia with Linear A Inscription recording vases with fractional ligatures, perhaps serving as units of measurement.

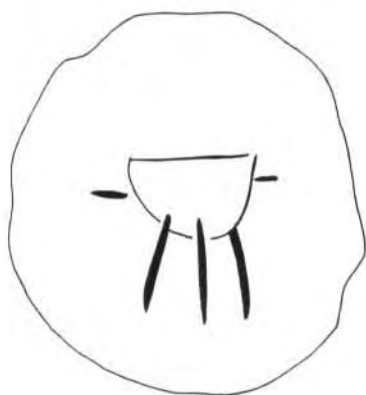


HM 1366 - 5,80 x 8,70 x 0,80 cm.

HT 122a : Linear A Tablet from Hagia Triada :
lengthy text with total at bottom (31) without apparent ideograms.



HT 115 a and b : Linear A Tablet from Hagia Triada inscribed on both sides with ca.
13 distinct entries recording at least four different quantities of the commodity grain.



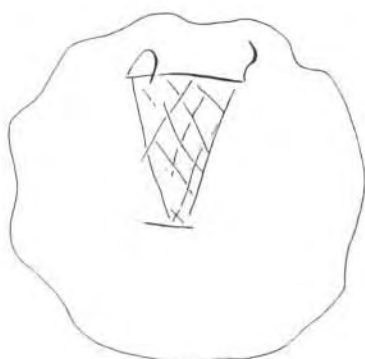
-4.70 x 5.00 x 1.20 cm.

KH Wc 2012 : Linear A Roundel from Khania with tripod ideogram inscribed.



-4.40 x 4.10 x 1.50 cm.

KH Wc 2030 : Linear A Roundel from Khania with ligatured man ideogram.

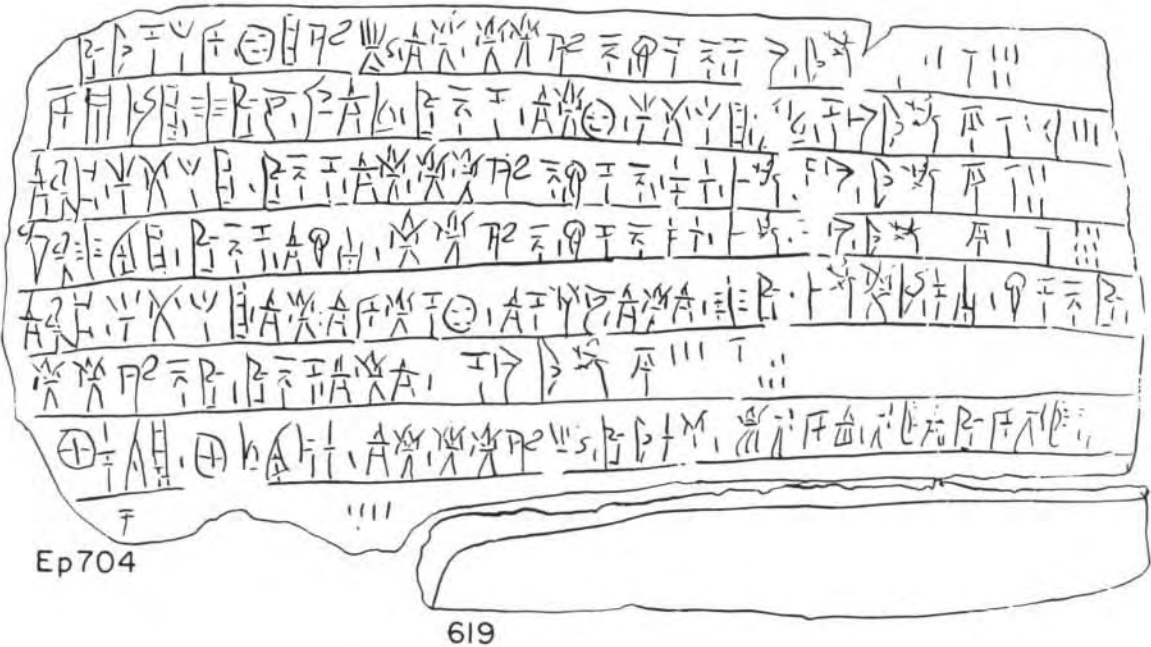


-4.50 x 4.40 x 1.60 cm

KH Wc 2006 : Linear A Roundel from Khania with ideogram for basket or conical vessel inscribed.



GO Wc 1 : Linear A Roundel from Gournia : ideogram for male ox and quantity 5 inscribed on face b. Face a has six seemingly phonetic characters inscribed.



PY Ep 704 + 619 : Linear B Tablet from Pylos recording landholdings.



PY Wa 114 : Linear B Clay Label from Pylos referring to monthly rations for women in the further province. Backside of label shows clear traces that clay was impressed on wickerwork.