

THE WORKSHOPS AND WORKING AREAS  
OF MINOAN CRETE. THE EVIDENCE OF  
THE PALACE AND TOWN OF ZAKROS  
FOR A COMPARATIVE STUDY

VOLUME I - TEXT

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## ABSTRACT

This dissertation attempts to approach the problem of function and organization of Minoan work places. The study and detailed presentation of the relevant material originating from the palatial complex of Zakros aims at presenting as clear a picture as possible of the work areas in one of the most important Minoan centres during the Late Bronze Age.

In the Introduction, a short definition of the term 'Minoan workshops' is given and the object of this study is presented. The method of approach of the material from Zakros is selected and the limits of the present study are set.

Chapter II contains a short criticism on the existing bibliography and criteria for identifying work places are sought and classified on the basis of the type of production.

Chapter III presents the Zakros workshops. Part I presents the material, Part II contains descriptions and evaluations of each work place.

Chapter IV contains comparative material – other Minoan workshops more or less contemporary as well as some Mycenaean and Aegean ones.

The last chapter consists of a discussion of the workmen's socio-economic position, the work places' features and their organization as shown by their location, architectural form and their contents.

Στούς γονείς μου.

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## AUTHOR'S DECLARATION

The work presented in this thesis on "The Workshops and Working Areas of Minoan Crete. The Evidence of the Palace and Town of Zakros for a Comparative Study", is entirely my own. Full credit is given in the Acknowledgements for suggestions and advices offered by others.

*Garwy*

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46. Zakros. Above: Little bronze saw (Br. L. S. cat. no. 2). Below: Little bronze saw (Br. L. S. cat. no. 1), and fragments of small bronze tweezers (Br. Tw. cat. no. 3).
47. Zakros. Bronze punches (in order from above: Br. P. A. P. cat. nos. 1, 11, 12, 15, 16, 17), and bronze blade (below, Br. Bl. cat. no. 4).
48. Zakros. Above: Bronze nail (Br. N. cat. no. 1), and bronze awl (Br. P. A. P. cat. no. 3). Below: Bronze punch (above, Br. P. A. P. cat. no. 7), and bronze cutters (Br. Cut. cat. nos. 2, 3).
49. Zakros. Above: Bronze awl (Br. P. A. P. cat. no. 18). Below: Solid drill (Br. S. Dr. cat. no. 6).
50. Zakros. Above: Bronze nails (Br. N. cat. nos. 4, 2, 3). Below: Bronze fish-hooks (in order from above: Br. F-h. cat. nos. 3, 5, 2, 1).



51. Zakros. Above: Small bronze tweezers from Workshop  $\Phi$  (Br. Tw. cat. nos. 4, 5). Below: Handle and leg of a bronze cauldron, found in Room XII, XIII of the palace West Wing.
52. Zakros palace, Room XI. Above: Copper ingots in situ. Below: Copper ingots (C. I. cat. nos. 1-6).
53. Zakros palace, Room XXVI. Above: Construction with three rows of slabs in SW corner. Below: Unworked steatites in situ.
54. Zakros palace. Above: Unworked steatites of Room XXVI in situ. Below: Bronze razor from Room XV in situ.
55. Zakros palace. Above: Bronze saw and stake-head on the steps of the Lustral Basin (XXIV). Below: Long bronze saw in situ, in the lightwell of Room XXVIII.
56. Zakros. Stone cup with rough surfaces found in South Wing area.
57. Zakros kiln. Above: Plan and section. Below: The channels.
58. Zakros kiln. Above: View from the south. Below: Small channel on south wall.
59. Zakros palace. Above: Room XX with built-in troughs. Below: Loomweights and rubbers in situ in Magazine III.
60. Zakros. Above: Wine-press in House A on NW hill. Below: Wine-press in House I.
61. Zakros. Above: Wine-press in House B on SW hill. Below: Room B of the wine-press in House B.
62. Zakros. Above: House B with the wine-press on the right. Below: Room A of the wine-press in House A on SW hill.
63. Zakros, House  $\Delta$  wine-press in Room  $\Delta'$  (NE House, SW hill).
64. Above: Wine-press in Epano Zakros. Below: Wine-press in Vathypetro.

LIST OF ABBREVIATIONS USED IN  
CHAPTER III AND IN THE CATALOGUE

- HM : Heraklion Museum.
- SM : Siteia Museum.
- Dim. : Dimensions.
- L. : Length.
- W. : Width.
- Th. : Thickness.
- Dm. : Diameter.
- Ht. : Height.
- prs. : Preserved.
- O. cat. no. : Obsidians, catalogue number.
- S. cat. no. : Steatites, catalogue number.
- Oth. St. cat. no. : Other stones, catalogue number.
- St. w. Seg. cat. no. : Stones with a segment removed by  
a drill, catalogue number.
- S-pr. St. cat. no. : Semi-precious stones, catalogue  
number.
- F.-I.-Gl. cat. no. : Faience, ivory, glass-paste, catalogue  
number.
- Rub. cat. no. : Rubbers, catalogue number.
- St. Q. or Q. cat. no. : Querns, catalogue number.
- Tr. cat. no. : Troughs, mortars, catalogue number.
- Oth. St. T. cat. no. : Other stone tools, catalogue number.
- Cl. T. cat. no. : Clay tools, catalogue number.
- M. R. to P. cat. no. : Material related to pigments,  
catalogue number.
- B. T. cat. no. : Bone tools, catalogue number.
- Br. S. cat. no. : Bronze saws, catalogue number.
- Br. Ch. cat. no. : Bronze chisels, catalogue number.

Br. Kn. cat. no. : Bronze knives, catalogue number.  
Br. Ax. cat. no. : Bronze axes, catalogue number.  
Br. St-h. cat. no. : Bronze stake-head, catalogue number.  
Br. Sl-h. cat. no. : Bronze sledge-hammer, catalogue  
number.  
T.w.T.T. : Tools with three teeth.  
Br. C. cat. no. : Bronze cones, catalogue number.  
Br. D. A. cat. no. : Bronze double adzes, catalogue number.  
Br. P. A. cat. no. : Bronze pick adzes, catalogue number.  
Br. R. cat. no. : Bronze razors, catalogue number.  
Br. H. Dr. cat. no. : Bronze hollow drills, catalogue  
number.  
Br. S. Dr. cat. no. : Bronze solid drills, catalogue  
number.  
Br. Cut. cat. no. : Bronze cutters, catalogue number.  
Br. C. Ch. cat. no. : Bronze carpenters' chisels, catalogue  
number.  
Br. Sp. : Bronze spatula.  
Br. Bl. cat. no. : Bronze blades, catalogue number.  
Br. L. S. cat. no. : Bronze little saws, catalogue number.  
Br. P. A. P. cat. no. : Bronze punches, awls, pins,  
catalogue number.  
Br. N. cat. no. : Bronze nails, catalogue number.  
Br. Need. : Bronze needle.  
Br. F-h. cat. no. : Bronze fish-hooks, catalogue number.  
Br. Tw. cat. no. : Bronze small tweezers, catalogue number.  
C. I. cat. no. : Copper ingots, catalogue number.

LIST OF ABBREVIATIONS  
USED IN BIBLIOGRAPHY

AAA : 'Αρχαιολογικά Ανάλεκτα εξ' Αθηνῶν.

ΑΔ : 'Αρχαιολογικόν Δελτίον.

ΑΕ : 'Αρχαιολογική Έφημερίς.

AJA : American Journal of Archaeology.

Annuario : Annuario della Scuola Archaeologica di Atene  
e delle Missioni Italiane in Oriente.

AR : Archaeological Reports.

BSA : The Annual of the British School at Athens.

Έργον : Τό Έργον τῆς ἐν Αθήναις Αρχαιολογικῆς Έταιρείας.

Hesperia : Hesperia. Journal of the American School of  
Classical Studies at Athens.

JHS : Journal of Hellenic Studies.

Kadmos : Kadmos. Zeitschrift für Vor und frühgriechische  
Epigraphik.

Πρακτικά : Πρακτικά τῆς ἐν Αθήναις Αρχαιολογικῆς Έταιρείας.

SIMA : Studies in Mediterranean Archaeology.

SMEA : Studi micenei ed egeo-anatolici.



CHAPTER I  
INTRODUCTION

Under the term Minoan 'workshops' one may classify some specific places in the Cretan settlements and palaces in which working activities took place for longer or shorter periods of time. On the other hand, the term 'workshop' in a modern sense applies to a specific permanent area, well organized and equipped, where a craftsman or a group of craftsmen, sometimes few in number, is practising its craft to produce goods for a wider social group.<sup>1</sup>

For the purposes of the present study, the term 'workshop' will be applied simply to areas in which manufacture was carried on,<sup>2</sup> despite the fact that in most cases these particular areas were very different from modern workshops.

The present research deals principally with the forms of organization and functions of the Minoan working places, and the socio-economic status of the craftsmen. The technology itself has also been briefly studied, though more specialized research on this matter has been published recently.<sup>3</sup>

This work does not aspire to give answers to all the questions arising from the study of Minoan working places, but it does attempt to present and discuss the evidence for them. It is hoped that the study may be of use for comparative purposes when future assemblages are examined.

A useful method of approaching the subject is to study together all the working activities which took place at a

single site during the same period. Among the four excavated palaces, which seem to include most of the identified working places, Zakros offers an additional advantage: the working activities which took place inside the palace can be studied in parallel with those which took place in the surrounding town. Thus, the unpublished material from Zakros, which is presented in this work, can give us a reasonably complete picture for work at a significant Minoan site during the Late Bronze Age.

Most of the fully excavated sites in Crete belong to the neopalatial period. Settlements dated to the older periods usually lie underneath the neopalatial ones, and consequently one cannot have a complete picture of them. This is the reason why this research will mainly refer to evidence coming from neopalatial or postpalatial contexts. Nevertheless, the structure of the society, and even more the technology, do not appear to be very different from those of the previous periods. Thus, workshops dated to the protopalatial and prepalatial periods on Crete will also be included, since some evidence coming from them may help us toward a better understanding of the Late Minoan workshops. However, it should be noted here that this particular evidence is not in any case sufficient to produce a complete chronological sequence for the modes of organization and function of the workshops in Crete.

The study of a specific body of material from Zakros presents some difficulties which are mainly due to: 1) the long duration of the excavation, 2) its continuation while this research was being conducted, 3) the absence of the

final publication.<sup>4</sup> The main difficulties are the following:

1. a. Twenty-seven years have passed since 1961, the year in which the excavation began. During this time archaeological science has advanced and its demands have become more specialized.
- b. During these twenty-seven years many archaeologists, architects and technical assistants have worked at the site of Zakros; so differences in the methods of excavation, as well as in the notebook details, often exist.<sup>5</sup>
- c. The restoration of the material has not been completed, because of the lack of sufficient technical staff and adequate workshops to cover such a great quantity of material in the Cretan museums. In addition, the heavy duties of the Greek authorities during the period of the 'excavation boom' (1960-1980) and the lack of financial resources<sup>6</sup> prevented the systematic restoration of 'secondary' finds.
- d. The dispersal of the material in various places is directly connected with the problems which museums are faced with in Greece.<sup>7</sup> At this moment the Zakros material is housed separately in two museums in the following places:

- 1) Heraklion Museum

- Exhibition Halls
- West Storeroom
- East and Central Storerooms
- Scientific Collection



## 2) Siteia Museum

- Storerooms
- Temporary Exhibition

2. The fact that the excavations have continued while this study has been carried out makes it necessary to have a terminal point in the research. This study will therefore deal with the period 1961-1984 (as regards the Zakros material). In cases where an important find related to the study has come up more recently, reference to it will be given in a note.
3. The absence of the final publication of Zakros is an additional problem for the scholar. Nevertheless, the published annual reports of the Archaeological Society of Athens,<sup>8</sup> enriched with many photographs and plans, can give valuable but not exhaustive information. The book Zakros by the excavation director, Professor N. Platon, produced in two languages (English and Greek) is also useful for its general information and its points of view.<sup>9</sup>

In order to meet the last problem I have decided to approach the subject in two ways:

- a. By studying the museum material related to the subject and attempting to present it through all possible means: drawings, photographs, detailed descriptions and accurate archaeological information for each object.
- b. By approaching the material through the excavation diaries.<sup>10</sup> When the objects described in them have been identified among the museum material, the information given in the diaries can only serve as subsidiary. However, there is information as well for objects which

could not be identified while researching in the museums. Then the reference of the diary is considered as definitive. For instance, in the excavation diary of 1963 it is mentioned that 'many, large pieces of unworked stalactite have been found in the fill of Room XXVI', which could not be identified during the study in the Heraklion Museum.<sup>11</sup> In this case, the diary information is considered as definitive and it contributes towards the room being characterized as a workshop area.

In other cases the gathering of the dispersed material in such a way as to allow description as a unit was not possible. For instance, in the case of rubbers and querns which have been found in Zakros a complete study and presentation seems impossible since part of the material has not been moved from the excavation area. So, the detailed study of a small number of grinders which have been transported to the museums is no more than suggestive. The evidence for the rest of the material is mainly based on the information of the excavation diaries and the corresponding reference in the published annual reports. The catalogue of some unidentified masses, which have been considered by N. Platon as slags produced during bronze melting,<sup>12</sup> is also based on the above sources.

This study will be limited to the palace and the surrounding town. It will not be extended to other excavations and surveys carried out during the same period in various sites in the Zakros area.<sup>13</sup> Material from those

sites will be used only when it has special significance since it comes from the same district and its connection with the palatial centre would have been close.

The material from the old excavations of D.G. Hogarth will also be presented as it comes from houses of the Minoan town, some of which have been re-excavated during the recent work. The approach to this material in the Heraklion Museum has been based on the publication by D.G. Hogarth in BSA 1901.<sup>14</sup>

The comparative material comes from: a) all the excavated Minoan sites, b) Mycenaean sites, more or less contemporary with the Minoan ones, and c) other Bronze Age Aegean sites. For the Mycenaean district the internal arrangements of workshops and many of the materials seem to be similar. Although we do not know precisely who controlled the Minoan palaces, nevertheless we shall see that the Minoan workmen operated mainly under overall palace control as did the Mycenaean workmen.<sup>15</sup> In addition, the technology during the whole Bronze Age in the Aegean presents identical features.

The presentation of the comparative material will be based on the relevant published information of which a short critical discussion will also be attempted. On the other hand, some other subsidiary published information which is not directly related to workshops, will be accepted as it is, without a separate discussion. On this basis, the dating for the various contexts will be accepted as given in the relevant publications.



## CHAPTER II

### METHODOLOGY: IDENTIFICATION AND CLASSIFICATION OF WORKSHOPS

The scholars who study any specific subject connected with the function of Minoan towns or palaces have to face three main problems. a) The difficulty of identifying the function of an area exclusively on the basis of its contents. b) The absence of information from written sources, a fact which intensifies the above problem. c) The difficulty of evaluating and criticizing the old and incomplete publications which are presently available.

a) The difficulty which is described in 'a' is felt even more in cases in which the contents of the area cannot be reconciled with the interior architectural arrangement or with its position in a complex of rooms whose function is known. For instance, in the central shrine of the palace of Zakros, on the bench, where one might expect to find a cult figurine or other attention-focussing material, the only thing which was found was a millstone.<sup>1</sup>

In the specific issue of workshops the problem described above is even more clear. Tools were found in areas hardly considered as working places. In the Hall of Ceremonies (XXVIII) at the palace of Zakros many bronze tools including four saws have been found.<sup>2</sup> Among the finds of the Treasury (XXV) in the same palace there were bronze tools which have been considered to have fallen from the upper floor.<sup>3</sup> On the carefully paved floor of the spacious hall (XLIII) of the South Wing, a large half-sawn block of veined marble has

been found; this suggests that it was worked in situ, in spite of the fact that it is difficult to identify this area as a workshop.<sup>4</sup>

In other cases, difficulties are created because of the variety and sometimes the quantities of the material found in the same area. In Room XLIV of the palace of Zakros many clay and stone vessels, bronze tools of various types and small artifacts from various materials have been found together with raw materials, clay loomweights and a group of stone weights.<sup>5</sup> In this case, the tools and the raw materials suggest the presence of a workshop, the loomweights prove the existence of at least one loom, and the vessels indicate the use of the area as a storeroom for objects of high quality.

On the other hand, there are cases where, although the interior arrangement of the area suggests a workshop, the complete absence of characteristic contents prevents a safe identification of the place. For instance, the SW block of rooms in the West Wing of the palace of Zakros (Rooms XVII-XXI) has been considered as an industrial quarter exclusively on the basis of its interior arrangement.<sup>6</sup>

In order to overcome this difficulty the reasons which created it must be studied. One should take into account six factors.

1. The fall of material from the upper floor. Almost all the Late Minoan buildings had at least two floors, and the palaces, in certain areas, had three or more.<sup>7</sup> Part of the material which was found in the fill of the ground floor rooms belongs to the contents of the corresponding

upper floor apartment. The mixture of two or three different deposits creates the problem of distinguishing them, if there is no satisfactory description of the stratification of the area. Additional evidence for the distinction of the material which fell from the upper floor is its horizontal and vertical dispersal. The objects which have been found at a high level in the fill (more than 0,30 m. from the floor of the ground floor room) should generally be considered fallen from the upper floor, though the possibility that they fell from shelves of the ground floor room should not be excluded.<sup>8</sup> The dispersal of the fragments of the same object in a wide area on the floor, or their discovery in neighbouring areas should be considered as evidence that they are fallen from the upper floor. The same fall may explain the dispersal of the same types of objects in neighbouring ground floor areas. Moreover, the way in which the object fell is an additional clue. Furthermore, if heavy material has fallen from an upper storey one could expect some sort of damage on the ground floor.

Sometimes the function of the ground floor area excludes the possibility that the objects found in it were in situ. For instance, it is impossible that the saw and the hammer which have been found on the staircase of the Lustral Basin (XXIV) in the West Wing of the palace of Zakros were in situ. It is clear that they fell from the upper floor.<sup>9</sup>

Nevertheless, often the material fallen from the upper floor apartment became absolutely mixed with the



contents of the ground floor. Unfortunately, the distinguishing of such mixed material is not usually made easy from the information available in the old publications because they are usually incomplete. In these cases, the scholar is compelled to accept the view of the excavator which has been based on his personal evaluation.

2. In some cases, only a small part of the original total of movable finds of the area has been found. This happens either because the material was perishable (wool, wood), or because of a chance event, damage or disturbance of the fill (removal of the contents before the final destruction of the area, etc.). Consequently, in areas in which the interior architectural arrangement suggests workshops, one often finds only ordinary pots which possibly fell from the upper floor, or which comprised the auxiliary movable objects of the room.
3. Sometimes, there were rooms used as temporary workshops and afterwards they were altered for different use. In such cases, material connected with the use of the area as a workshop can be found under the last floor, or can be included in the final context of the room. A permanent piece of equipment used in a temporary workshop could sometimes go out of use without being destroyed, or it simply changed use. In the opposite case, if a temporary workshop was functioning before the final destruction of the area, remains from its contents could be found in the destruction layers. In that case, in the same layer one could find material from the former use of the area which

has not been removed during the time of the functioning of the temporary workshop.

4. It is very probable that areas with a different, non-workshop function were sometimes used for various working activities. So, in 'luxurious' areas often tools and partly worked and completely unworked materials have been found. In most cases, spacious, well lit rooms which offered comforts for working were chosen for such temporary activities. Areas which had been used as storerooms for pottery were also sometimes used as working areas; the opposite is also true. It seems possible that, if the area was spacious, along the walls the pots were placed on shelves, while the remaining area would be used for working activities. For some months of the year, open-air spaces and courts could also be used as temporary workshops.
5. Sometimes work had to be done in a certain area, at a distance from the workshop. For instance, carpentry or other repairs to architectural members had to be done wherever the need arose. Consequently, the discovery of some tools and materials together in a certain area proves working activity but not necessarily a workshop.<sup>10</sup>
6. Finally, the case of storing workshop material together with other objects not necessarily connected with them should be noted. In most cases, the storage of tools and raw materials would be done in the workshop; however, it is also possible that the material which was not destined for immediate use, or was precious, was stored in separate storerooms for security.



b) The lack of information from written sources is a significant problem for the study of Minoan society and the life in the palaces. Of course, there is some information since the decipherment of the Linear B tablets from Knossos, and from the similar tablets of the Mycenaean centres which refer to workshops.<sup>11</sup> However, in the case of the Knossos tablets the information refers to workshops organized principally on Mycenaean models, since they belong to the Mycenaean period of Knossos.<sup>12</sup> On the other hand, in the Mycenaean district also, some problems arose after the decipherment of the tablets. Some places have been identified as workshops without other clear indication except the finding of tablets which refer to work activities. For instance, the 'Workshop' of Pylos is a building which could never be characterized as such if it were not for the literary evidence. From the whole complex of rooms only Room 100, at the SE end of the building, presented some evidence for ivory-working; a group of bronze arrowheads has been attributed to the same workshop without any additional evidence. Bronze remains and masses of lead, as well as some colour stains on the floor of other rooms have been interpreted as evidence for workshops; yet this is always done on the basis of the information drawn from the tablets which were found in one of the rooms (Room 99).<sup>13</sup> The example of the 'Workshop' of Pylos is very instructive. If, in this case, the tablets had not been found, the function of the area would remain unknown. Consequently, unidentified areas in the Minoan palaces could be identified as workshops if there were written sources which would ascertain their function.



c) One of the most significant problems for the identification and the understanding of the function of workshops is the incomplete information given by most of the publications to date. Only in a few cases is there a stratigraphical description for a relevant area, while a serious attempt at understanding their function is rarely made. The descriptions of the rooms are not usually exhaustive and most of the time the contents are isolated and broken down into various classifications which prevent the creation of a complete picture. In other cases, the interpretations come before any systematic analysis and are based on subjectively selected evidence. Elsewhere, the preserved and registered data are not enough for modern definitional requirements. Sometimes, exact measurements are lacking and there is insufficient description of the location and disposition of each object, while applications of the natural sciences were rarely used since they were not then of proven worth.

Almost all the publications of most significant Minoan sites are today old. Significant information for the Minoan world is given in The Palace of Minos, by A. Evans.<sup>14</sup> The principal disadvantage of this work is the lack of detailed descriptions of the areas and the incomplete information about their contents as a whole. For areas considered as workshops, descriptions and measurements are given only for the elements which helped their identification.<sup>15</sup> In addition, some information is also given by Evans in the annual reports in BSA.<sup>16</sup> For Phaistos, the old publication of Pernier and Banti<sup>17</sup> is useful for understanding the second palace but it has the disadvantages of the publication of Knossos. The

absence of good photographs and plans makes it difficult to follow the detailed descriptions, while there is no stratigraphical study of the areas. If one excepts a kiln in the NE court of the palace and an installation considered as an oil-press (belonging to the protopalatial period), other identifications of workshops in the palace area have not been risked. Also significant is the huge publication of the more recent excavations of the first palace of Phaistos by Levi, with two separate volumes for the plans and photographs.<sup>18</sup> The recent publication of H. Triada<sup>19</sup> is based on the old excavation diaries and this is the reason for its incompleteness and lack of detailed information. For the palace and town of Mallia, the old publications in Études Crétoises are useful, though emphasis is given to the description of the contents and not to the interpretation of the function of areas.<sup>20</sup> In the new publication of the palace by Pelon,<sup>21</sup> emphasis is given so far only to the architectural part of the description, while once more the interpretations of the function of the areas have not been discussed. Such interpretations have been discussed in a valuable work by H. van Effenterre,<sup>22</sup> where, unfortunately, certain detailed descriptions of areas and objects are missing.

For the town and palace of Zakros the preliminary annual reports in the Praktika<sup>23</sup> are useful, where enough data for the contents of the rooms are given, but not complete descriptions and interpretations. In Zakros,<sup>24</sup> by the excavator N. Platon, interpretations for the function of the areas have been attempted based on the surviving evidence. In spite of the fact that the interpretations have not always



been proven and alternative solutions or additional evidence have rarely been given, the work is significant for the understanding of the function of the areas of the palace.<sup>25</sup>

For the town of Palaikastro, preliminary reports were published in BSA from 1902 to 1906,<sup>26</sup> while there is an additional volume for the objects of the site published in 1923 by Bosanquet and Dawkins.<sup>27</sup> Here, as elsewhere, there is lack of stratigraphical descriptions, as well as of details for the location of the objects in the area.<sup>28</sup> Slightly similar is the old publication for the town of Gournia which presents some interpretations as well as detailed descriptions for selected objects, but leaves lacunae in the description of the areas and omits all the secondary elements.<sup>29</sup> A significant problem here also is the lack of a systematic stratigraphical study. The publication of the villas of Tylissos by Hazzidakis,<sup>30</sup> is insufficiently detailed since the stratigraphical study of the areas is not clear and the descriptions and photographs are not considered exhaustive today. Here also, the secondary data are not presented. Again, only a few such data are given in the publications of the villas of Nirou Khani<sup>31</sup> and Sklavokampos.<sup>32</sup> Nevertheless, here there is an attempt to interpret the principal areas with a selection of certain data.<sup>33</sup> This happens also in the only publication of the villa at Amnisos, where there is only a brief reference to the movable objects.<sup>34</sup>

More detailed are the preliminary reports for the 'megaron' at Vathypetro<sup>35</sup> and the villas at Zou,<sup>36</sup> Achladia,<sup>37</sup> Profitis Ilias<sup>38</sup> and Piskokephalo Sitias,<sup>39</sup> where short descriptions of the areas and their contents are given



without exact measurements. In all the cases interpretations are attempted, usually based on selected evidence.<sup>40</sup> Short as well are the preliminary reports of the excavations done by the British School at Athens, in AR. The information given is very summary and it is not easy for the student to make any sort of analysis and synthesis.<sup>41</sup> The villa at Myrtos-Pyrgos and the recent excavations at Knossos in the section of the city beside the Stratigraphical Museum have been presented in more detail, though still preliminary, in the same periodical.<sup>42</sup>

Short annual reports of excavations carried out during recent years in West Crete have been presented in the annals of the AA and in the AAA. Here, as elsewhere, the information is brief and it is not possible to use it as a subject of detailed study. Among the principal sites presented in the above periodicals is Kastelli Khandia.<sup>43</sup>

More detailed are the preliminary reports for the recent excavations in Archanes,<sup>44</sup> Jouktas,<sup>45</sup> Syme Viannos<sup>46</sup> and Vasiliki,<sup>47</sup> in Praktika. Beside the detailed description of the architecture and the contents of the buildings, there are usually some attempts at interpretation of the function of various areas.<sup>48</sup> Here also, the problem of the incomplete presentation of the whole evidence is clear and consequently any criticism of the interpretations is difficult. The photographs accompanying these reports are not in every case satisfactory. More sufficient are the excavation reports for the harbour of Kommos, in Hesperia.<sup>49</sup> Here there is a good stratigraphical description though its understanding in connection with the chronological stages of the buildings

is not easy in every case.

The publication of Myrtos-Fournou Korifi by P. Warren<sup>50</sup> is systematic. Each of the areas and their contents are discussed separately and interpretations based on the existing evidence, which is presented completely, are given.<sup>51</sup> In separate chapters, there is discussion of more general problems connected with the pottery and the other finds, the town planning, the social organization, and the environmental analysis of the district.

The recent publication of the Unexplored Mansion of Knossos by M. Popham and others is also very good.<sup>52</sup> Here, in specific chapters, various subjects are discussed on the basis of evidence drawn from the excavation data.<sup>53</sup> In the first chapter all possible excavation data have been given and the contents of each room are described in detail. Additional plans with the location of each find are also included.

Some of the specific studies relating to Minoan workshops have dealt with their organization and the socio-economic status of the craftsmen. Branigan discussed craft specialization in Minoan Crete,<sup>54</sup> while M. van Effenterre showed the difficulties for the identification of 'real' workshops in the palaces.<sup>55</sup> Poursat in an article on the workshops of 'Quartier Mu' at Mallia gave an interpretation of their location emphasizing their social-administrative significance.<sup>56</sup> Recently, Evely has discussed the fundamental question of the recognition of Minoan workshops on the basis of their architectural location, form and contents.<sup>57</sup> He deals also with their organization and proposed



methods in order to approach the Minoan manufacturing processes. An attempt to define certain indicators for the identification of Mycenaean workshops has also been given recently by Tournavitou.<sup>58</sup> She deals only with permanent palatial workshops and she divided them in two large groups on the basis of the nature of the craft practised therein. Finally, she proposes another method for establishing Bronze Age workshops, which includes a comparative study with selected modern workshops.

Significant studies connected with technology and workshops have been published in recent years. First of all, one could mention those related to the Knossian workshops which have been based on detailed study of the gypsum material coming from the old excavations. Warren published in 1967<sup>59</sup> the material stored in the Stratigraphical Museum of Knossos which came from cists 2 to 6 in Magazine XIII of the palace. The publication includes detailed descriptions and general observations based on this specific material. This is presented as a unit, separately from the rest of the contents of the same cists. Evely undertook the description of the techniques of manufacture of gypsum stone vessels by using the same published material.<sup>60</sup> His analysis is persuasive and very useful for understanding the methods of manufacture. From marks on partly worked pieces, the use of three tools in the different stages of manufacture has been confirmed. Their form and method of use are described in detail. Younger, in 1979,<sup>61</sup> studied once again the evidence which led A. Evans to the identification of the 'Lapidary's workshop', in the South Wing of the palace.



Some general confirmation of the locality, date and character of the workshop are presented, and a criticism of the specific pieces of evidence for the identification of the area is also made. A general description of the process of manufacture of stone vases, based on the evidence drawn from the known unfinished pieces, is given in Minoan Stone Vases (P. Warren).<sup>62</sup> A short description of the method of manufacture of stone vases and a reference to the specialized tools used are given by Warren on the occasion of the publication of stone vases coming from Thera.<sup>63</sup> A discussion on the same matter comes also from Warren in his article in Thera and the Aegean World.<sup>64</sup> Nevertheless, the most significant work on the subject of the Minoan stone vase manufacture is the unpublished thesis of Evely on Minoan tools.<sup>65</sup> Every kind or type of tool and its method of use is separately described in detail. A typological classification is also given, where all the published material is classified in lists and catalogues at the end of each specific chapter. Moreover, there is a short reference to the known Minoan workshops. In another significant study, Deshayes<sup>66</sup> undertook principally the typological classification of prehistoric bronze tools. Together with the publication of tools from the Indus and Danube districts, similar Minoan tools were described and classified. The work is very useful for the typological classification of every specific case. The method of use is briefly discussed, while the general chapters connected with their historical development are not exhaustive.

Extensive discussion of Minoan bronze tools and their

use in the preparation of building material is presented in the excellent study by Shaw, Minoan Architecture.<sup>67</sup> In another chapter of the same work, the techniques of quarrying and the transportation of material to the place of its final preparation are described. The sites of quarrying in Minoan times are also discussed.

For the sealmaker's workshop in Mallia there is a satisfactory analysis in van Effenterre's Le palais de Mallia.<sup>68</sup> Some general observations are included based on study of the material. A separate description of each stage of manufacture is attempted.

There are specific studies for the manufacture of pottery. Fiandra and Pelagatti<sup>69</sup> gave a complete description of the manufacture of pottery based on evidence drawn from the observations of the work of modern potters. Betancourt's recent book about Minoan pottery is also valuable.<sup>70</sup> Here, some technical details of the process of pottery manufacture have been discussed for each different Minoan period. Pottery manufacture of Tylissos is discussed by Hazzidakis<sup>71</sup> in the publication of the site. The process of modern pottery production in the village of Thrapsanos in Crete has been studied and published by many, among them R. Hampe and A. Winter.<sup>72</sup> Evidence for ancient ceramic technology and its stages of development is included in the great work A History of Technology.<sup>73</sup>

Concerning prehistoric pottery kilns, Davaras<sup>74</sup> has published and discussed two of them. In both of his articles, he gives briefly the method of operation of kilns, a typological classification, and finally a list of the



published examples. In the publication of the H. Triada kiln by Levi-Laviosa,<sup>75</sup> (who considers it as a pottery kiln), a short description of the main known kilns in the prehistoric Aegean is given.

For Minoan potter's wheels there is the old study by Xanthoudides.<sup>76</sup>

Many specific studies and extensive books have been written on ancient metallurgy. Significant are the studies by Maryon,<sup>77</sup> who discussed all the known methods of ancient metallurgy and draws the attention of scholars to terminology. On the same subject, the work of Forbes is also significant.<sup>78</sup> Tylecote's book is very useful for an approach to the technical methods used by ancient metallurgists, though it is concerned mainly with the British Isles.<sup>79</sup> Muhly, in his Copper and Tin<sup>80</sup> and other works has been concerned mainly with the sources and trade of metals during the Bronze Age. The earliest steps in the development of metallurgy have been discussed by Renfrew<sup>81</sup> in his book The Emergence of Civilization (1972). A detailed presentation of the metallurgy in the Mycenaean period in Cyprus has been given by Catling.<sup>82</sup> Besides the extensive presentation of the hoards of bronze Cypriot objects, some evidence for the different stages of manufacture is also given, as well as a typology for the copper ingots.

Useful information for the metallurgy of Early and Middle Minoan times is presented in Branigan's Aegean Metallurgy of the Early and Middle Bronze Age.<sup>83</sup> Typological classifications for each kind of bronze tool are given, while the techniques, the sources of the metals in the Aegean area,



and the alloying of other metals with bronze in Minoan times are also discussed. For Minoan and Mycenaean bronze vessels there is the fundamental volume by Matthäus in the Prähistorische Bronzefunde series.<sup>84</sup> For the different types of bronze tools numerous specific studies have appeared with typologies. For example, we may mention the study by Buchholz<sup>85</sup> on the double axe or that by Sandars<sup>86</sup> for the one-edged knife.

N. Platon in his presentation of a kiln found in Zakros<sup>87</sup> referred to other kilns in the prehistoric Aegean, considered as foundry kilns.

Poursat deals systematically with ivory-working in the Cretan and Mycenaean area in two excellent books.<sup>88</sup> On the same subject, there is also the study by J. Sakellarakis<sup>89</sup> who examined ivory workshops and techniques. Even more detailed on ivory-working is the unpublished thesis of Krzyszkowska.<sup>90</sup> For faience in the Aegean the work of Polinger-Foster<sup>91</sup> is useful, in which the techniques are described and the most significant known Cretan and Mycenaean works presented. On the specific category of glass, there is a study by Haevernick.<sup>92</sup> On the subject of ancient jewellery the work by Higgins<sup>93</sup> still remains fundamental, since it includes a discussion of the ancient techniques for making jewellery. For workshops producing jewellery valuable information is given in an old study by Keramopoulos.<sup>94</sup> In addition to some observations on the jewellery trade during the Mycenaean period, there is a complete publication of a great number of partly worked semi-precious stones. There is a detailed description and measurements for each

of them, but there is no emphasis given on the techniques used. Reference to the techniques used in the manufacture of jewellery is given in the publication of a group of finds from Thebes, by Symeonoglou.<sup>95</sup> Here, there is also a detailed description for each find. In Thebes as well there was a workshop producing jewellery, which has been described in a short paper by Demakopoulou.<sup>96</sup> For the jewellery moulds in Crete, the comprehensive study by Papaeuthimiou<sup>97</sup> is useful, who published such a mould from Poros of Heraklion. For jewellery moulds coming from Mycenae there is a discussion in a study written by Tsoundas,<sup>98</sup> where problems connected with their function have been discussed.

For the manufacture of dress worn in Minoan Crete, an article by H. van Effenterre<sup>99</sup> should be taken into account, though it is only a possible interpretation for a 'puzzle'. E. Sakellarakis's Μινωϊκόν Ζῶμα<sup>100</sup> does not include dress-making techniques, apart from a chapter dealing with dyeing of fibres and cloths.

For the method of producing oil in ancient times, the study by Paton and Myres<sup>101</sup> is instructive, as is an extensive description of a relative modern method of production in the village of Karpofora in Messenia, by McDonald and Rapp.<sup>102</sup> The description of an oil-press of the Hellenistic period has been used many times for the interpretation of similar prehistoric installations.<sup>103</sup> Marinatos in his preliminary report on Vathypetro discussed wine-making arising from the discovery of a wine-press at the site.<sup>104</sup> In the unpublished thesis by Kopaka<sup>105</sup> there is a chapter which deals with installations used for the production of



flour, oil and wine. Here, besides every possible bibliographical information, interpretation for each specific case is attempted, while some general conclusions have been drawn. The same subject has also been discussed by Warren in the publication of Myrtos.<sup>106</sup>

From the brief summary in the bibliography described above, the following conclusions can be drawn:

1. From the evidence given in the old publications it is difficult for the researcher to form detailed views of the function of relevant areas. In some cases, he can examine the published views by using comparative evidence drawn from other similar areas. Otherwise, if there is no such evidence, he may be obliged to accept the view of its author.<sup>107</sup>
2. There are many general works on subjects connected with the relevant technology and materials in wider geographical districts and periods. Because of the extensive nature of these subjects, authors are mostly concerned with bibliographical information and place emphasis on the general features, techniques and typology. Some theses dealing with wider subjects are principally based on bibliographical sources as well.<sup>108</sup>
3. A good number of useful specific studies has been written on material from certain areas. Since these studies discuss very specific problems, the publication of the material used as the base for drawing conclusions is often needed. There are cases where an older complete publication of a particular material is used as the base for a new study in a more specific point of research.<sup>109</sup>



All the difficulties discussed above in 'a', 'b' and 'c' make clear that a determination of the method of approaching the subject of workshops is needed. Two basic methods should be used for the identification of a workshop:

1. Comparative method. Every possible use of comparative evidence drawn from other workshops should be made. Similarities and differences between the workshops belonging to the same category should be presented.
2. Inductive method. Every case should be separately studied, each time in connection with its surroundings. As regards the second method, it is immediately clear that we should determine from the beginning what the evidence required is. Consequently, since in this case we are looking for workshops, a definition of the term is needed first.

A 'workshop' is defined as a specific area in which one or more specialized craftsmen worked for the manufacture or production of one or more categories of object.

If we further analyse the definition given above, we may distinguish the following features for a 'workshop'.

1. 'A specific working area'. This includes both permanent and temporary areas of working. There were rooms or open-air areas used for a short while as workshops, but they had all the features of a permanent workshop. In some cases, temporary working activities had taken place in areas principally used for other purposes; this was done either accidentally or because of some necessary repairs. For example, in the last days of the palace of Zakros, repairs had been carried out in the Hall of Ceremonies (XXVIII) as the saws found on the ground floor indicate.<sup>110</sup>

In this case, we could not speak of a workshop, but rather of a place where a temporary working activity had taken place. Rooms of the upper floor for which there is satisfactory evidence that they had been used as workshops, should be considered also as specific working areas. For instance, a stone workshop functioned probably above Rooms XIV, XI, XV at the Zakros palace.<sup>111</sup> Although its architectural position and form are not absolutely known, it is clear that there was a specific area of working the material, which was found fallen in the ground floor apartments.

In some cases, the existence of a workshop is likely but the identification of the principal area of working is difficult. Such is the case of the bronze-smith's workshop in the Unexplored Mansion at Knossos, where the evidence for a workshop comes from Rooms H, L, M, N and P, but its exact location could not be determined.<sup>112</sup> On the other hand, we must presume the existence of a working area; thus we may refer to a workshop whose location is not precisely identified.

In some cases, areas used as working places were also used for storing objects. In such an instance, we could name the area 'workshop'; however, we should also determine the wider function of the area. For example, the workshop on the upper floor of the West Wing at the palace of Zakros was also used as a storeroom, as indicated by the quantities of objects which fell from the upper floor together with the tools and the raw materials.<sup>113</sup>

2. 'One or more specialized craftsmen'. In most cases, as we can deduce from the dimensions of the areas identified as workshops, as well as from the quantities of raw materials discovered, the craftsmen were no more than two. For instance, in each of the stone workshops in the area of the palace of Mallia, the existence of two craftsmen has been surmised.<sup>114</sup> It has also been assumed that two people (a craftsman with his assistant), worked in the sealmaker's workshop at Mallia.<sup>115</sup> Furthermore, it seems that only one craftsman was making the amphoras in the 'Sculptor's workshop' at Knossos.<sup>116</sup> In other kinds of workshops there were probably more workmen present. More than two people have been assigned to the bronze workshop at Mallia,<sup>117</sup> as well as to most of the pottery workshops.

At this point we should note that the term 'specialized' refers to people who had experience in some specialized kind of work, and not to a craftsman whose full-time permanent occupation was that work. The existence or not of specialists has been recently discussed for the case of Minoan Crete by several scholars.<sup>118</sup> Moreover, it has been supposed that each craftsman practised at different times or even simultaneously more than one craft.<sup>119</sup> Consequently, it is not surprising that, in some cases, the carpentry and stone workshops have been found together, since the carpenter and the stone-vase maker could be the same person. For example, the carpenter's tools found together with tools for stone, which had fallen in the short



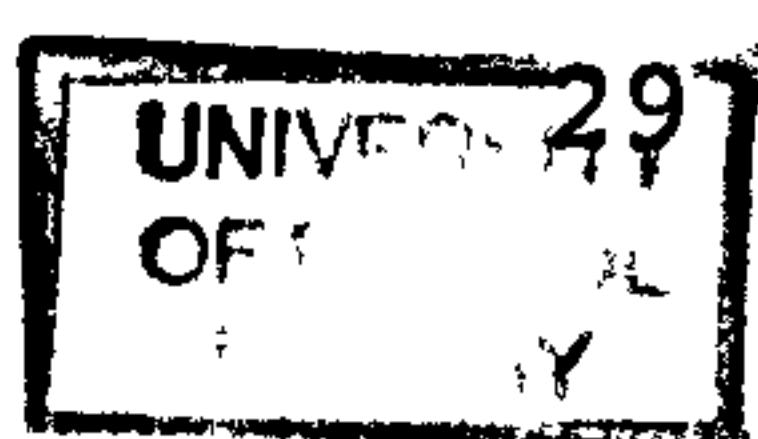
corridor beside the Lustral Basin at the palace of Zakros (XXIV), probably belonged to one workshop and might have been used by the same person.<sup>120</sup>

3. 'One or more categories of object'. It is reasonable to suppose that a specialized craftsman could produce objects in a variety of ways: by working continuously at one object, e.g., a stone vase, from start to finish, by working at several objects to bring each to the same partly finished state, then reverting to the first object and bringing the whole group to a finished state in turn, or by using either of these methods but with intervals in the work, during which other objects could be made or other tasks performed. In instances when unspecialized individuals may have made an object for personal use, the area which was used for working should not necessarily be considered a workshop. For example, many places were used for the production of obsidian blades, but were not the location for continuous production. In House Δ of the SW hill of Zakros an isolated unfinished seal from a black stone was found, which had broken during the drilling of the suspension hole.<sup>121</sup> Apart from this seal there was no other indication that a sealmaker's workshop functioned in this place. The unfinished seal itself indicates probably that it was in process of manufacture in the place, the quality of the manufacture, on the other hand, would suggest rather an unspecialized worker.

Furthermore, the similarity of objects manufactured in a single workshop is not always to be expected, since as was mentioned above, a craftsman could be specialized

in different crafts. Sometimes a completely different technique was used for each craft. So, in the workshop on the upper floor of the palace of Zakros, besides stone-working, bronze-working activities were probably taking place.<sup>122</sup> In the NE building at the palace of Pylos, the manufacture of bronze arrowheads was probably done in the same room where the ivory was carved.<sup>123</sup> Nevertheless, in some cases the possibility that two or more craftsmen, each with his own specialization, worked in the same area cannot be excluded. For instance, this view has been favoured for the workshop under Polythyron III, 7 in the palace of Mallia.<sup>124</sup> In such cases, we should accept that two different workshops were housed in the same area.

Somewhat different was the case in which the work did not demand unique or very limited specialist knowledge, but was connected with the needs of a wider social group. In this category the installations connected with agricultural production are principally included. Areas with such installations could be characterized as workshops, though the work was not necessarily done by specialized persons in rooms destined for only one function. Usually, the most spacious areas of the ground floor were used for such working activities, while, simultaneously, other domestic activities were taking place in the same rooms.<sup>125</sup> It is probable that the activities connected with agricultural production were done in every case by groups rather than by individual workers; the character of these groups cannot be determined before a more systematic study of the Minoan social





organization takes place.

Now that we have determined what we will consider to be a workshop, we can define necessary features for the identification of these workshops. Thus, in a workshop one expects to find the following features:

1. Raw materials. Usually the raw materials were stored in the workshop area. It is also possible that they were stored in a neighbouring room, as in the case of the Spartan-basalt blocks in the 'Sculptor's workshop' at Knossos.<sup>126</sup> There, the workshop was on the upper floor while the basement was used as a storeroom for other raw materials which probably were to be worked in the workshop. The raw materials were usually stored in the workshop area itself, either because there was no separate storeroom, or because the raw material was needed ready at hand. So, in the workshop of Polythyron III, 7 at Mallia, many unworked blocks from various stones were found in the workshop area, as well as stone moulds. In Room XLIV of the South Wing of the palace at Zakros, an unworked lump of rock crystal was found together with finished objects from the same material.<sup>127</sup>

On the other hand, the raw materials, if rare and precious, were often stored in secure areas of the palaces. For instance, the bronze ingots of the palace of Zakros were stored for security in a storeroom on the upper floor of the West Wing, at a distance from the place where they would be melted for casting into objects.<sup>128</sup>

2. Unfinished objects. In some cases, the discovery of even one unfinished object is sufficient for the identification



of the area as a workshop. If this object is a stone vase, it is reasonable to suggest that it had been carved in situ. However, there are cases in which one could not say whether the object was unfinished or simply damaged. For instance, fragments of damaged bronze vases have been considered as parts for the assembling of other bronze objects on the upper floor of the West Wing of the palace of Zakros.<sup>129</sup> We should not exclude the possibility that such pieces have been broken off from the original objects. A similar difficulty exists for the identification of amorphous bronze sheets which have been found in many sites, as in Rooms 98 and 99 of the 'Workshop', at Pylos.<sup>130</sup> Moreover, there should also be taken into consideration the instances where the makers themselves discarded unfinished objects. In these cases, it is possible that the discarded objects will be found as part of the waste material, or even as an accidental find among the contents of a room. Nevertheless, partly worked pieces of precious material could be temporarily stored. Such an explanation has been considered for the partly worked semi-precious stones of onyx and agate found in the House of Cadmos by Keramopoullos.<sup>131</sup> Once more (as has been previously discussed), the possibility of the manufacture of an isolated object by an unspecialized craftsman for personal use should not be excluded.

3. Waste material. The identification of waste material coming from a workshop is rather difficult. Most of the time the waste material was discarded after the completion

of the work. Furthermore, it may frequently have escaped the attention of the excavators. So, there is no mention of waste material in the 'Sculptor's workshop' at Knossos, in the stone workshops of Mallia, or in the workshop of artifacts in Room XLIV of the palace at Zakros. A waste material frequently discovered is obsidian flakes. Nevertheless, during the Late Minoan period, obsidian was not usually worked in specific areas; in this case, the waste material does not form a special feature for the identification of a workshop. In some cases, the waste material is distinguished with difficulty from the fragments of a damaged object. So, often the excavators referred initially to waste material, but subsequent detailed analysis did not support their view. The ivory chips found in many sites are usually described as waste material, though most of the time they have come from damage to finished objects.<sup>132</sup> In the case of bronze, material which does not possess the features of a finished object has been systematically studied only during recent years. In most of the cases, waste material coming from bronze-working has been identified as such and, through the detailed study of the technology itself, it has been possible to determine at what stage of the manufacturing process it was produced. Moreover, a terminology for the different kinds of bronze waste material is today used.<sup>133</sup>

On the other hand, lumps of unidentified material previously interpreted (due to their similarities with them) as slags, are today usually submitted to chemical

analysis which shows in detail their real composition.<sup>134</sup>

In the case of the pottery manufacture possible flaws were usually discovered after the firing stage when the objects were essentially finished. Consequently, pottery wastes were usually found in areas where there were installations for the pottery's firing, such as of Silamos<sup>135</sup> or the H. Triada kiln.<sup>136</sup>

In other cases, one cannot find or identify the whole waste material. For instance, in the process of the pottery manufacture, the identification of unused clay or remains created during the final polishing is practically impossible. Moreover, in cases in which the raw material was precious, as in the case of gold, the waste material was usually collected by the craftsman to be used for the manufacture of another object. This was also the case with bronze, since fragments of damaged bronze objects were sometimes used as raw material for a new process of manufacture.<sup>137</sup>

Similarly, the identification of waste material coming from agriculturally oriented activities is also very difficult. In some cases the chemical analysis of some remains found in a close association with such activities offers evidence for the type of the production.<sup>138</sup> Elsewhere, perishable material has not been preserved either as waste or in the form of an unfinished object. This happens in the case of the carpenter's workshops (which may have been identified only if quantities of burnt wood were found in the workshop), the textile workshops and the tanneries.



4. Tools. The occurrence of tools is more frequent than that of waste material, since they were of durable materials, bronze, bone or stone. In spite of their relative frequency, one can easily observe that tools for specific working activities have been rarely found in what on other grounds may have been a workshop for such activities. In the majority of cases, not even one tool has been found,<sup>139</sup> while in other instances some uncharacteristic or unspecialized tools found in a workshop could be connected only with difficulty to the specific activity taking place in that area.<sup>140</sup>

This notable absence of tools from identified workshops is probably connected with their value. If the workshops did not belong to the final stage of the area's habitation, the residents collected the tools, either for further use elsewhere or for remelting, if they were from bronze. Even when the workshop belonged to the final stage of the area's habitation, it seems that the craftsman stored the tools separately in a secure place. Perhaps this was the reason why bronze tools are usually found in hoards, stored in a specific area. Moreover, there is a possibility that the craftsman may have hidden his valuable tools during absence.<sup>141</sup>

Besides bronze tools, moulds for the tools' manufacture or for making small artifacts of various materials were considered valuable. So they were also stored separately when not in use.

Tools of stone (whetstones, wedges, rubbers, millstones and pestles) were not valuable but do not offer

satisfactory evidence for the identification of an area as a workshop, since they were destined for everyday uses. Bone tools also offer only unsatisfactory evidence for the identification of a workshop, since they were easily made and were not very specialized. In many cases, as has already been discussed,<sup>142</sup> the tools were transported to different places when a need arose. As has become clear, the discovery of tools alone in an area is not strong evidence for its identification as a workshop. Moreover, despite the usual specialization of Minoan tools,<sup>143</sup> in some cases these are <sup>not</sup> made for one exclusive function. Consequently, it is possible that a group of just two or three general tools will not offer significant evidence for the type of workshop to which they belonged. However, in the case of agricultural activities, the large, characteristic installations which comprised the principal equipment of the workshop, could be considered as tools. In this category belong the wine- and oil-presses, the oil-separators, the millstones and rubbers. When the installations were massive or built (wine- and oil-presses), they should be considered as permanent equipment of the area, which was necessarily used as working area. The presence solely of rubbers, grinders and millstones, since they are easily manufactured and transported, cannot always safely identify an area. For example, it is possible that the area in which these tools were found was used for their storage or even their manufacture.<sup>144</sup> Elsewhere, they could be used for small scale household activities.

Other installations used for the manufacture of objects or raw materials were the kilns. The presence of a kiln defines the area as a working place. In the case of pottery kilns, we would expect to find clay or stone potter's wheels in close proximity. In fact, it appears that the potters usually took their portable tools home with them, so they have often been found in storage.<sup>145</sup>

From the textile industry only the clay or stone loomweights have been preserved. Generally, their discovery proves the existence of looms; nevertheless, looms could function in various areas, not easily identified with workshops.<sup>146</sup>

5. Other additional equipment. A room used as a workshop should also contain auxiliary equipment. Unfortunately, a large part of such equipment would be of wood, and thus has not been preserved: working tables, stools and benches, shelves for the placing of the materials and the finished objects and probably wooden chests for the storage of tools. In some cases, built benches along the walls would be used for sitting for the workmen or the craftsmen.<sup>147</sup> In other cases, the hypothetical location of the wooden equipment can be determined in the workshop area. For instance, in the Workshop of the Shrine (XXVI) at the palace of Zakros, three rows of irregular slabs probably supported a low wooden platform which was interpreted as a working table.<sup>148</sup> Other equipment included various auxiliary pots which contained useful materials or simply water. For instance, in a stone workshop one would expect to find a pot for the abrasive powder and amphoras or



basins for the water, things needed during the process of manufacture.<sup>149</sup> Nevertheless, since these pots did not have specific features, they are distinguished with difficulty from other pottery, unrelated to the workshop.<sup>150</sup>

In some cases, produced goods could have temporarily been stored in the workshop area itself. For instance, in Room XLIV of the Zakros palace, finished objects from rock crystal were found alongside a lump of similar raw material. Nevertheless, finished objects alone are not a positive indicator of a workshop area, though their presence could confirm the identity of the space.

It would be especially satisfactory if in every case of the identification of a workshop all the above mentioned criteria were satisfied. However, in most cases, a researcher is compelled to suggest the use of an area as a workshop, having only a few pieces of evidence. This is the reason for the careful evaluation of these factors by themselves, as well as in combination with each other. In the case where we have to deal with only one of the features, unfinished objects and waste material could be considered the more significant. The unfinished objects, generally, could identify a workshop since in the case of their temporary storage it would not make much sense to transport them elsewhere. Thus for the unfinished amphoras of the 'Sculptor's workshop' at Knossos, it has been suggested that they were made in situ, despite the lack of any additional supporting evidence. In the case of the manufacture of

small artifacts, temporary storage in chests should not be excluded; most probably they were stored in the workshop area itself.<sup>151</sup>

The presence of a large amount of waste material concentrated in one place, even if no other factors exist, suggests work on the spot. Here, we should take into account any case when waste material was discarded in fills or pottery deposits.

Raw materials will probably identify a workshop. If they were not stored for security elsewhere, raw materials are usually found in the workshop, ready to be processed by the craftsman. We should note once more that several kinds of raw materials, being perishable, will not have survived.

Tools, when they are found isolated, are not considered sufficient evidence for the identification of a workshop, with the exception of permanent equipment associated with agricultural activities. The unsatisfactory evidence provided by the tools results from the fact that they can be easily transported or stored away from the workshop area.

Finally, finished objects and additional equipment can be considered evidence, but only in combination with another indicator.

Classification of workshops  
based on the result of production

The classification of workshops in the three general categories which follow is based on the result (object) of production.

- A. Workshops producing objects.
- B. Workshops producing food.
- C. Workshops producing cosmetics and medicines.

In the workshops of Category A various objects, vases and pots of ordinary or ceremonial use, furniture and other equipment of houses and palaces, dress, jewellery and weapons were made. Moreover, tools were produced and raw materials were further refined; these tools and materials could also be used for the manufacture of other objects in other workshops of the three categories.

In the workshops of Category B quantities of basic foods, which usually exceeded the needs of a small group of people, were produced. The areas in which these basic foods were used for the preparation of meals should not be considered workshops but kitchens.<sup>152</sup>

Each category includes workshops which processed different materials.

Category A

- a. Workshops working in stone.
- b. Workshops working in clay.
- c. Workshops working in bronze and lead.
- d. Workshops working in various other materials.
- e. Workshops working in leather, wool and flax.



f. Workshops working in wood.

g. Workshops for working lime and pigments.

Each of the above types in turn include some more specialized workshops. In type 'a' we classify all workshops for the making of stone vases and tools, workshops for seal-carving, obsidian workshops and workshops for the preparation of building materials.

In type 'b' we will classify workshops for the making of pottery and of figurines.

In type 'c' we will classify specialized workshops for weapon production, as well as workshops for metal vessels.

In type 'd' we have workshops specialized in faience, ivory, bone and glass. In this type also belong the specialized workshops for jewels of semi-precious stones and gold.

In type 'e' we include workshops for weaving and making dresses and workshops for working leather. Specific workshops for weaving baskets and shoemaker's workshops are also classified.

In 'f' we have the carpenter's workshops. Probably specialized workshops for preparing wooden building material should be included.

In 'g' we classify kilns for the extraction of lime and workshops for processing of pigments.

### Category B

a. Wine-presses.

b. Oil-presses and separators.

c. Workshops producing flour. The areas where the grinding of cereals or similar activities took place.

d. Apicultural workshops.

e. Workshops for dairy products.

### Category C

a. Workshops for producing perfumes.

b. Workshops for producing cosmetics.

c. Workshops for medicines.

Sometimes two workshops working in the same material were occupied with different stages of the process of manufacture. For instance, bronze-working had three different successive stages. a) The smelting of the copper from the ore. This usually was done near the mines since the transportation of great quantities of ore was pointless. In some cases, probably this first stage of working was done outside Crete and consequently had no connection with the Minoan workshops, which, during the Late Minoan period, took the raw material in the form of ingots. b) The melting of the copper or bronze was done in the kilns, and after the desired alloying with other materials, the mixture was poured into the moulds. c) The hammering and the finishing of the objects was done in the bronze-smith's workshops. In the same workshops the assembling of the different parts in the cases of compound objects took place.

Distinct stages in the manufacture of faience in different workshop areas have also been suggested. During the first stage, the material was poured in moulds, then it was fired in kilns and lastly the finishing touches would be given, probably once more at the first working area.

Unlike faience, all the stages of pottery manufacture should be done in adjacent areas. We have no reason to

postulate the existence of distinct steps in the manufacture of stone,<sup>153</sup> wood and ivory.

In spite of the fact that the different stages of oil production should be done in the same area or in neighbouring ones, nowhere in Minoan Crete have the corresponding installations been found in a close association with them. In some cases the oil-presses have been found, in others the oil-separators. Perhaps the two main stages of production were done in adjacent areas, but such a hypothesis has not yet been proven.



## CHAPTER III

### THE ZAKROS WORKSHOPS I

#### Materials and Tools

##### A. Materials

##### 1. Obsidian (O. cat. nos. 1-437, figs. 36-55, pls. 1-3).

The great amount of obsidian which has been found scattered on the palace and town area at Zakros suggests that this material was locally worked and that it remained important at the site during the Middle and Late Bronze Age. More than four hundred blades, cores and flakes of obsidian were found in the palace and town area; the material was used principally for the manufacture of small knives and razors. Four-hundred and thirty-seven (437) pieces of obsidian (blades, cores and flakes) have been studied and are included in this chapter.

##### a. The material

The type of material used for the manufacture of small tools<sup>1</sup> comes from Melos, with one possible exception (cat. no. 426). One may notice the variety in the quality of the different specimens. The colour ranges from a grey, grey-black, to black. Some pieces are not especially glossy, while some others present an impressively glossy surface. In some of the pieces, the natural veins of the material are easily discernible, and sometimes the thin edges of the blades or flakes are transparent.

From the material studied (437 pieces) 221 were blades (50,47%), 209 small or big flakes (48,05%) and six were cores

(1,14%). One could add one specific cutting tool which was formed after a secondary trimming on a flake (0,22%) (cat. no. 228, fig. 46, pl. 1).

#### 1) Blades

The preferred type of blade at Zakros was apparently the trapezoidal blade. From the 221 blades, 130 are of the trapezoidal type (58,82 %), eighty-one of the triangular-section type (36,65%), two have four facets on their one side (0,91%), one six facets (0,45%), while seven more specimens have a roughly worked upper surface (3,17%).

The preserved length of the Zakros blades does not exceed 5 cm. and in most cases the blades are 2-3 cm. long. The longest triangular-section blade is 5,5 cm. (cat. no. 58), while the longest trapezoidal one is 5,2 cm. long (cat. no. 86). The widest blade is trapezoidal and is 1,8 cm. wide (cat. no. 146). The narrowest triangular-section blade is only 0,47 cm. wide (cat. no. 36), while the narrowest trapezoidal blades are 0,5 cm. wide (cat. nos. 174, 176, 203).

Great variety is found in the forms of the blades. Some of these are more or less regular with parallel facets, but others present a more irregular upper surface with edges which usually intersect each other. Sometimes, between the two principal facets of the triangular-section blades a narrow secondary facet appears, which does not extend from one end to the other (e.g., cat. no. 25). Usually, a kind of tip which tapers and is slightly raised is formed at one end, while a small bulb is shaped on the corresponding lower surface (e.g., cat. no. 134). This tip is formed on the

opposite end from that on which the blow of the flaking tool is struck; this feature is due to the stresses built up along the blade during the fracture. Sometimes, similar stresses create a slightly curved blade.

The specific form of some particular blades suggests a different use. For instance, one blade has an S-like form (cat. no. 77). Despite the fact that this form suggests a blade worked on one edge only, traces of a secondary trimming, which would make the other edge blunt, are not discernible. Some pieces with pointed end were probably used as small punches though the material is not very suitable, since it easily fractures.

In a few cases only traces of secondary trimming can be observed. In seven cases the blades have a roughly worked upper surface, which is a process of work probably made by the pressure-technique<sup>2</sup> after the initial shaping. In three cases (cat. nos. 48, 50, 59) one of the two upper facets of triangular-section blades was roughly worked out in the same way. One blade (cat. no. 156) presents thin denticulation in one edge, probably created by secondary trimming (or is the blade worn because of its long use?).

Apart from the triangular-section and trapezoidal blades there are two with four facets on one side and one with six facets. The last one (cat. no. 215) could be considered as the remaining piece of a core, though its form suggests a use equivalent to the use of the blades.

Blades were usually used as small knives or razors, although their use as punches cannot be excluded for some specific cases.



## 2) Cores

Despite the fact that the percentage of blades in the total number of obsidian pieces is especially high, only a few cores, from which the blades have been detached, were found. The six cores found are relatively small, the longest only 3,2 cm. (cat. no. 226). From two other specimens only a fragment has been preserved (cat. nos. 224, 225), while another is impressively small (cat. no. 227) proving that the material in this case was economically used. Two more specimens (cat. nos. 223, 225) present one completely unworked surface, while their opposite side consists of the segments of five detached blades.

In two cases cores, or pieces of them, were finally used as small tools. In the first instance a piece of the core was transformed, by flaking, to a blade with six facets on its one side (cat. no. 215), and in the second a core with a tapering end was probably used as a small punch.

## 3) Flakes

The flakes studied belong to the two following categories.

a) Big unworked pieces (more than 2,5-3 cm. long), which were detached at a first stage of working and which could be further used for making blades or other small tools. They form 12,85% of the flake assemblage.

b) Smaller irregular, multi-faceted flakes detached either at a first stage of working of the core, or at a later step, during the shaping of a flat striking platform from which the blades could be detached.<sup>3</sup> They make up 87,15% of the cases. In some cases these flakes were

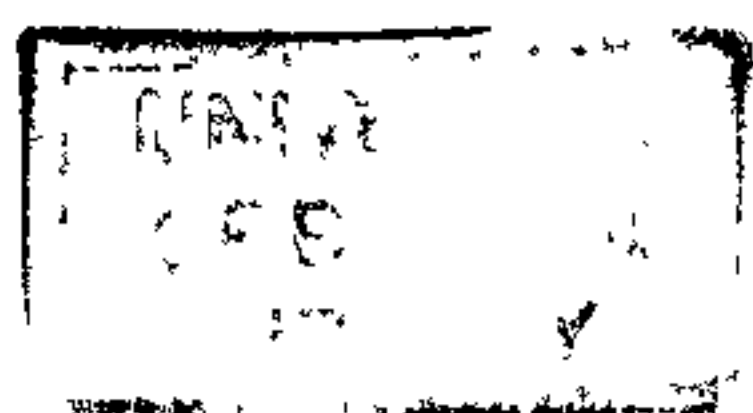
probably used as small tools (cutters), or arrowheads (cat. no. 326?).<sup>4</sup>

The largest flake (cat. no. 299) is 6 x 3,8 cm. and 1,54 cm. thick. The great variety of forms and sizes of flakes does not permit their further classification. However, many of them present some common features, such as a single bulbous facet in one side which has been formed during the fracture, while the other side consists of irregular facets. Twelve flakes (5,71% of the total) show concentric traces on their multi-faceted side; these traces are created also during the fracture and prove that other flakes have been previously detached from these particular points.

Traces of secondary trimming for the manufacture of more specific tools are rare. One could refer to one specimen (cat. no. 326), in which the pressure technique was used for transforming the flake into an arrowhead. More characteristic is the case of another flake (cat. no. 228) which has been transformed into a small tool-cutter, since its one end presents three teeth.

#### b. The trimming

As has been already discussed, blades are the most favoured type of obsidian tool in Zakros. From the various specimens it becomes clear that the inhabitants of Zakros had great experience in blade manufacture, based probably on a long tradition. The elegant blades, the technique and the variety in forms support this view. On the other hand, the fact that the craftsmen manufactured almost exclusively this specific tool is negative evidence for a more specialized industry. However, this limited production is probably



not due only to the lack of experience in the manufacture of other types of tools. The material was imported and consequently rare and this is probably the reason for which it was not used for the manufacture of other common tools (besides blades). Perhaps some other materials, such as bone or bronze, were preferred for such manufacture; the first of these (bone) because it was ready to hand, and the second (bronze) because it was more permanent.

It seems that for blade manufacture the blade-flake technique was once more used,<sup>5</sup> while for the secondary trimmings the pressure flaking<sup>6</sup> technique was used.

c. Attempt to identify an obsidian workshop

A significant observation on the study of the material from Zakros is that there is no concentration in particular areas. In some cases, the material was found in relatively dense quantities, but they are much lower than those which were found in obsidian workshops of Knossos, Mallia and Khandia, and cannot support the hypothesis of organized production in particular areas. The scattering of the pieces is very similar in palace and town, which shows that the material was moved without control by the central authority. Of the 437 pieces studied, 201 come from the palace (45,99%). Of these, 98 are blades (48,76%), 99 flakes (49,76%), two cores (0,99%) and there is also one specialized tool (0,49%) (fig. 1).

From the above percentages, it becomes clear that there is no one particular area in which the material was worked or distributed, as was the case with other imported materials.<sup>7</sup> In an attempt to identify a particular area



in which the obsidian working took place, let us look at the West Court of the palace area, just to the west of the neopalatial facade, where one notices a small concentration of material (see Plan).

There, forty-one obsidian pieces were found together, in two groups. Twenty-five of these are flakes and six are blades. The two groups were found in the following areas:

1) in the area of the protopalatial multi-sided construction: 18 flakes and 6 blades.

2) in the area to the north of the neopalatial drain, under the pavement of the neopalatial court: 7 flakes.

It is very difficult to connect these two groups with any well defined architectural construction; in addition, the material seems heterogeneous. The quality of obsidian differs from specimen to specimen and the absence of any core from which the blades could be detached is negative evidence for the identification of a workshop. It is most probable that we have to do with filling material, though the presence of a number of pieces found close together perhaps indicates that the material was worked somewhere in the neighbourhood.

On the other hand, one must take into account that the layers in which the above described material was found probably belong to the protopalatial period, since they were under the neopalatial floors, as in the case with the West Court or the Building to the north of the Harbour Road. This probably means that the significance of obsidian diminished when other materials were preferable for the manufacture of tools. On the other hand, the increased experience in the working of obsidian probably played a part in the

disappearance of the early and small number of specialized workshops and in the wider distribution of obsidian working on a less intensive scale in the town. This view explains the dispersal of the material to every part of the Zakros palace and town, since everyone could work wherever he wanted a limited amount of material according to his needs. In any case, the dispersal of the material has increased because of the artificial fillings created by the transport of soil from elsewhere to where it was needed and through any post-depositional modification. This fact makes the dating of the material difficult; for instance, even if it has been found in neopalatial floors, it was probably transported there together with the soil for filling the substratum of the floor. So, the date of the Zakros obsidian before the publication of the contextual material is very difficult. Let us only note that there is a density of material in areas and layers of proven protopalatial use, while only in a few cases (such as the case of the paved lightwell of the Hall of the Ceremonies), could the material be securely dated to the phase of the final destruction of the palace, namely to the LMIB period.

## 2. Steatite (S. cat. nos. 1-115, figs. 56-73, pls. 4-8).

The identification of possible workshops for steatite<sup>8</sup> emphasizes the significance of the material in Zakros. Apart from the heaps of unworked steatites coming from the workshops already described, ninety-five more pieces, which have been found scattered throughout the palace and town, were separately studied. In this chapter, the material which has been attributed to the workshops has also been

included, in order to have a complete picture of the working of this particular stone.

a. The material

The source for the Zakros steatites has not yet been identified. None of the known sources of the material<sup>9</sup> lies in the immediate neighbourhood of the site, while chemical analyses have not been done to prove if there is any connection with any of these. Although the Zakros material varies as regards its colour and texture, one can easily distinguish two main groups on the basis of these particular features.

1) One kind of grey-bluish to black steatite with discernible veins of other materials. This is the type of material in thirteen of the fourteen heaps of steatites attributed to possible workshops. On the exterior, the pieces are almost rough, with a not very glossy texture and usually with thin white patches; sometimes in their interior they have an olive-<sup>green</sup> colour. On many pieces there is a big white section which gives the impression that these sections belong to veins of another material (cat. nos. 13, 15, 17, 18, 19). In most of the unworked pieces veins of other materials and principally of serpentine are easily discernible.

2) One of the heaps connected with the workshops and a great number of the peculiar prismatic steatites belong to a different kind of the same material with soap-like texture, olive-<sup>green</sup> coloured to green, without veins of other relative materials.

Some examples with other colours are present:



two of the prisms are almost blue (cat. nos. 64, 65), and two or three small unworked pieces are closer to red. Of the 95 isolated pieces studied, 26 had olive-<sup>green</sup> colour (27,36%), 50 dark blue to black (52,63%), 15 brownish with shades which ranged from green to reddish (15,78%), and 3 grey-blue (3,15%). From the unworked pieces 55,81% have dark blue to black colour and almost 23,25% olive-<sup>green</sup> and from the worked specimens 50% had dark blue to black colour and 30,76% olive-green.

The material can be divided into two categories: 1) unworked pieces and 2) pieces that were worked by rubbing. The unworked pieces comprise most of the material, since over 56 kg. of such pieces were found mainly in the West Wing of the palace, probably stored in the workshops.<sup>10</sup> Only one heap of unworked pieces (cat. no. 13) was found in a house in the town. On the other hand, in Workshop  $\Phi$ , to the east of the NE gate of the palace,<sup>11</sup> a great number of partly worked steatites was found together with some unworked pieces, but this quantity does not surpass 550 gr. and is much smaller than that of the unworked material.

Of the remaining 95 isolated pieces which have been studied, 43 (45,26%) are unworked pieces and 52 (54,74%) are pieces with traces of simple working by rubbing.

The unworked pieces have various forms and sizes. Large pieces usually occur in the heaps of unworked material, but are rarely found isolated, at a distance from the workshops. The largest isolated piece was only 4,4 x 4,0 x 2,77 cm. (cat. no. 46), while the largest piece which was found in a heap of material was 12,1 x 8 x 6,6 cm.

The material is soft and does not have finished edges, and it is easier to cut it than to flake it. So the pieces usually have a curved surface and sometimes a more or less globular form, while oblong forms are also present (e.g., cat. no. 86).

Sometimes in the interior of the piece one can observe some deep, almost parallel grooves, which resemble traces of a comb-like tool. It is most probable that these particular grooves have been created accidentally during the cutting of the large pieces to smaller ones.

Apart from the completely unworked pieces, a great number of pieces present traces of rudimentary working. The latter consists of some very thin incisions in the same direction, created undoubtedly by rubbing the piece upon a harder material. This is the only kind of working observed in these pieces.<sup>12</sup> Most of them have a prismatic oblong shape; 34 of the 52 worked specimens (65,38%) are of this particular form. Apart from this, one can distinguish a few other forms.

a) Triangular form with one or two parallel sides worked by rubbing (cat. nos. 59, 99, 102).

b) Parallel-sided form with blunt edges, almost cylindrical (cat. nos. 106, 108).

c) Disk-shaped form, worked by rubbing on both sides (cat. no. 100).

d) Multi-faceted irregular form with discernible facets, with traces of rubbing (cat. nos. 109, 110).

e) Completely irregular form, with a few traces of rubbing at least on one place (cat. nos. 61, 105 and

some of the pieces which have been included in Group B of cat. no. 67).

The length of the prismatic oblong steatites varies from 2 to 3,7 cm. (cat. no. 67, Group A<sub>2</sub> the second specimen), while their maximum width does not exceed 1,3 cm. (cat. no. 65).

Two or three pieces have some polished surfaces, without the characteristic incisions described above (cat. nos. 86, 97, 110, 112). Certainly, in these cases, another method of working was applied, probably by using a polishing agent or a specialized tool. In the particular case of a large, partly worked piece coming from Workshop  $\Phi$  (cat. no. 47), the worked flat side bears marks in two places which form angles in succession and suggest the use of a specialized tool with a triangular point.

#### b. Workshops and scattered material.

Six possible workshops for steatite have been identified in Zakros.<sup>13</sup> These identifications were based principally on the concentration of the unworked or worked material in particular areas. Of these workshops, four are hypothetically placed on the upper floor of the West Wing of the palace, one just outside its NE gate, and one more in one of the buildings on the SW hill. The greatest concentration of material inside the palace is very characteristic: thirteen of the fourteen groups of unworked steatites (about 55 kg.) were found in the palace, and only one in the town (1.65 kg.). On the other hand, a great number of worked pieces were found together in a workshop located outside but close to the palace.



The concentration of this particular material in the palace, which is probably due to its rarity or to centralized industrial production, is confirmed by the study of the remaining, scattered material. Of 95 pieces studied, 63 come from the palace (66,31%), and 32 from the town (33,69%). Of the unworked pieces, 55,81% were found in the palace and 44,19% in the town, while of the worked pieces 75% comes from the palace and 25% from the town (fig. 2).

In addition to the West Wing of the palace, a remarkable concentration of material can be noticed in its South Wing also. From the total of 95 scattered pieces, 27 (13 unworked and 14 finished) were found in the South Wing and the area around it (28,42%). In this case, the existence of a separate workshop for steatite cannot be proved, although the presence of other workshops in the same area suggests occasional working of isolated pieces of this particular material in the same places.

#### c. Use and date

The use of the small peculiar prismatic steatites and the presence of a great amount of unworked material remain problems without any satisfactory solutions. Equivalent quantities of this material have not been identified in the other palatial centres or settlements, and the type of object is exclusively confined to Zakros.

Apart from the manufacture of the prisms the material was probably used for making small artifacts or seals, though such objects are rare at this site (cat. nos. 113, 114, 115).<sup>14</sup>

From the above discussion, one could conclude that

the great amount of unworked material found in the West Wing of the palace was intended exclusively for the manufacture of prisms. Such a hypothesis cannot be accepted without reservation, since the finished product does not exceed 1% of the total material (unworked and worked).

The date of every isolated piece presents the same difficulties as for obsidian (see above). Only the bigger groups could be dated with some security. The thirteen groups of unworked steatite found in the palace belong to type '1' of the material and are easily dated to the final period of the palace, namely LMIB. On the other hand, a group which was found in Building Z at the SW hill and the steatites coming from Workshop  $\Phi$  are dated to the LMIA period.<sup>15</sup> As has already been suggested, this could mean that two different veins of steatite had been mined, in two different periods (probably in LMIA and LMIB).

The above conclusion is confirmed by the apparent dating of the isolated pieces. Of the twenty-three pieces which belong to type 2 (with olive <sup>green</sup> colour), thirteen should be dated to LMIA at the latest, for seven the date cannot be defined, while only three can be dated, with some reservation, to the LMIB period.

3. The working of other stones at Zakros (Oth. St. cat. nos. 1-18, figs. 74-78, pls. 10-11.

Apart from obsidian and steatite, only a few other stones were worked at Zakros.

#### a. Flint

Only a few pieces of flint have been found at the site. Of the six pieces studied, four are small unworked cores or

flakes, one had been shaped into a small, almost triangular, blade, and from one an arrowhead was made.

The material is usually flaked creating edges, and it varies in colour from honey-coloured (4 examples) to grey and blackish. The material is sometimes transparent, as in the case of the blade thin edges (cat. no. 2). The dimensions of the unshaped piece (cat. no. 4) are 2,5 x 2,5 x 0,82 cm. No trace of secondary trimming was noticed in these specimens.

It seems that flint was rarely used for the manufacture of small tools or arrowheads, as was proved by the finding of only one arrowhead flint in the West Wing of the palace. The type of the arrowhead (cat. no. 6) suggests a process of working with specialized tools for the shaping of its delicate form, while the pressure technique was probably used for the better working of its rough surface.<sup>16</sup>

Of the six examples of flint, four come from the palace.

#### b. Whitish limestone

Eight pieces of whitish limestone were found in Room XXVI of the West Wing of the palace (cat. no. 8). The material is fragile and flakes easily. No other trace of the same or equivalent material was found elsewhere at Zakros.

#### c. Veined marble

A big, half-sawn block of veined marble was found in Room XLIII of the South Wing of the palace. Also, two small pieces of black marble-like stone with parallel white veins come from the palace.<sup>17</sup> Both pieces are small (cat. nos. 9, 10), unworked, with almost flat surfaces.



#### d. Flint-like material

Two unworked pieces from a not easily identified flint-like material should be added. One of these (cat. no. 7) is greenish and forms edges on its rough surface. The second (cat. no. 13) is irregularly pyramidal in form, with two of its facets broken, and is blackish in colour. Neither piece has any trace of secondary trimming.

#### e. Other types of stone

A depressed globular bead of blackish stone (cat. no. 12), a roughly worked blade from a grey stone (cat. no. 14), and a small stone disk (cat. no. 13) complete the picture of stone uses for the manufacture of small artifacts and tools.

Nine of the above pieces were completely unworked, two were shaped into blades, one was disk-like, one was an arrowhead, and one a small bead. Apart from the flint, which more usually occurs in the palace, the other materials were rather scattered throughout the whole site. The material offers little information on methods of working which seem to have been comparable to those for obsidian.

Apart from the manufacture of small tools and artifacts, various kinds of stone were used for big objects and vases. Two large pieces of a blackish serpentine which were considered as partly worked<sup>18</sup> (cat. nos. 16, 17) because they present one curved side and another completely rough, are probably fragments of finished stone objects.

One piece of a stone vase, probably from a cup, made of a brown steatite with a number of incisions on the interior and exterior surface is included in the catalogue

(cat. no. 18). This vase was probably not yet completely polished since one can still see the incisions created by the use of a polishing agent.

4. Stones with a segment cut out by a drill (S.w.S. cat. nos. 1-20, figs. 79-84, pls. 12-15).

A specific category of stone objects consists of stones with roughened surface and a segment cut out by a drill. Warren,<sup>19</sup> studying briefly their use, considers that they were used as wedges to keep the hollow drill straight to the interior of the stone vessels during their manufacture. As the drill worked downwards it removed an edge or segment of inserted stone along with the host rock of the vessels. From Zakros twenty more examples were studied, coming from the town and palace.

a. The material

Of the twenty stones studied, ten have an almost globular form, three are flattish, five are large and irregular, and three are only fragments (consequently, it is difficult to speculate about their original form). Only two of the twenty examples (cat. nos. 1, 2) have one hole which is preserved in its entire periphery, almost cylindrical, which is pierced through the middle of the stone. In one instance the hole did not go through the lump, as is shown by a small piece preserved on the bottom of the hole (cat. no. 10). The dimensions of the two largest stones are 12,5 x 12,5 x 7,5 cm. (the first one weighs 1,730 kg. and the second one 1,900 kg.).

The hypothetical diameters of the almost cylindrical holes have been estimated at 2-3,5 cm. (cat. no. 3: 3,5 cm.).

The longest hollow is 9 cm. long (cat. no. 12).

Almost in all cases the stone used is serpentine. Twelve of the specimens (60%) have a green-black colour, four are grey-black, and four are black.

b. The distribution of the material and its possible use

Of the twenty cases, only four come from the palace (20%), thirteen are from the town (65%), while three more were found in the filling of the East Wing of the old palace. However, only eleven of these come from stratified deposits. All the others were found in rubble or artificial fillings.

Three examples from the palace (cat. nos. 1, 2, 9) were found together with bronze hoards, belonging to particular workshops<sup>20</sup> (lapidary's and carpenter's workshops). It becomes clear that these stones had a specific function, while their preservation shows that they were to be used repeatedly. Despite the fact that the specimens could be used as rubbers or grinders (with the hollow used by the workman for a better grip on the stone during the rubbing), no traces of rubbing or grinding have been noticed on their surface, with one possible exception (cat. no. 12).

In one case (cat. no. 2), traces of oxidised bronze were observed, close to one end of the hollow. It is possible that this is the result of an accidental oxidation, since the particular specimen was found together with bronze tools.

The fact that almost all the stones belong to varieties of serpentine (a stone which was principally used for stone vase manufacture in Minoan Crete) confirms the view expressed by Warren, that the above discussed stones are related to



this particular industry. On the other hand, if they were used as wedges, it is difficult to explain the two specimens with the complete holes in the middle of the stone, which were not thrown away as useless, but were kept among the bronze tools of the workshop. Moreover, it remains unclear why a relatively rare material used for the manufacture of vessels, was preferred for making wedges.

It is also possible that those two stones which had already been taken away from the interior of the stone vessels during their manufacture, sometimes (cat. nos. 1, 2, 9) were used, as Warren considers, to help the regular rotation of the drill in the interior of stone vases. The stones might have been waste lumps from vase making, now used thus.

This view also presents a difficult point (as was the case with the previous view of wedges): namely, the presence of only one hollow on the sides of the stones, since in removing such a core from the interior of the vessel, a series of equivalent holes should be observed. In addition, the specimen with the hole which did not go through the stone, is probably waste and could not be used for helping the rotation of the drill, neither for wedging it.

If the stones discussed were actually used for manufacture of stone vases, one should accept that independent lapidaries made vessels for personal use in various areas of the town. The percentage of the stones which were found in the town is too high to be considered accidental (65%).

#### c. Date of the material

Only a few examples could be securely dated. The three pieces which were found in the destruction layers of the

palace belong to the LMIB period, while three others found in the filling of the East Wing of the old palace should be dated to the MMIIIA period, at the latest.

#### 5. Bore Cores (cat. nos. 21-23, fig. 84).

Also related to the manufacture of stone vessels are the bore cores which have been found in many of the Minoan sites.<sup>21</sup> From Zakros only three specimens can be added, all coming from the town. They are three small truncated cones. The diameter of their large base varies from 1,6-2,3 cm. (cat. no. 23) and their height does not exceed 2,6 cm. (cat. no. 21). All the specimens are of a black stone which is a kind of serpentine.<sup>22</sup> In one case (cat. no. 23), a few small white spots are discernible. One of the cones has the curved side somewhat bulbous and this shows a flexible drill, which was probably a simple hollow reed.

It is not very likely that there was any particular use for the small cones described which were probably thrown away together with other rubbish. So, their presence cannot support stone working in situ without additional evidence; however, it is suggestive of a local stone industry.

#### 6. Semi-precious Stones (S.-pr. St. cat. nos. 1-31, figs. 85-87, pls. 16-18).

##### a. The material

There are only a few indications of the working of semi-precious stones in Zakros. Apart from seal-making, semi-precious stones were used for the manufacture of beads of various shapes, for necklaces or amulets, and sometimes for the manufacture of other artifacts, as for instance,

pin-heads. The catalogue of the kind of stones favoured by the local craftsmen includes primarily rock crystal and secondarily carnelian, jasper, amethyst and lapis lazuli. Of these, quartz and rock crystal comprise 67,74%, carnelian-onyx 12,90%, lapis lazuli 6,45%, while the remaining kinds share the 12,81%.

#### 1) Rock crystal-quartz

There are strong indications that in Room XLIV of the South Wing of the palace there was a workshop working on semi-precious stones, especially rock crystal.<sup>23</sup>

Rock crystal is a kind of quartz.<sup>24</sup> It is semi-transparent and breaks into facets, usually irregular, which sometimes have the same direction (cat. no. 4). The material, although hard, can be cut by using small saws and emery or other abrasive powder for the manufacture of small luxurious artifacts and jewels. At Zakros, rock crystal is a preferred material, since apart from a relatively large number of unworked pieces eleven finished products were found, among them the famous rhyton from the Treasury of the palace.<sup>25</sup>

Of the twenty-one pieces of quartz, sixteen (76,19%) are rock crystal. The remaining five (23,81%) are common quartz, whitish, almost opaque, unworked or partly worked (cat. no. 8). The pieces of quartz do not form easily discernible facets and edges. Only one of them comes from the palace area (cat. no. 8).

#### 2) Carnelian

Of the other kinds of semi-precious stones from Zakros, carnelian is the most frequent. This material is usually reddish, yellowish with some reddish patches, or



simply yellowish. Three pieces are small beads of various forms, while an unworked piece is also included. Two of the specimens were found in the palace, the remaining two in the town.

### 3) Onyx

A large piece of a white-veined material (cat. no. 1) seems to be pure onyx. It has been worked only on one side. One end has two vertical and parallel white veins. It was found in the fill of the Central Court of the palace.

### 4) Amethyst

A small, light-coloured, purple, semi-transparent flake of amethyst forms the single specimen of this material in Zakros.

### 5) Agate

A drop-like bead is made of a type of agate which could not be identified more closely. It is veined with red, white, orange and blue patches. It comes from the north quarter of the town.

### 6) Lapis lazuli<sup>26</sup>

Two partly worked pieces of lapis lazuli of a deep blue colour come from Workshop Ø. One of them has been shaped into a small plaque, the second is oblong and broken, but resembles a triangular-section blade. Its use as a blade is doubtful because this particular material is extremely rare and precious in Minoan Crete.

#### b. Distribution of material, use and date

Apart from the existence of Workshop XLIV in the South Wing of the palace, no other concentration of semi-precious

stone in the town or the palace was noticed; seventeen pieces were found in the palace (54.83%), fourteen specimens come from the town (45,17%).

Some concentration could be observed in the South and the East Wings of the palace. In the South Wing, seven pieces were found, all of them quartz and rock crystal, five of which were found in the workshop already described. In the East Wing of the palace six pieces were found: three rock crystal, two carnelian and one amethyst. Of these, two are beads, two were used as inlays, one is unworked and one is a flake, possibly a fragment from a finished luxury object.

The above evidence does not justify a hypothetical identification of a workshop in this wing. The discovery of a relatively large number of semi-precious stones in that area confirms the luxurious character of these rooms.

Of the pieces studied, a large part (9 pieces) consists of unworked material (20,03%), while only four of the specimens are partly worked (12,90%). The rest of the material consists of finished products: eight were used for the manufacture of small beads or amulets (25,80%), five were small inlays (16,12%), four were for elegant small artifacts such as the pin-heads (12%), and one is a fragment of a bigger luxurious object (3,22%) (fig. 3).. As is well known, there is one more example of the use of semi-precious stones in Zakros, the rock crystal rhyton from the Treasury of the palace.

In conclusion, only a few semi-precious stones were used in Zakros, for the manufacture of jewels, small artifacts and luxurious vases. The most favoured of them is the rock

crystal. This last must have been imported since large cores, such as these used in Zakros, have not yet been found at the known Cretan sources.<sup>27</sup>

7. Faience (E.-I.-Gl. cat. no. 1, fig. 88, pl. 19).

The presence of a number of objects of faience in Zakros suggests that the process of working this material was not unknown at the site. Objects from faience were mainly found in the West Wing of the palace and especially in Rooms XXV, XXVI and XXIX; they were principally 'plastic' rhytons, a model argonaut and small inlays.

Room XLIV in the South Wing<sup>28</sup> of the palace was considered by the excavator and other scholars<sup>29</sup> as an area in which faience-working took place. However, the closer study of the material itself did not confirm such a view. In this room only fragments of finished products were found. They are almost amorphous because of the erosion of their surface, created during their long stay in the wet stratum. The pieces were already fired since the modelling is done before firing, which is almost the final stage of the process of manufacture.

Apart from the palace, only one building of the town (the East Building to the south of Harbour Road) furnished a group of faience objects. They are two amulets (cat. no. 1), the first one solid and ovoid, the other one hollow and almost square; in addition, there was a small elegant vase of the same material.<sup>30</sup> They come from a single room (Room B) in the west part of the building. The probability that a faience workshop was located in this particular area is slight since there is no additional evidence to support such a view.



It is to be noted that many other objects made of luxury materials, such as ivory, bronze and various stones, were found in the same area,<sup>31</sup> and this fact suggests that the particular area was either: a) a room for significant and official persons, or b) a storeroom for luxurious objects (treasury), or c) a working area for luxurious materials, or a 'shop' for 'selling' luxurious objects.

a. Use and date

Faience in Zakros was mainly used for the manufacture of small luxurious vessels and other objects, probably of a ceremonial significance. Moreover, it was used for making small inlays or amulets. It should be noted that it was not used here for the manufacture of beads, as in other known Minoan sites.<sup>32</sup>

The faience pieces found in the West Wing of the palace belong to its final phase, namely the LMIB period. The same is true for the pieces found in the fill of the basement in Room XLIV of the South Wing.<sup>33</sup> On the other hand, the material which comes from Room B of the East Building to the south of the Harbour Road was found in a stratum probably sealed at the end of the LMIA period. The pottery which was found together in the same layer also dates the faience material to the above period (LMIA).<sup>34</sup>

8. Glass-paste (F.-I.-Gl. cat. no. 3, fig. 88, pl. 20).

Fourteen beads of glass-paste (cat. no. 3) were found in the fill of Room XLIV of the Zakros palace. The exterior of this material is easily flaked and is iridescent and like gold. The beads vary as regards their size and are roughly disk- or ring-shaped with a central hole. The largest is

almost spherical, but depressed (diam. 1,9-1,4 cm.). It is clear that the beads belong to a necklace which was scattered, since there is no evidence that the beads were worked in situ.

A similar bead, depressed, spherical, of iridescent glass-paste, was found in the north quarter of the settlement. In this case, the bead was found together with two more beads made of other materials.

The evidence for the making of faience and glass-paste at Zakros is completely insufficient. The finished products suggest there may have been a local industry; however, the area in which the workshop was housed cannot yet be identified.

9. Ivory (F.-I.-Gl. cat. nos. 4-13, figs. 88-91, pl. 19).

Ivory, an imported and consequently rare material, was used on a wide scale at Zakros, for the manufacture of inlays, jewels and small carved boxes (pyxides). It should be noted here that groups of ivory objects were found in the same places in which faience groups were found. For Room XLIV and Room B of the East Building, there is a possibility that they were used for ivory-working.<sup>35</sup> Ivory inlays fell from above and were found scattered in Rooms XXV, XXVI and XXIX of the West Wing.<sup>36</sup> These are finished products and probably belong to wooden furniture or boxes, which had decayed. Despite the fact that the ivory-working areas at Zakros are not securely identified, there is no doubt that ivory-working flourished during the last two neopalatial phases. This has been suggested by the great number of small ivory artifacts and jewels found in groups, mainly in

the palace area and in a room of a building outside the palace, as well as by the discovery of three completely unworked tusks stored on the upper floor of the West Wing of the palace.<sup>37</sup> The material, which is dated to the LMIB period, was obviously kept (along with six copper ingots) for working in the future in one of the secure small storerooms located on the upper floor of the West Wing.

All three tusks were in a bad state of preservation, burnt in some places, while from other parts some big fragments had flaked off. Their colour, because of the burning, varies from white, cream, blue to black.<sup>38</sup> Their pointed ends are blunt and they are strongly curved, but are not very long. The longest (cat. no. 4-7) is 1,13 m. long and the maximum width (cat. no. 6) is 14,5 cm. There are no discernible traces of working on any of the tusks and this confirms the hypothesis that in the moment of the final destruction of the palace they were in storage.

This particular type of curved and short tusk probably comes from Syria. This view is suggested by the discovery of copper ingots in the same place, perhaps coming from Cyprus. It is probable that these unworked materials were simultaneously imported to Zakros during one commercial journey in the area of the SE Mediterranean coasts.

The storage of unworked tusks together with the precious copper in a small storeroom not easily accessible, and the concentration of a big part of the material in the palace, suggest that ivory was especially precious and its working was controlled by the central authority. The case of the East Building is a special one and should be



considered separately.<sup>39</sup>

The two ivory groups coming from the palace, as well as the elephant tusks, must be dated to the final phase of Zakros, namely the LMIB period. On the other hand, the material from the East Building was found under the LMIB floor of the room in a layer which contained, as we have already mentioned,<sup>40</sup> pottery of the LMIA period.

## B. Tools

### 1. Stone tools

The majority of the stone tools from Zakros were used for grinding, principally cereals and other fruits, for the production of basic foods. Some specialized tools were used for working pigments, for weaving and for sharpening metal tools. In some cases, rough stone tools were used in place of bronze ones, though the material is not very suitable, since it is easily broken or worn; nevertheless, it was easily replaceable.

a. Pounders and rubbers (Rub. cat. nos. 1-327, fig. 92, pl. 21).

#### 1) The material

The material consists of 327 rubbers and grinders from the palace and town.<sup>41</sup> One can distinguish a great variety of forms: spherical, depressed spherical and semi-globular, egg-shaped, cudgel-formed, mushroom-like, flattened, conical and truncated-conical, cylindrical, acorn-shaped, disk-like, elliptical, parallel-sided, pyramidal and prismatic, tongue-shaped, rod-like, triangular, spindle-shaped, curved on both surfaces, curved and flat, almond-shaped,

semi-lunar, of a human-foot, and completely irregular. Of the above mentioned forms the most common is the spherical, or depressed-spherical and semi-globular (22,93%), while also common is the egg-shaped form (14,37%). The rarest forms are the semi-lunar (cat. no. 296) and the acorn-shaped (cat. no. 169), while the human-foot form is also rare (it occurs twice: cat. nos. 25, 221).

Sometimes the rubbers bear traces of secondary trimming for their better grasping by the workman. This trimming is usually confined to some small cavities on the top or the side of the rubber (cat. nos. 53, 105, 138, 162, 219, 287); yet, in some cases, this work shows a well thought out process (cat. no. 79). In one case the trimming was extended to the further shaping of the rubber's top, to make gripping easier by using the whole wrist (cat. no. 81).

The information on the rubbers, grinders or pounders given in the excavation diaries does not include (in most cases) the exact kind of stone from which they were made. Consequently, one cannot have a complete picture of the variety of the forms. Most of the rubbers were made of trachyte or serpentine. However, there are cases in which rubbers were made of rarer kinds of stone, such as rosso-antico (cat. nos. 51, 178), or nephrite (cat. nos. 129, 136). Various kinds of veined, marble-like stones were also used (cat. nos. 169, 251, 267), as well as probably a kind of conglomerate (cat. no. 71). In a few cases where an unusual stone has been carefully worked, rubbers could have had some aesthetic value (e.g., cat. no. 169).

Rubbers and grinders were mainly used for rubbing

and grinding cereals and fruits. However, it is difficult for anyone to distinguish which particular tools were used for grinding and which for rubbing. For the first function oblong tools were usually used and the work was done inside deep mortars. The common rubbers were used on querns and they have usually a flattened side, created during the rubbing. On the other hand, in only one case has the method of grinding left some traces on the tool used (cat. no. 74).

## 2) Distribution of material; workshops

Only fifty-six of the 327 rubbers or groups of rubbers were found in the palace (17,12%), while a greater number was found in the houses of the town (fig. 5). Sometimes a number of rubbers and grinders was found together in the same place or room and this suggests organized group work.<sup>42</sup> Many of these groups of tools were found in artificial fillings of open-air areas (cat. nos. 220, 225-231, 302, 303, 320, 325, 326), or in roofed areas contained in the substratum of floors (cat. nos. 49, 306). In this case, despite the fact that this suggests organized grinding or rubbing for a limited time in this place or in its neighbourhood, it cannot be taken as positive evidence for the identification of the area as a permanent or temporary workshop.

On the other hand, the discovery of a number of rubbers in the destruction layers of a particular room provides significant evidence that the area was used, even for a limited time, for organized grinding. One should note here the case of the East Building (cat. no. 141), where at least thirty rubbers of different forms were found in a single group. Despite the fact that the destruction by ploughing makes



difficult the identification of the particular working area, one can speak of a grinding working area. There are three more cases (cat. nos. 1, 196-201, 218) where a number of rubbers or grinders was found in architecturally defined areas which were used even for a short time for grinding. One can speak also of areas used for grinding in the cases in which a number of rubbers was found together with querns in the same place (cat. nos. 52, 57, 90). In this case, the presence of the querns emphasizes a permanency for the use of the area, since transportation of the heavy querns would be impractical.

In conclusion, one may note that the grinding work is better represented in the town, while in the palace it appears isolated and not well organized. The dispersal of the material shows that grinding was principally domestic activity and it did not consist of an industry controlled by the central authority. In any case, it should not be excluded that collective work was sometimes done by groups of workmen for the preparation of a particular product, destined to be consumed by larger social groups. However, it is clear that in this case, too, the magazines of the palace were filled by the products coming from the residents of the town. It is possible that the officials of the palace consigned a particular task to the residents of the town. Perhaps, the palace allotted the land for agriculture and took a defined percentage of the production.<sup>43</sup>

The date of the rubbers and grinders presents the same difficulties as other kinds of material (obsidian and steatite). On the other hand, it is logical that the process of grinding

cereals and other fruits does not change from the Neolithic Age to the end of the Bronze Age in the Aegean. A greater skill in the manufacture of tools and an attempt to use luxurious stones for specific cases can be noticed in the neopalatial period, when experience and wealth have obviously increased.

b. Querns (Q. cat. nos. 1-120).

1) The material

Apart from the rubbers and grinders, 120 querns from the palace and town of Zakros<sup>44</sup> were used for grinding. In contrast with the rubbers, the querns do not vary as regards their form. One can distinguish two general categories of querns based on their method of use.

a) Querns with a flattened rubbing surface and the other side roughly shaped.

b) Querns which have a curved surface for rubbing.

Both forms are usually elliptical or rectangular with somewhat curved corners. There are also circular querns (or circular-like: cat. no. 67), as well as spindle-shaped, square, rod-like, trapezoidal and irregular.

Two types of more carefully formed objects were also used for rubbing.

a) Three-legged basins with almost semi-globular cavity made of trachyte (cat. nos. 14, 120, pl. 20).

b) Small rectangular slabs with or without legs (cat. nos. 47, 85), probably used as tables for colouring matter.

The dimensions of the largest quern were 0,60 x 0,40 x 0,30 m. (cat. no. 12). Almost all the querns were

made from various common kinds of limestone. There are only a few exceptions, which usually consist of the more carefully formed objects of this category such as the three-legged basins and the colouring-tables already described. They are made of better quality limestones or schistose stones.

The querns were used almost exclusively for grinding cereals and probably various kinds of spices. The grinding was done by moving the rubber-stones on the surface of the querns which was usually concave to make the movement easier. Some, more elegant querns would be used for working pigments, creams and ointments, though this has not left traces on the rubbing surface of the tables.

2) Distribution of the material; working areas (fig. 5).

From 120 examples of querns or groups of querns, only eleven come from the palace (9,24%), confirming again that the grinding took place mainly in the town and was not strictly controlled by the central authority. In one case (cat. no. 15), a huge quern was found in situ in one of the rooms of the South Wing of the palace, suggesting that grinding took place in this area.

In two cases, a large number of querns was found in one area; this provides positive evidence that grinding was sometimes collectively organized. In Room Γ of the NW quarter (cat. no. 20) over ten querns were found together with rubbers; in addition, a number of querns were found together in Room XIV of House B on the NW hill (cat. no. 58). Although it is possible that these areas were used for



collective grinding, some problems are created by the fact that there is no comfortable space for collective working. The possibility that the areas were used simply for storing querns, which would probably be used in a neighbouring, more spacious ground floor room, must not be excluded.<sup>45</sup>

Most of the querns should be dated to the last two neopalatial phases (LMIA and LMIB), since they are usually found in destruction layers of neopalatial buildings. However, there is no doubt that there were querns in Zakros in the older period as well (e.g., cat. no. 117).

c. Troughs and Mortars (Tr. cat. nos. 1-51).

The distinction between 'trough' and 'mortar' is not always easy. Usually a mortar is a high stone object with a deep hollow, which was used for grinding fruits and spices by using long grinders or pounders. A trough is a more shallow and lower stone basin which was usually used to keep small quantities of water for domestic or industrial work. Since formally the distinction of these two categories of stone objects is not easily made, objects belonging to both kinds are included in the same catalogue, though their use was probably completely different.

1) The material

Fifty-one troughs and mortars were found throughout the palace and town of Zakros.<sup>46</sup> Only in a few cases does the information given in the excavation diaries refer to the material from which these objects were made. The following are mentioned: nineteen objects of poros-stone, six whitish limestone and one of trachyte. It is impressive that poros-stone was preferred to other stones for the manufacture of

these objects, since this material is neither the most suitable for keeping water, nor especially resistant to being securely used for grinding fruits. It seems that the selection was connected with ease of manufacture, since it is known that poros-stone is rather soft and can be worked out by using simple tools. Troughs occur only in a few repeated forms: circular, rectangular, elliptical and oblong (cat. no. 31). Sometimes, their sides were not worked completely (cat. no. 34), while there are some troughs completely irregular on their exterior. One trough is peculiar. It has two cavities, the one bigger than the other, which had a tap, probably used as a sink (cat. no. 45).

Mortars occur also in a few forms and their varieties: conical, squarish and cylindrical. A high mortar of poros, almost cylindrical, bears on its exterior three parallel horizontal grooves which were probably created during manufacture.

2) Distribution of the material; working areas (fig. 5).

Troughs and mortars are not easily movable objects. Thus, their discovery in destruction layers suggests that the areas in which they were found were used for domestic or industrial activities. Usually, troughs or mortars were fixed on the floor or on built-constructions, confirming that they were used in situ (cat. nos. 20, 24).

However, there are some cases in which these objects, when they fell out of use, were used for building material (cat. no. 45). In this case, one cannot know where the object was first used.

Only three troughs and mortars were found in the palace area (5,88%) confirming once again that such activities were occupations of the residents of the town.

Almost all the material was found in destruction layers belonging to the LMIA and LMIB periods, but the exact date of each specimen is again very difficult to determine before the publication of the rest of the ceramic material.

d. Other stone tools (Oth. St. T. cat. nos. 1-16, figs. 93-97, pls. 21-23).

#### 1) Whetstones

Among the stone tools four were probably used as whetstones. They all come from the town, three of them found in rooms of private houses and one in the fill of a town road.

Two of them (cat. nos. 2, 4) were made of a very hard, grey stone with small white spots (emery?), which was very suitable for the manufacture of such tools. They are oblong and flat-convex. The use of a third specimen has not been clearly identified, since it is made of a grey-black local stone. The preserved part of it points to an almost parallel-sided form. Its one surface bears slight incisions, a fact which confirms the view that it was used as a whetstone.

The fourth specimen (cat. no. 3) is an oblong stone tool of black stone, smoothed on its one surface. On the same surface is a deep groove, triangular in section, which broadens towards one end. It is likely that the purpose of the groove was to control the movement of the knife being sharpened.



## 2) Other stone tools of unidentified use

The catalogue of the stone tools includes seven more small objects, mostly made of a grey-blue stone, probably a kind of serpentine. These tools are of various forms: four have one pointed end (cat. nos. 6, 10), or instead, a tongue-shaped cutting edge (cat. nos. 5, 8, 11). A bar-like tool has a disk-shaped end (cat. no. 7), while another has blunt ends (cat. no. 9).

The use of the above mentioned tools remains obscure. Those with the pointed end would probably be used as punches, while those with the cutting edge as a type of cutter. The particular material would not be very resistant to blows and their use as chisels should be excluded. Finally, the tool with the disk-shaped end was probably used as a kind of spatula.

## 3) Stone pyramidal weights

The sixteen stone pyramidal weights (cat. nos. 12, 13, 14), which were found in Room XLIV of the palace and were made of a blackish stone (serpentine?), probably belonged to a loom located upstairs, since they were found together with a dozen clay loomweights of the common disk-shaped type.

## 4) Stones with traces of trimming

Two more stones bear traces of trimming on their surfaces.

a) An irregular stone with artificial, incomplete perforations (cat. no. 15). Probably the actual purpose of this trimming was to cut out two small cylindrical cores and then the stone was rejected as useless.

b) One stone plaque of a whitish stone with semi-globular cavities and grooves of an irregular to almond-like shape on its one surface (cat. no. 16). It is very unlikely that this plaque was used as a mould because the grooves are irregular and the arrangement of the cavities appears to be accidental. Traces of a channel for metal to flow do not exist. Its use remains obscure.

## 2. Bone tools (B. T. cat. nos. 1-39, figs. 98-100).

The number of bone tools found at Zakros is not large. The material studied consists of thirty-nine pieces found, almost in every case, scattered throughout the palace and town and in the pits of the SW hill.<sup>47</sup>

### a. The material

Only one type of bone tool is almost exclusively represented at Zakros: the punch. Of the thirty-nine pieces studied, thirty-seven are punches, mainly of two types.

1) One type has a wide back end and a progressive reduction in width towards the point (83,78%).

2) A second type has a relatively thin back end and an almost cylindrical point (only six examples, 16,22%).

In most cases the punches of type '1' are roughly worked and usually have a hollow side which is due to the natural hollow of the bone. On the other hand, the punches which belong to type '2' are carefully worked, especially in the shaping of the thin cylindrical point, and are more elegant and certainly made for more delicate work.

Most of the punches have the natural colour of the bone, whitish to yellowish (76,67%); four of them which have been carefully polished, are brown (cat. nos. 3, 15, 16, 17),

while one is white (cat. no. 4).

In four cases the accidental action of fire changed the colour of the bone to blue (cat. nos. 23, 24, 27) or black and white (cat. no. 1).

In five cases traces of polishing of the tool can be observed (cat. nos. 1, 3, 15, 16, 17). In one of them (cat. no. 1) the traces of the polisher are discernible.

The longest punch in type '1' is 12 cm. (cat. no. 10), while the longest in the second type is 6,2 cm. (cat. no. 8).

Apart from the punches, only two different types of bone tool are included in the material studied.

1) A needle, which preserves part of the thread-hole (cat. no. 30).

2) A tool in the shape of a myrtle-leaf with a pointed end and the other end leaf-shaped (cat. no. 19).

This particular tool could probably be used at both ends, in two different ways: as a punch with the pointed end, and as a spatula with the blunt end.

#### b. Distribution of the material; date (fig. 6)

As has already been discussed, the material was found scattered throughout the palace and the town, and in all cases the pieces were found isolated. Only ten among them were found in the palace and around it (25,64%), while twenty-one come from the town (56,41%). The remaining seven specimens were found in the East Wing of the old palace and the pits of the SW hill (17,94%).

The date of the material presents the same difficulties as other materials. However, it is certain that the greater part of the material belongs to the LMIA and LMIB destruction



layers. The presence of five specimens from the East Wing of the old palace proves that tools with similar form were already used in the protopalatial period (Middle Minoan) at Zakros.

### 3. Bronze tools

Of the 130 bronze tools (or groups of similar tools) studied, seventy-nine come from the palace area (60,76%) and the remaining fifty-one were found scattered throughout the whole town (39,24%) (Fig. 6). One unusual concentration was observed in the West Wing of the palace, where the tools had probably fallen from workshops and storerooms housed on the upper floor, and secondly in the South Wing and the area around it (see Plan).

This concentration of the bronze and more specialized tools in the palace confirms that the most significant workshops were housed there. This is very logical, since bronze was precious and was probably a monopoly of the central authority.<sup>48</sup>

On the basis of the typology of the bronze tools one can consider some of the workshop types which operated under the supervision of the central authority: stone vases workshops and workshops for making stone jewels and artifacts, a seal-maker's workshop (probably), bronze workshops, ivory workshops, carpentries, leather workshops, and workshops for weaving. Some other occupations of the residents such as fishing, hunting, painting and body embellishment, are confirmed by the presence of objects related to them (fish-hooks, needles, spatulas, bronze earrings and amulets, tweezers, etc.).

The date of the Zakros bronze tools is rather easy since most of them were found in the last destruction layer of the palace and town, at the end of the LMIB period. Some of the tools belong to the LMIA period, but only a few were found in protopalatial layers. This is well understood since it is very probable that the older, useless tools were melted for reuse of the bronze.

The classification of the 130 tools studied which follows was based on exclusively formalistic features. In each type classified by the writer there is noted the equivalent type in D. Evely's classification,<sup>49</sup> which consists of a more detailed study of all the Minoan tools.

a. Saws (Br. S. cat. nos. 1-9, figs. 105-112, pls. 27-28).

A very significant group of bronze saws was found in the West Wing of the Zakros palace. Of the nine saws,<sup>50</sup> four were found in different places on the floor of the spacious Hall of the Ceremonies (Room XXVIII); one was found in the short dog-leg corridor to the east of the Lustral Basin (XXIV); one had fallen into the staircase of the same room, and lastly three were folded (the one into the others) in the sotto-scala of Staircase X.

Apart from the three saws which were folded in the sotto-scala<sup>51</sup> (cat. nos. 2, 7, 8), two more saws were folded in two unequal pieces (cat. nos. 1, 3). This folding probably means that five of the nine saws were out of use during the final destruction, and they were securely folded to conserve space in the not so spacious storerooms.<sup>52</sup> It should be noted here that two of the five saws mentioned above

(cat. nos. 7, 8) were folded twice, one inside the other.

Of the nine saws, eight were toothed and only one is completely untoothed (cat. no. 1).<sup>53</sup> The eight toothed saws belong to type '3' of Evely,<sup>54</sup> while the untoothed specimen is of type '5'.<sup>55</sup>

One can distinguish two types of toothed saws.

1) One with almost rectangular ends (cat. nos. 1, 7, 8).

2) A second with one rectangular wider end and a second narrower and slightly curved (cat. nos. 4, 5, 6).

Three of the saws preserve only one end and consequently their classification into these types is impossible.

In almost all the cases the saws have at both ends three small holes in a triangular arrangement for the attachment of wooden handles. The operation of this type of saw was clearly done by two persons seated one opposite the other.<sup>56</sup> In some cases, one end bears two (cat. no. 6) or more (cat. no. 8) holes for the attachment of the handle; this proves that the method of fixing the handle was based on experience.<sup>57</sup> Sometimes, some carbonized remains of the wooden handle was preserved around the holes. In one case (cat. no. 5), a big piece from the bronze plate has been cut away together with the handle.

The teeth in most specimens (cat. nos. 2, 3, 4, 5, 9) are badly worn from use, especially around the ends of the tools (cat. no. 2). It should be noted here that in two cases (cat. nos. 7, 8) the teeth in the middle of the saws are thicker while in the ends they are thinner and more numerous.



The longest of the saws is 1,68 m. (cat. no. 5), while the maximum width is 21,5 cm. (cat. no. 6).

All the saws come from the destruction layers of the West Wing of the palace and are securely dated to the end of the LMIB period.

b. Chisels (Br. Ch. cat. nos. 1-11, figs. 113, 115, pls. 29-32).

Of the eleven chisels found at Zakros,<sup>58</sup> ten come from the palace and only one was found in a house, on the NW hill (cat. no. 11). Like the saws, the chisels were found mainly in the West Wing of the palace in three different and not closely located rooms, four in the Hall of the Ceremonies (Room XXVIII), two in the Treasury (Room XXV), and three in Room XIII. One more specimen comes from Room XLIV of the South Wing of the palace. One can distinguish three principal types of chisels.

1) One with a wider flared end which forms a tongue-shaped cutting edge and a tapering solid back end where the hammer blows were directed (cat. nos. 1, 7).

2) A second type, with two broad ends, one of which was more or less straight, the other one curved. It does not seem very probable that this kind of tool was used at both ends according to circumstances because, in this case, the absence of a blunt striking surface for the hammer would probably create problems (cat. nos. 4, 5, 6, 8, 9).<sup>59</sup>

3) A third type, with a narrow solid stem which has an almost rectangular section and which stops with a straight cutting edge, not especially broad (cat. nos. 10, 11).

It is especially difficult for anyone to define where

each of the above types was used.<sup>60</sup> Certainly, the chisels which belong to type '1' were for different functions from those of type '3', which principally differ as regards the width and thickness of their cutting edges. The chisels of type '2' which, even if they had wooden sleeves would have had problems with striking at one of their ends, were probably used on softer materials such as wood, bone, ivory.<sup>61</sup>

The biggest chisel weighs 320 gr. (cat. no. 7) and the widest cutting edge is 4, 5 cm. (cat. no. 2) wide. The narrowest cutting edge (cat. no. 10) is only 1,1 cm. wide.

c. Knives (Br. Kn. cat. nos. 1-13, figs. 116-118, pls. 33-36).

In contrast to the types of tools already discussed, knives were found equally in the palace and town of Zakros: six specimens come from the palace (46,15%) and seven from the town (53,85%). The knives studied could be classified as follows.<sup>62</sup>

1) One-edged knives.

a) With a curved cutting edge and a straight back (cat. nos. 4, 7, 8, 10, 11).

b) With concave cutting edge and curved back (cat. nos. 5, 9).

2) Two-edged knives.

a) With two cutting edges tapering to a point and a reinforced mid-rib (cat. nos. 1, 2, 3, 12, 13).

b) With two almost parallel cutting edges and reinforced mid-rib and a triangular point (cat. no. 6).

A further classification could be made related to the

method of fixing the blade into the wooden handle.

a) With small rivets in one axis along the blade (cat. no. 7, 8, 9, 10, 11).

b) With small rivets in a row parallel to the back end of the blade (cat. nos. 5, 12, 13).

c) With the tapering of the plate at the back end and its wedging into a hollow in the handle (cat. no. 2).

In three cases, the method of fixing the blade in the handle remains unclear because of the fragmentary preservation of the particular pieces.

The longest one-edged knife belonging to type 'a' is 18,5 cm. long (cat. no. 4) and the longest of type 'b' 22 cm. long (cat. no. 5). The longest two-edged knife of type 'a' is 14,5 cm. long (cat. no. 3) and of type 'b' 26,5 cm. long (cat. no. 6). The heaviest of the knives weighs 50-60 gr. (cat. no. 5).

d. Axes (Br. Ax. cat. nos. 1-10, figs. 119-124, pls. 36-39).

Of the ten axes found at Zakros, seven come from the palace (70%) and three from the houses of the town (30%). All seven axes found in the palace were scattered in four different rooms of its West Wing, certainly fallen from the upper floor's workshops: three of them come from the short corridor to the east of the Lustral Basin (Room XXIV), two from Magazine IV, one from the Treasury (Room XXV) and one from the fill of Room XV.

The ten specimens from Zakros could be classified in the following types, on the basis of their form.

1) Two-edged axes with a central broad cylindrical



hafting hole (cat. nos. 1, 2, 3, 6, 7, 8, 9, 10).<sup>63</sup>

1a) Two-edged axe with a central narrow hafting hole (cat. no. 5).<sup>64</sup>

2) One-edged axe, without hafting hole (cat. no. 4).<sup>65</sup>

The axes which belong to type '1' are rather narrower but thicker in the middle and they become broader and thinner near their edges. These last are almost always slightly curved. In most cases in one of the narrow facets placed opposite to the hafting hole, two shallow grooves are discernible. These were probably used as wedging grooves for the better fixing of the shaft (cat. no. 2).<sup>66</sup> Two opposite interior grooves were certainly used for the same purpose (cat. no. 2): to accept thin wooden wedges for securely fixing the haft.<sup>67</sup>

One of the axes (cat. no. 5) is different in form from the others.<sup>68</sup> It is almost parallel-sided, badly cast, with a narrow hafting hole in the middle. The peculiar form is probably the result of an unsuccessful process of manufacture.

The one-edged specimen<sup>69</sup> does not have a central hafting hole and is slightly thicker in the middle. Its one end forms a cutting edge while the other is broken and rather thicker. The fixing of the haft was probably done by wedging in a wooden haft, and by binding for security. It seems probable that the haft was fixed in the opposite end from that with the cutting edge and not in the middle of the axe, which is thicker. Some traces of burnt wood are visible on the plate, close to the blunt end.

The longest of the axes is 22,3 cm. long (cat. no. 9) and the shortest is 12,6 cm. (cat. no. 5). The maximum

width of the edges is 6,4 cm. (cat. no. 9). The heaviest of the specimens weighs 1380 gr. (cat. no. 10).

e. Flat adzes

Under this category of tools Evely classifies the 'chisels' of type '2' (5 specimens) and the 'axe' of type '2'. Although there is no evidence for function of these particular tools, Evely considers that they were bound in a wooden haft, almost in a vertical position with respect to the body of the adze. He considers also that they were used mainly for removing earth in agricultural works. All the Zakros specimens come from the West Wing of the palace and are dated to the LMIB period.

f. Stake-head (Br. S-h. fig. 125, pls. 39, 41).

Among the bronze tools which fell from the upper floor in the West Wing of the palace was a small stake-head with battered end.<sup>70</sup> It is roughly six-faceted, but the natural joint of the facets is smooth without edges, except for the facet on which the blow was directed. The stake according to Evely<sup>71</sup> is the property of the metal-vase maker, and used to raise vases from disks or sheets. The Zakros stake-head weighs almost 1700 gr.

g. Sledge hammer (Br. Sl. H. fig. 126).

An example of a sledge hammer comes also from the West Wing of the palace. To be precise, it was found in the fill of Magazine IV, certainly fallen from the upper floor. It has two, much battered, striking surfaces and

a central hafting hole with two opposite grooves probably for wooden wedges. Its form is not symmetrical and its ends are worn down to a slanted edge. Its weight is almost 850 gr.

h. Tools with three teeth (T.w.T.T. fig. 142, pl. 41).

Two bronze pieces belong to a kind of tool which ends in three triangular teeth. The two pieces were found together in one of the rooms of the West Wing and it is probable that they made up the two ends of the same tool. In that case, the tool would have been used according to need, with both ends. If the tool was so used, its use as a chisel is very doubtful unless for softer materials (wood, ivory). However, it seems more possible that the two pieces belong to two different, but similar tools, which were stored in the same place and could have been used like chisels. The existence of the three teeth suggests that the tools were used for specific work, probably of a decorative character (engraving with a triple-groove system?).

i. Bronze cones (Br. C. cat. nos. 1-8, figs. 127-130, pls. 39-40).

These peculiar objects were found in two separate groups, in the palace and in the town: a) in the fill of the west part of Room XXVIII (Hall of the Ceremonies), fallen from upstairs (cat. nos. 1, 2, 3, 4); b) in House A on the NW hill (cat. nos. 5, 6, 7, 8).

They are oblong bronze cones, hollow at the broad end and solid at the tapering, opposite end which is almost blunt. One can distinguish two types:



1) The cones of the first group have a circular section throughout their whole length.

2) The cones of the second group have a circular section on the hollow part and an almost square section on the solid part.

This differentiation does not seem to be connected with the use of these peculiar objects. If, on the one hand, the square section was intended to secure the attachment of the solid end into a wooden handle, then the circular one, used thus, would create problems, since the haft could easily rotate in the hollow. It seems more probable that a wooden haft or shaft was inserted at the hollow end into the cone and was fixed in some cases with the help of a small rivet (cat. no. 8). The object would then have been used at its solid end, though the exact function remains unknown since the end is usually blunt (has it become worn?), without specific features. It has been considered that these objects were attached as the butt end of a spear-shaft, for fixing it into the ground,<sup>72</sup> but this interpretation does not justify the square section of the four specimens, while the blunt point remains a negative indication. Despite the above difficulties, this interpretation is the only one which has so far been expressed.<sup>73</sup>

The longest cone is 21 cm. long (cat. no. 2) and the diameters of the hollows are 2-3 cm. (cat. nos. 1, 2). The heaviest of the objects weighs 560 gr. (cat. no. 3).

j. Double adzes and pick adzes<sup>74</sup> (Br. D. A. and Br. P. A. cat. nos. 1-5, figs. 131-134, pls. 39, 42).

Of the five adzes found at Zakros, three come from the

palace, and the remaining two from the town. The ones from the palace were all found in the same place, in the short corridor beside the Lustral Basin (XXIV), probably fallen from upstairs where they were stored. One can distinguish two main types.<sup>75</sup>

1) A larger form with two symmetrical tongue-shaped ends (cat. nos. 2, 4, 5).

2) A smaller form with one end tapering to a point, the other tongue-shaped (cat. nos. 1, 3).

The longest adze is 25 cm. long (cat. no. 5) and the shortest 13,2 cm. (cat. no. 3). The heaviest weighs 1280 gr. (cat. no. 5). All are collared, for the better fixing of the shaft. The edges, in most cases, are blunt from use.

k. Razors (Br. R. cat. nos. 1-3, fig. 135, pls. 43. 54).

Only three bronze razors were found at Zakros.<sup>76</sup> Two of them (cat. nos. 2, 3) were together in a building in the town, while the third (cat. no. 1) had fallen from the upper floor onto the ground floor of a room in the West Wing of the palace. The razors are more or less tongue-shaped, but vary in their general form and in the width of their blades. Their cutting edges outline the whole blade which was fixed into the wooden handle by rivets. In two cases (cat. nos. 2, 3), the rivets are in a row parallel to the back end, while in the third they are in one axis, in the direction of the blade (cat. no. 1). In this last case, the bronze sheet is folded around the handle to make the attachment secure.

The blade of the razors is very thin and so is damaged

on the cutting edge (cat. nos. 1, 3). It is probable that these tools were used for working leather and not as razors for shaving.<sup>77</sup>

The longest is 17,2 cm. (cat. no. 1), while the broadest blade reaches 4,7 cm. (cat. no. 2).

#### 1. Drills

a) Hollow drills (Br. H. Dr. cat. nos. 1-2, fig. 136, pl. 44).

Two bronze tools, one from the palace and the other from the town, were possibly used as small drills. One end is wider and hollow, while the other is solid, cylindrical or parallel-sided, with a blunt point. If these particular tools were used with the solid end, the hollow end would have been fixed in a wooden shaft. Such a view explains a small rivet preserved near the hollow end in one of the two specimens (cat. no. 1).

In this case, the tools would have been used as punches of some kind. But this is not very probable, since their other end, as already mentioned, is blunt. On the other hand, one of the two specimens has a square section at the solid end and this suggests that this end was wedged into a wooden handle. In this case, the tool worked with the hollow end was probably used as a small hollow drill. The diameter of the hollow ranges from 0,5-0,7 cm. and the longest of the two tools (cat. no. 2) is 11,6 cm. long.

b) Solid drills<sup>78</sup> (Br. S. Dr. cat. nos. 1-6, figs. 136-137, pls. 39, 43, 44, 49).

Six small, delicate tools could have been used as the lower ends of rotating drills of the solid type. Five



of them were found in the palace together with other tools, while only one specimen (cat. no. 6) comes from the town.

Two of the five examples are much longer (cat. nos. 5, 6), but they all have the same width in their middle and at their point. The bigger part of their body has a square section, while the point is tongue-shaped and flattened except in one case (cat. no. 1), which is almost conical and blunt because of use. The square section shows that the tools were fixed into a wooden handle. The two longest specimens could hardly have been used as chisels, since they would easily be bent, especially if the material worked was hard. This last suggests that the tools were probably used as lower ends of solid drills. The longest is 35 cm. long (cat. no. 6), while the shortest reaches 10,9 cm. (cat. no. 2). The broadest tongue-shaped end is 1 cm. wide (cat. no. 6).

m. Cutters (Br. Cut. cat. nos. 1-7, figs. 138-139, pls. 35, 45, 48).

Seven small bronze tools were probably used as cutters in delicate work. These tools vary as regards their forms and they have as a common feature one end flared and tongue-shaped, while the other one varies in form according to the method of use of the tool. So, in two cases it forms a second, narrower, tongue-shaped cutting edge (cat. nos. 1, 3). In two other cases there are rivets at the back end for fixing the wooden handle (cat. nos. 5, 7) and in one other, a small disk was probably used as a striking surface, suggesting a function equivalent to that of the small chisels.

Of the tools described above, four were found in the palace, and the remaining three came from the town.

Three even smaller specimens belong to another category of objects usually called 'cutters'. They have a flared, tongue-shaped end, while their other end is usually formed by the twisting of the plate itself to make a small spiral loop. It is very possible that this last category does not have any connection with the small cutters, since the shaping of the loop suggests that the objects were probably suspended. This last supports the view that these particular objects were rather amulets which were probably used also as small instruments for body embellishment (spatulas).<sup>79</sup>

n. Carpenter's chisels (Br. C. Ch. cat. nos. 1-2, fig. 139, pl. 44).

Two ovate, small tools were probably used as small chisels for wood-working. Their almost triangular point is shaped by gradual tapering of the body of the tool, while the remaining outline of the blade is not knife-edged but has a small facet. Consequently, this particular tool could be used only by its point in a slightly oblique position against the surface which was to be worked. The longest of the two carpenter's chisels (cat. no. 2) is 9,6 cm., while both of them are 0,9 cm. wide and their thickness reaches 0,3 cm. These two tools were found together in the lightwell of Room XXVIII (Hall of the Ceremonies), and they certainly belong to that group of tools which had fallen from the upper floor workshops.

o. Spatula (Br. Sp. fig. 139, pl. 45).

A small tool with one hollow end and a tongue-shaped thin blade at the other could well have been used as a

spatula. Inside the hollow a narrow plate is visible, a kind of rivet probably for the better fixing of a wooden handle. A little hole for another rivet was also preserved near the hollow end.

The blade of the tool could not be used as a cutter because of the curved, tongue-shaped end, neither as a punch since it does not have a point. It is obvious that a wooden handle was fixed in the hollow end and that the tool worked with the flattened, tongue-shaped blade. This blade could only be used as a little spatula for working and moulding plastic materials (pigments, clay, ointments, etc.).

p. Blades or small knives (Br. Bl. cat. nos. 1-5, fig. 139, pl. 34).

Among the small bronze tools one can distinguish five blades or small knives which, in spite of their variety in form, may be classified in the same category. Two of them (cat. nos. 2, 5) are similar, one-edged with a curved cutting edge and a straight back. Two others (cat. nos. 1, 4) are essentially only very thin blades, two-edged and especially worn by use, while the last specimen is two-edged with slightly tapering body forming a point, and a little rivet at the back end for fixing the wooden handle. The longest of these knives is 6,5 cm. (cat. no. 2) and the broadest is 1 cm. wide. Four of them were found in different places in the town and only one comes from the palace area.

q. Little bronze saws<sup>80</sup> (Br. L. S. cat. nos. 1-4, pls. 35, 36, 46).

One further category of small bronze tools was used for delicate work such as seal-making, jewellery and ivory-



working. It consists of little toothed bronze saws. At Zakros, little saws with very thin teeth have been found, five of which are very similar and comprise a separate group (cat. no. 4).<sup>81</sup> All these saws were found in the town, in four different places, but the other finds from the same context were unrelated to them, and so do not offer any additional evidence for a clearer definition of their use.

One may distinguish two types of the same tool.

1) A form with a single toothed edge and a blunt back.

2) A form with two, more or less curved, opposite toothed edges of almost rectangular small plates (5 examples, cat. no. 4).

The longest small saw is 6,9 cm. (cat. no. 4a), while the broadest is 4,2 cm. wide (cat. no. 4e). The longest toothed edge is 5,9 cm. long (cat. no. 2).

r. Punches-awls-pins (Br. P. A. P. cat. nos. 1-18, figs. 141-142, pls. 36, 47-49).

The distinction between thin bronze pins used in dressing and hair-dressing, and the punches, namely thin and usually cylindrical small tools which were used in different operations, is very difficult. Only one of the specimens could safely be identified as a pin (cat. no. 16), because of its elegant shape in the back end, while four more pieces of medium size (12-18 cm. long; cat. nos. 1, 2, 5, 9) with a circular or square section and a pointed end, could have been used as punches.

The remaining specimens in the list probably belong to the category of punches, and one can roughly distinguish three different types.<sup>82</sup>

1) Long stems, usually fixed in wooden handles. These could have been awls (cat. nos. 3, 4, 18). Of these, two (cat. nos. 3, 18) preserve two small rivets at one end for the attachment of the handle. The longest is 35 cm. (cat. no. 3).

2) Very thin and short punches with a circular section which were probably used as bodkins (cat. nos. 8, 10, 13). The shortest is 6 cm. long (cat. no. 13) and 0,1 cm. thick.

3) Punches of medium size in various forms: there are specimens with a circular (cat. nos. 6, 11, 12) or square section (cat. nos. 14, 17), or of a mixed type with circular section near the pointed end and square section near the other (cat. no. 15, probably for fixing a handle?). In one case the back end has been hammered and flattened, almost rectangular, probably for better grasping during use (cat. no. 7).

Twelve of the eighteen pieces described above were found in the palace area (66,66%), and only six were found in the town (33,33%).

s. Nails (Br. N. cat. nos. 1-4, fig. 143, pls. 48-50).

Only four nails were found at Zakros, of which three come from the South Wing of the palace, while the fourth was found in the fill of the rooms in the East Wing of the old palace. All the specimens have an almost hemispherical head. One can distinguish two types:

- 1) With a circular section stem (cat. nos. 1, 2, 3).
- 2) With a square section stem (cat. no. 4).

Although the single specimen with a square section

stem seems to be older, there is not enough evidence to support that the morphological difference is also a chronological one.

The longest nail is 13,5 cm. (cat. no. 1), while the shortest is only 7 cm. (cat. no. 4).

t. Needle

(Br. Nee. fig. 143).

Apart from category '2' punches described above, only one bronze needle was found at Zakros. It was bent, with a drop-like thread hole and its preserved length was 11 cm. It comes from the palace area.

u. Fish-hooks (Br. F-h. cat. nos. 1-9, fig. 143, pl. 50).

Nine small bronze fish-hooks were found. Most belong to the same type: a cylindrical thin stem is bent in a 150° angle and ends in a point with a small projection (cat. nos. 4, 5, 6, 7, 8, 9). This projection is preserved on three of the specimens (cat. nos. 1, 2, 3). One has an S-form and was probably used as a suspension hook rather than for fishing. The biggest fish-hook is 6 cm. long (cat. no. 6). None of the specimens comes from the palace area.

v. Small tweezers (Br. Tw. cat. nos. 1-5, fig. 144, pls. 45, 45, 51).

In some cases although we know the form of the tool it is difficult to decide if it had been used for one particular process of manufacture or for other needs, practical or not. As a result, the pairs of small bronze tweezers which are usually considered as depilatories because of their similarities to the equivalent modern tool of body/



facial embellishment, were probably used as auxiliary tools in various operations, such as ivory-working, seal-making, and for jewellery.

Five specimens of tweezers were found at Zakros which preserve both of their stems in only two cases (cat. nos. 4, 5). These stems are flared and they form a tongue-shaped edge which is slightly bent towards the interior (cat. nos. 3, 4, 5). One can distinguish two types according to the form of the back end of the stems and the method of their joining.

1) A type in which the plates are bent in such a way as to form the second leg of the tweezers (cat. nos. 3, 4).

2) A type in which the two legs end in a point and are separately made. In this case, the joining was done with a thin bronze wire (cat. nos. 1, 5).

The longest leg is 7,7 cm. (cat. no. 1), and the widest tongue-shaped end is 2,6 cm. wide (cat. no. 2).

Only two of the specimens come from the palace, while the two complete ones were found in Workshop  $\Phi$  of the prismatic steatites.

w. Copper ingots (C. I. cat. nos. 1-6, fig. 145, pl. 52).

It is well known that copper was imported into Crete during the palace period. The discovery of six copper ingots at Zakros which were stored together with elephant tusks also imported from East Mediterranean countries, confirms that there were neither suitable nor sufficient copper sources for exploitation in Crete during this period.

Copper was usually imported in the form of ox-hide

ingots, a form which the six Zakros specimens also have.

Each of the six ingots weighs almost 29 kg. It seems that this particular weight was precisely calculated, since in one case it was completed with the addition of a mass of bronze stuck on the surface of the ingot (cat. no. 3). One surface of the ingots is almost flat or slightly convex, while the opposite is concave. Their general form is roughly similar in all specimens, though in two examples it is closer to the butterfly-form (cat. nos. 5, 6). No specimen has incised or stamped signs, except for a possible case of a  $\Delta$  (cat. no. 2).

The copper ingots may safely be dated to the end of the LMIB period, the final phase in the life of the Zakros palace.

CHAPTER III  
THE ZAKROS WORKSHOPS 2

Location, Description and Contents

A. Stone Workshops (Category A, Type 'a')<sup>1</sup>

Introduction

Zakros is the only site where the Shrine Treasury was found with all its contents in situ. The richness and quality of the stone vessels used in religious ceremonies in the palace are impressive: more than fifty stone vases of great artistic value and incredible workmanship were found in built receptacles in the same place. It was termed the Shrine Treasury because of its contents, architectural form and location.<sup>2</sup> Moreover, stone vases of all types and qualities were found scattered in other parts of the palace, principally in the West and South Wings. A great number of stone vases was found in the surroundings of the palace, though their quality is not the same as that of the ones found in the palace itself. Many of the stone vases are made of rare or imported materials. Rock crystal, for instance, is a rare material, but it could be found in Crete in small sizes. However, to manufacture a stone vessel from this material a large piece is necessary, from which a whole vase could be carved. Such large crystals are not obtainable in Crete. In other cases, too, the material was imported; lapis lacedaemonius and rosso antico came from the Peloponnese, obsidian was imported from the island of Giali.



The quantity and quality of working of stone vessels found in Zakros lead to the conclusion that specialized lapidaries operated in the palace area. From the variety of forms, material and from the workmanship, it could be considered that the lapidaries had already obtained great experience in stone-working.

Moreover, the existence of local workshops is confirmed by the presence of two imported predynastic stone vessels from Egypt which have been adapted by the Minoan lapidaries.<sup>3</sup> Since maritime exchanges between Zakros, Anatolia and Egypt took place,<sup>4</sup> it is reasonable to conclude that the adaptation of the Egyptian vessels was done in Zakros by native craftsmen.

The following presentation of the material indicates that stone-working took place continuously in Zakros until the day of its complete destruction.

#### 1. Room XXVI Workshop of the Shrine

Room XXVI ( $\Psi$ ),<sup>5</sup> located immediately east of the Shrine Treasury was identified as a lapidary workshop by the excavator in the annual report of 1963.<sup>6</sup> The same point of view has been presented in Zakros<sup>7</sup> and is based on two pieces of evidence: a) the presence of raw materials in the fill and upon the floor; b) on the existence of a peculiar construction on the SW corner of the room, which has been considered as a working bench. For evidence 'a' the published information is the following: "The raw materials were a heap of steatite fragments (pl. 53) and pieces of red marble, a material from which some of the stone vases of the Treasury had been made,"<sup>8</sup> and "it contained [Room XXVI] heaps of steatite fragments

and pieces of red marble or porphyry, related to industrial activities."<sup>9</sup> However, in the excavation diary of 1963<sup>10</sup> it is mentioned that "many large pieces of unworked polychrome stalactite were found" in the fill and that "between the rows of slabs [of the bench] and the Lustral Basin (XXIV), a heap of unworked steatite, small or larger sized fragments, was found upon the floor."

The three sources are in agreement on the steatites but they give different information for the other raw materials. The problem will be discussed further after the presentation of the material which has been identified and studied in Heraklion Museum.

For the second piece of evidence ('b') the published information is in almost absolute agreement with the notebooks: "...from the peculiar construction of irregular slabs in three rows which probably served to support planks," and "Three rows of irregular stone slabs placed at the corner served to support planks on which the craftsmen sat to work." For the same thing only a description without interpretation is given in the excavation diary: "between the three rows of stone slabs in the west part [of the room], which are irregular and placed at unequal distances apart. They are not the remains of paving and probably they served to support planks or they had been used in other unknown activities."<sup>11</sup>

a. Location (Fig. 7)

Room XXVI lies east of the Shrine Treasury in the West Wing of the palace. It is at the heart of the cult between the Hall of Ceremonies (XXVIII), the Lustral Basin (XXIV), the Treasury (XXV) and Storeroom XXVII. It had immediate



access to three of these: to the Treasury by a door at its NW end, to Storeroom XXVII by a door in its SE corner, and to the Hall of Ceremonies through a dog-leg corridor from its NE end. The Treasury and the Storeroom had no other door and consequently were only accessible through Room XXVI. If somebody wanted to approach Room XXVI, he would have to pass from the SE part of the Hall of Ceremonies whether he came from the entrance at its NE corner, or from the central entrance of the West Wing through Room IX. The SW part of the Hall of Ceremonies with the polythyron gave access to Room XXVI through the dog-leg corridor.

The whole arrangement probably served to isolate the group of Treasury, Storeroom XXVII and Room XXVI from the rest of the apartments of the West Wing since there was only one approach to it, through a corridor which was closed by a door.<sup>12</sup>

b. Lighting

The lighting of Room XXVI is also uncertain. There is no possibility of direct light since the room was surrounded by others. Perhaps there was indirect lighting from Storeroom XXVII through a window on their party wall. In this case, it could be accepted that there was one more window, located on the west or the south wall of XXVII. There is no evidence for either of them since the walls have been preserved in a low height, but such a hypothesis should not be rejected. Some indications support the view that at least one window existed in Room XXVII. In Minoan buildings there were usually windows giving into open-air areas, unless there was a reason not permitting it. For instance,



in Zakros the whole West Wing of the palace was perforated by windows giving light to each room or storeroom lying beside the facade.<sup>13</sup> A window in Storeroom XXVII had also probably been used for filling, emptying or taking out the storage jars. If this was not so, all the above works would have to have been done through the luxurious Hall of Ceremonies.

Another possibility of indirect lighting is a window on the east wall of the south part of Room XXVI itself. It is quite probable that the Banquet Hall (XXIX) was sufficiently lit through windows on its east and south walls.<sup>14</sup> An indirect lighting through the Lustral Basin (XXIV) or the Treasury (XXV) must be excluded since these rooms would not be well lit because of their use.<sup>15</sup>

Artificial illumination with lamps, well known in Minoan Crete, is also a possible solution. However, there is no evidence for it since lamps or fragments of them have not been found in the fill of the room. Moreover, the artificial lighting would be a negative piece of evidence for the identification of a workshop area, since it is insufficient for working activities.

c. Architectural form and construction (Fig. 8)

Room XXVI had a dog-leg shape consisting of two balanced parts. Its shape was probably created by its adaptation to the shape of the east halls; the southern corner of the Hall of Ceremonies penetrated into it and covered the whole hypothetical NE part of the room.

Dimensions: NW part, 4 m. x 2,7 m.; SE part, 2,1 m. x 1,85 m.; enclosed area, 14,5 m<sup>2</sup>.

The walls of Room XXVI are plastered and were different from each other in width and method of construction. The south wall, the party wall with Storeroom XXVII, is very thick (0,85 m.). It is constructed of large stones which mostly occupy the whole width of the wall. Smaller stones and clay were used to fill the gaps. The width and method of construction of the wall suggest that in an earlier period the wall was used as the south facade of the West Wing, before Storeroom XXVII was built. The same conclusion is drawn from a prominent row of stones along the exterior side of the wall, probably the foundation remains of the first facade of the palace.

The SE wall of the room is almost equal in width to the south one (0,85 m.). It was constructed of two rows of medium-sized stones with a filling of clay. The north wall of the SE part of the room was at the same time the south wall of the Hall of Ceremonies (XXVIII). This is the widest of the walls of the room (0,90 m.) and was constructed of two rows of medium-sized stones, replaced sometimes by one block.

The east wall of the NW part of the room was thinner (0,50 m.). The north wall, also used as a party wall with the Lustral Basin (XXIV), was made of mud-bricks; it had a wooden frame and a stone foundation. Finally, the west wall, which was the east wall of the Treasury (XXV), was not very thick (0,65 m.), and was constructed of two rows of medium-sized stones.

The wider door is the NW one, which leads to the Treasury (1,15 m. wide). At each end of the doorway there

is a slab on the floor, probably used to secure the bolt or the door-leaf. The NE door, giving access to the corridor and through it to the Hall of Ceremonies, is about 1 m. wide. Two slabs are set in a similar way at each end of the doorway.

The third door, which leads to Storeroom XXVII, is about 0,75 m. wide. At its SE end two projections were constructed opposite each other. The spaces made beside them would be used as sockets for the door-leaves. Finally, the short corridor which joined Room XXVI to the Hall of Ceremonies was also closed by a door, as it is easily deduced by the two slabs set at each end of the doorway.

The floor was also plastered,<sup>16</sup> although on the whole it is not very well preserved. In the SW corner there were three rows of irregular stone slabs set with unequal spaces between (pl. 53). It seems probable that the whole was surrounded by a rectangular thin and low partition, as it is indicated by the ending of the plastered floor around it. The dimensions of the rectangular place of the slabs are 2,90 m. x 1,90 m.

This peculiar arrangement could not be a pavement since between the slabs there are empty spaces and they are placed in three visible rows. N. Platon considered that the slabs supported a lintel platform used for working.<sup>17</sup>

The hypothesis that the slabs supported planks is very possible. However, this does not prove that the low table was used for working since: a) it is not very suitable for sitting while working because of its low height (it is almost 0,20 m. high) and its width; b) it is more suitable



for a working table, but in this case the craftsman must have sat on the floor; c) there is no other evidence to support the hypothesis. Between the slabs were found only ivory and faience inlays which may have fallen from the upper floor since they also have been found elsewhere on the plastered floor of the room.<sup>18</sup>

d. Contents

As has already been discussed, the evidence used for the identification of the area as a workshop was the finding of quantities of raw materials: according to the annual report of 1963 steatite and red marble, according to Zakros steatite and red marble or porphyry and, finally, according to the excavation diary steatite and polychrome stalactite.

1) Steatites (S. cat. no. 10, fig. 60)

Provenance: Room XXVI, from the cleaning of the plastered floor. Between the slabs and the Lustral Basin (XXIV), immediately to the south of its staircase, close to the north wall of the room. More than two hundred large and medium-sized fragments of unworked steatite. Their colour is blue-black with olive patches. Some fragments are partly white, probably because they had been mined from the deeper veins.<sup>19</sup> Most of the pieces have a glossy polish and a corrosion on their surface and in other cases some white stains are visible.

2) 'Red marbles' (Oth.St. cat. no. 8, fig. 75)

Provenance: Room XXVI. Eight pieces of unworked reddish limestone. Their interior has white colour with some reddish patches and is friable, probably because of the effect of fire. They are of irregular but flat form.

Small flat fragments have become separated from the surface of some of them. Two pieces are larger than the others.

### 3) 'Polychrome stalactites'

They have not been identified. The related information is exclusively drawn from the excavation diary: "In the fill of the same room (XXVI) many large pieces of unworked polychrome stalactites were found," (17-9-63). Perhaps the 'polychrome stalactite' is the 'banded tufa' of P. Warren.<sup>20</sup> The description in the diary does not exclude the possibility that the fragments of this material had fallen from the upper floor. The fact is that they were not found in a heap, as the steatites.

#### d. Discussion of the raw materials

There are some discrepancies in the information about the raw materials found in Room XXVI. After the detailed study of the identified material in Heraklion Museum, we could suggest the following:

1) There are no problems about the steatites which have already been found and identified. These fragments, blue-black with olive patches, had probably been mined from deeper veins as their white parts indicate. The material consisted mainly of steatite with other minerals in smaller proportions (as serpentine)<sup>21</sup> and appears to be glossy on its surface.

2) It is not possible that the term 'red marbles' might be confused with the term 'polychrome stalactites', which has been mentioned in the excavation diary, since both materials are very different. On the other hand, the eight fragments described above cannot be identified with

the reference in the diary. (In the diary, "many large lumps" of the material were mentioned.) Consequently, two different materials must be distinguished: first, the identified material described as 'red marble' and second, the unidentified material described as 'polychrome stalactite'. The existence of the latter may be considered as certain, based on the diary information.

3) The 'red marble'<sup>22</sup> is probably a type of limestone with some reddish patches. However, the information that many vases of the Treasury were made of the same material is not correct.<sup>23</sup> Perhaps, there is a confusion with rosso antico or porphyry, which does not resemble this material.

e. The remaining contents

According to the excavation diary, in Room XXVI have also been found:

1) One piece and the lower part of the rhyton with the relief scene of the Peak Sanctuary. The smaller fragment was found in the lower stratum of the fill and the lower part of the rhyton on the floor. Both of them were found next to the projecting angle in the east part of the room (17-9-63).

2) Ivory, faience and bone inlays, in the same fill where the rhyton was found. Other inlays were found upon the floor a little further to the west. The inlays are mostly in the form of double axes, sometimes combined with the symbol of sacral knot, in the form of shells or floral motives.<sup>24</sup> Other inlays were of disc or stick-like shape. In the annual report of 1963, it is mentioned that the above were found on the plastered floor and between the slabs, on



the SW corner. It has been also considered that the material had fallen from the upper floor, since similar objects were also found in the SW part of the Hall of Ceremonies (XXVIII).

3) In the lower stratum of the fill were the fragments of a lid with short handles, small basins, fragments of a globe-shaped vase and the fragments of a jug at the SE part of the room (17-9-63).

4) The following were found on the floor of the room (Fig. 9): close to the north wall, from west to east, an amphora with oval mouth (1), a large stirrup jar (2), and a third amphora (3). Two more amphorae were found, the first one on the ruined SE wall of the Lustral Basin (XXIV), the second one in the corridor between Room XXVI and the Hall of Ceremonies (XXVIII). In the SE part of the room, beside the east wall, a jar and three amphorae were placed in the doorway to Storeroom XXVII, a jug with a trefoil mouth was found. In the centre of the SE part a vase of uncertain shape was found (19-9-63).

5) Close to the vases beside the north wall (1-3) and just to the south, a group of four clay loomweights with a single hanging hole was also found.

The above evidence leads to the following conclusions:

a) The rhyton with the relief scene of the Peak sanctuary probably fell from the upper floor. Its first smaller fragment was found before the lower part of the vase, in a higher stratum of the fill. Moreover, the dispersal of the other fragments of the same vase in different places in the palace area,<sup>25</sup> proves that the vase at least was not in situ.

b) It seems that the ivory and faience inlays had also fallen from the upper floor since they have been scattered in the whole area of the room and its surroundings. Moreover, most of these were found at different depths in the fill (17 & 18-9-63).

c) It is possible that some of the vases had also fallen from the room upstairs, such as a jug from the SE corner (found in many fragments) and the amphora on the wall of the Lustral Basin (XXIV). Perhaps the lid and the small basins also fell from above. However, most of the above mentioned vases could have belonged to the context of the ground floor, since they have been found in the lower layers of the fill, right over the floor.

d) Pots which belong to the context of the ground floor room are certainly those represented in the drawing of Fig. 9:<sup>26</sup> seven oval-mouthed amphorae, one stirrup jar, one jug, one jar and one vase of uncertain shape. In the same context were the four clay loomweights.

#### f. Date

Room XXVI existed until the final destruction of the palace, that is, the end of LMIB. The date is confirmed from its pottery and the fact that the room was used simultaneously with the other areas of the West Wing of the palace. From the study of the stratigraphical and typological data, an earlier or later use of the same place has not been proved.

#### Summary

Location. The room was surrounded by the Shrine apartments. Its NW door provides the only access to it.

Approaches. Room XXVI was reached through the Hall of Ceremonies (XXVIII).

Lighting. Indirect, from another room, or artificial.

Contents. a) Raw materials: steatites, limestones, stalactites. b) Unfinished objects: one steatite fragment polished on its surface. c) Waste material: no evidence. d) Tools: no evidence.

The remaining contents. Vases of domestic use and four loomweights. No large storage vessels (except one small jar).

Other equipment. A wide, low wooden platform.

Date. LMIB.

#### Discussion and Evaluation

We might begin the discussion with the evidence considered by the excavator sufficient to describe the room as a workshop area, namely the raw materials and the wooden platform at the SW corner. There is no doubt that three different kinds of raw material were included in the contents of Room XXVI: steatites, limestones and stalactites. We know exactly the steatites' find place: they were found in a heap between the Lustral Basin (XXIV) and the platform. However, one could not confirm that they were in situ at the time of the destruction or that they had fallen from the upper floor. Despite the fact that they were found on the floor, we must be cautious, since the rhyton and most of the inlays also found on the floor had fallen from above, as previously considered. In addition, close to the north wall of the Treasury, another group of steatites was found, probably fallen from the upper floor.<sup>27</sup> On the other hand,



the steatites in Room XXVI were found in a heap and not scattered in the fill, as were the steatites in other places of the West Wing.<sup>28</sup> Moreover, there is no mention in the excavation diary of damage to the floor of the room as a result of the fall of material weighing 17,5 kg. from a height of 3 meters. So, it could be accepted, with some reservation, that the steatites were in situ.

There is no mention of marbles or limestones in the excavation diary. However, the limestones were placed along with the steatites in Heraklion Museum. Therefore, we can consider that they were found together.

The polychrome stalactites were found in the lower strata of the fill, since the ground floor contents had already appeared at the time of their discovery.<sup>29</sup> So it is difficult to decide whether they belong to the contents of the ground floor room or not. The fact is that they were not found in a heap, which might indicate that they were fallen from above.

If it is accepted that the heap of steatites was found in situ, it is difficult to suggest that it was stored there for two reasons: a) the room was not a storeroom, as we can conclude from the rest of the contents; b) the location of the heap was not suitable for storing, being found half way along the passage to the Treasury (XXV), between the Lustral Basin (XXIV) and the platform's construction.

The construction of the SW corner was probably wooden (in spite of the absence of burnt wood). It is possible that it was used as a work table although, as already discussed, its low height probably would create some difficulties.

On the other hand, what other use could such a construction have had? There is no evidence that it was used for storing vessels, since nothing was found between the supporting slabs, and the existing vases were placed beside the walls of the room. There is no indication of a ceremonial function.

The remaining contents of the room are not very indicative. All the pots belonging to the ground floor could have contained material used in the work, or simply have been used by the craftsmen during work. They are not storage vessels, nor typical ceremonial pots. Finally, the loomweights might have fallen from the upper floor, though they were found on the floor.

So, positive evidence for the identification of the room as a workshop is:

- the presence of two or three kinds of raw materials.
- the wooden platform, hypothetically used for working.

Negative evidence is:

- the problematic access.
- the insufficient lighting.
- the plastered floor and walls,<sup>30</sup> though plastered floors and walls were usual in the West Wing of the palace.
- the absence of tools and unfinished objects.

On the basis of the above evidence, the hypothesis that the room was used as a working area is sufficiently valid and should not be rejected. Accepting that the stalactites had fallen from the upper floor, we could suggest that a workshop was located on the upper floor, too. This is confirmed by the discovery, a little further to the north,<sup>31</sup> of the bronze tools fallen from above. The evidence that

boxes with inlays were located above Room XXVI is not against a workshop being located there.

#### Production and Function

It has been argued that Room XXVI is a possible stone workshop area. However, evidence for the workshop's function and production is not sufficient; from the examination of the materials worked there it could be deduced that the main products of the workshop were small artifacts of various kinds of stone. However, seals were definitely not manufactured, as steatite was not used for seal-making during this period.<sup>32</sup> On the other hand, the steatite pieces are not sufficiently large for manufacturing vases of a medium size. Perhaps the larger pieces were used for miniature cups and bowls. Some other artifacts such as spindle whorls, weights or beads could likewise have been produced from steatite. The limestone was not suitable for such products, while the fragments of the material were not sufficiently large to make small pots or vases. Perhaps, then, these were only waste materials remaining from the processing of larger pieces.

There is no evidence at all for the manufacturing process. The polishing of a small fragment, forming a concave surface, is not sufficiently indicative. One can only suppose that the way of working the materials was similar to the way used in the Minoan stone workshops, as described by P. Warren.<sup>33</sup> It may be considered that the workmen sat on low stools in front of the platform, where they put their tools and the raw material. Working was probably done on the platform. The auxiliary pots were also placed on the platform or on the floor.<sup>34</sup> It has been assumed that the



platform was used as a bench for the workmen and that the work was done at a higher level. However, the wooden platform is too wide and therefore not suitable for a bench. It is probable that the workmen were seated on low stools and they were working at a higher level.

There is no doubt that the room, because of its location, had a close connection with the Shrine and its Treasury (Room XXV). It is probable that some of the famous stone vessels of the Treasury were made or finished there, before they were stored in the next room. The association between Room XXVI and the room in which the stone vases were found led the excavator to name the place 'the Workshop of the Shrine'.

## 2. Workshop in the Upper Floor of the West Wing

The possibility that workshops similar to the previous one were established on the upper floor of the West Wing of the place, was first expressed in Zakros.<sup>35</sup> N. Platon describes Rooms XII and XIII and their contents and he refers to stone and bronze workshops which he suggests were located over these rooms. This hypothesis was based on the discovery of many fragments of unworked steatite in the fill of the rooms, which was connected with the bronze tools and the fragments of objects in the same area.<sup>36</sup> The discovery of steatite and of the bronze tools is also mentioned in the annual reports of 1962 and 1963, without special emphasis.<sup>37</sup>

A major problem that arises in considering these possible workshops, is whether there is sufficient evidence that the relevant material had fallen from the upper floor. The indications that certain materials had fallen are the

following: 1) the location and the depth where the material was found; 2) the discovery of similar material in neighbouring areas, separated by walls on the ground floor.

It is evident from the published information that very similar material was found in the fill of three neighbouring rooms in this area (Rooms XIII, XIV and in the south part of XII). From the excavation diary we have the information that similar material was also found in the fill of the north part of Room XVI and in the plastered cist at the NW end of Room XV. Some of the finds from the contents of Room XI should also be studied here.<sup>39</sup>

The above evidence leads to the conclusion that the whole material referred to had fallen from the upper floor, and that it belonged to a single room. The location, form and use of this room will be defined after the study of the material.

a. Location (Fig. 10)

In examining the upper floors of Minoan buildings it is necessary in most cases<sup>40</sup> to use evidence drawn from two sources: 1) the architectural form and construction of the ground floor; 2) the contents of the ground floor rooms which are being suggested as fallen from above.

We must keep in mind that the layout of the upper floor, especially if there is no higher level again,<sup>41</sup> does not have to reproduce the precise layout of the ground floor. This latter was usually divided by party walls into many small rooms, while large halls were avoided.<sup>42</sup> The partition walls in most cases were also used to support the walls of the upper floor and the beams of the ceiling. This explains

their width. On the upper floor the structural needs were not of the same significance. Therefore, the whole area was mostly for larger rooms and halls in which many activities were taking place. This is usually confirmed by the study of the material which it is argued had fallen from the upper floor.

In the architectural study of the ground floor which follows, we attempt to determine the arrangement of the upper floor rooms.

The area of the upper floor here corresponds to the Rooms XII, XIII, XIV, XV and XI of the ground floor, and it extends from the west facade to the lightwell and from Staircase X to the Lustral Basin (XXIV). The first difference between the ground floor area and the upper floor is that Staircase X should not be included in the upper floor arrangement. Thus, it could be suggested that the north wall of Room XI would have supported the north wall of the upper floor room.

A low partition separates the west side of Room XV from two rectangular enclosures. This low wall and another low partition in Room XVII, will not be considered as supporting walls.

If we start with Rooms XII and XIII, we cannot exclude the possibility that on the upper floor, immediately above them, there was only one room, extending from the north wall of Room XI to the south wall of Room XIII. If there were two rooms similar to those of the ground floor, they could not have extended further to the east, since the party wall on the upper floor would not have had any support underneath



in this direction. Consequently, it seems certain that the east wall of Rooms XIII and XII did support a corresponding wall on the upper floor.

Now, let us attempt to divide the rectangular area above Rooms XIV, XV and XI. The main problem is the complete absence of supporting walls or columns in the large rooms XI and XV. The only wall which could be used to support another wall on the upper floor is the wall separating Rooms XI and XV. A hypothetical wall dividing XV in two parts (west and east part) must be excluded since there is no supporting wall on the ground floor.

It is also difficult to have a similar corridor to XIV above it, since its east wall is very thin for supporting another wall on the upper floor.

From the above evidence it may be deduced that there were two groups of rooms on the upper floor: a) a single rectangular room or two similar to the ground floor ones, Rooms XII and XIII; b) a large square room above XIV, XV and XI, or two rooms corresponding to XIV, XV and XI.

The material which is considered to have fallen from above constitutes evidence for the hypothetical restoration of the upper floor. In Room XII there were only a few objects to consider: two fruit-stands with cross-shaped partitions on the interior, from the east doorway; and a leg of a bronze cauldron, which had probably fallen. The rest of the objects come from the ground floor, including two swords with golden rivets.<sup>43</sup>

In Room XIII a lot of small vases were found fallen from a height, but it is believed that they fell from

wooden cases fixed to the walls of the room.<sup>44</sup> Some larger storage vessels were found on the floor. It is mentioned that in addition to unworked steatites, bronze tools and sheets, fragments of wall paintings had also fallen from the floor above.<sup>45</sup> All of this material was found together in the fill along the east wall of the room.

Apparently the evidence for the material fallen from above is insufficient to understand the arrangement of the upper floor rooms corresponding to Rooms XII and XIII. The material found just west of the east wall of Room XIII could very well have fallen from a room located a little further to the east, since similar material was also found to the east of the same wall on the ground floor. The fall of a part of the material a little further to the west could be explained if we accept the wall above had fallen to the west, as happened with the facade of the West Wing.<sup>46</sup>

From the above discussion it is apparent that it is difficult to decide if there were one or two rooms over XII or XIII. However, if we accept that on the upper floor the rooms were generally larger, one may suppose that the area was unified into a single room.

For the second complex of rooms the evidence is as follows:

1) On the east side of rooms XI and XV more than ten large decorated amphorae and smaller pots had fallen from above. They had almost certainly fallen from the same area of the upper floor since some of their fragments were found in the neighbouring lightwell.<sup>47</sup> The vessels are principally for storage, while some could have been used for ceremonial

purposes. The fact that similar vessels were found in the fill of both of the rooms on the ground floor leads to the conclusion that the area above was a single, undivided one, although the possibility of dispersal during the fall cannot be excluded.

2) On the west side of Room XI the copper ingots and ivory tusks, which were certainly lying in store, had fallen from above together with mud-bricks.

3) A group of peculiar fruit stands with a cross-shaped partition in the interior was found throughout the west side of the area and, from their dispersal, it may be concluded that they had fallen from a single upper floor room (above Room XI, the doorway to Room XII and the north part of Corridor XIV).

4) The dispersal of steatites in Corridor XIV, on the west side of XV and along the east side of XIII (up to the NE corner of XVI) could only be explained if we accept that they had fallen from a single room on the upper floor, probably located above the west part of Rooms XV and XIV.

5) The variability of the remaining contents fallen from above does not assist the hypothetical restoration of the upper floor.

The evidence discussed above makes it quite possible that there may have been a single, almost square room over Rooms XI, XV and XIV. The upper floor was probably supported by a system of beams. A central beam (or complex of beams) starting from the centre of the north wall of the Lustral Basin (XXIV), at right angles to it, was supported by the projection of the north wall of the corridor leading to XV



(probably constructed exclusively for this purpose). This central beam rested on the partition wall between XI and XV and reached the north wall of XI. A system of beams vertical to it would complete the support of the ceiling.<sup>48</sup>

b. Approaches

This large upper floor room would have been accessible from the wooden Staircase X by a door at its northeast end, probably above the ground floor doorway between Rooms IX and XI.<sup>49</sup> The staircase would have served the circulation between the upper floor room and the ground floor apartments. It is possible that there was one more door at the SE end of the room, immediately above the corresponding door on the ground floor, between Rooms XXVIII and XV. This door could have been reached using Staircase XXX and passing through a hall above the Hall of Ceremonies (XXVIII). This means of access would have been preferable to the alternative up the narrow Staircase X, which apparently had a more special function.

c. Lighting

Sufficient light would have been provided by the lightwell of the Hall of Ceremonies (XXVIII). Presumably a double window, corresponding to the one on the ground floor, would have opened on to it.<sup>50</sup> It is also possible that part of the lighting came, indirectly, from the rooms above Rooms XII and XIII, which might well have been lit by windows in the west facade.

d. Architectural form and construction (Fig. 11)

The evidence for the construction of such a room located on the upper floor is necessarily insufficient.

The walls probably consisted of plastered bricks, as is shown by the material which fell to the ground floor.<sup>51</sup>

Perhaps some of them were decorated with paintings if, as is supposed, some fragments of wall paintings found in the fill of Room XIII had fallen from the west wall of the area under discussion.<sup>52</sup> The floor was almost certainly wooden, as is indicated by a thick burnt layer observed under the fallen material.

e. Contents

The identification of this place as a workshop area was based on the presence of quantities of raw material, mainly steatite, and of some bronze objects and tools. The material considered to have fallen from the upper floor above Rooms XI, XII, XIV and XV is as follows.

1) Raw material

a) Steatites (S. cat. nos. 1, 9, 11, 12, 14, 15, 16, 17, 18, 21; figs. 56, 58, 59, 61-64, 66; pls. 4-5).

Provenance: a) Room XIII, along the east wall in the fill, b) NE corner of Room XVI and the doorway to Room XIII, in the fill, c) Corridor XIV, in the fill, and d) plastered cist at the west side of Room XV, in the fill. Fragments of unworked steatite of medium and small size. On a few of them polishing is visible. Their colour is blue-black with olive patches. Some of them are partly white-coloured, probably mined from deeper veins. They all have a very glossy polish and, in some cases, a series of close grooves like a comb (probably due to the manner in which they were detached from the core) are visible. A large quantity.

Total weight: 23,7 kg.

b) Copper ingots (C. I . cat. nos. 1-6; fig. 145, pl..52).

Provenance: Room XI, NW side, opposite the low partitions. Fallen from the upper floor together with mud-bricks and other building materials (0,70-0,30 m. above the floor). There were six ingots, similar to those from Hagia Triadha, with rough surfaces, sometimes with small cavities and pieces of bronze adhering to the surface, probably to complete a certain weight. Each of them weighs approximately 29-30 kg. There are no discernible symbols on them, such as appear on some from Hagia Triadα.<sup>53</sup>

c) Ivory tusks (F.-Gl.-I. cat. nos. 4-7; figs. 89-91, pl. 19).

Provenance: Room XI, NW area, together with the ingots, a little further to the west. Fallen from the upper floor (found 0,40-0.10 m. above the floor). There were three tusks, not very long (up to 1,06 m.) but extremely curved. The largest and best preserved tusk was blackened at one end due to burning.

## 2) Tools

Bronze tools were found in groups in the fill of four different rooms and it is not certain that they all belonged to the same group. With them were also found some leaves and fragments of bronze as well as a huge handle and a leg of a bronze cauldron (pl. 51).<sup>54</sup>

### a) Chisels

Provenance: Room XIII, beside the east wall, NE corner, in the fill.

- Big flattened chisels with two cutting edges



(one curved, the other straight) at each end. They could be used with both ends according to requirement. (Br. Ch. cat. nos. 2, 3; fig. 113; pl. 29).

- Smaller chisel of the same type. (Br. Ch. cat. no. 4; fig. 114; pl. 29).

- A very small chisel-like tool with traces of a wooden haft. (It has not been identified; information from the excavation diary.)

b) Double axe. (Br. Ax. cat. no. 6; fig. 121; pl. 37).

Provenance: Room XV, approximately in the centre. Low down, in the fill. Of the usual type, with a hole in the centre for the shaft.

c) Leaf-shaped tool ('razor'). (Br. R. cat. no. 1; fig. 135; pl. 54).

Provenance: Room XV, beside the east wall; in the fill, 0,30 m. above the floor. Bronze tool with two nails for attaching the wooden haft. (Traces of a silver band?)<sup>55</sup>

d) Punches, awls

- (Br. P. A. P. cat. no. 1; fig. 141; pl. 47).

Provenance: Room XI, at the doorway to XII, in the fill. Thin bronze punch or awl, square in section. Together with pieces of another similar one.

- (Br. P. A. P. cat. no. 2)

Provenance: Room XI, in the central area of the room, in the fill. Similar to cat. no. 1, but fragmentary.

e) Other tools

- (Br. T.w.T.T.; fig. 142; pl. 41).

Provenance: Immediately outside the SW door of Room XIII (Room XVI). Two ends of a tool which appear similar to one another (perhaps from two similar tools), with three teeth. If the two pieces belong to a single tool, this might be used with both of them, according to requirements. It was probably used to incise circles or a triple grooving.<sup>56</sup>

- (Br. Kn. cat. no. 4)

Provenance: Room XI, doorway to XII, in the fill. Curved piece of bronze which may have been the part of the blade inserted in the haft of a knife.

f) The remaining contents

Besides the amphorae and the fruit-stands described above,<sup>57</sup> which had fallen from the upper floor, there were the following.

- A large part of the contents of Room XI. This included bridge-spouted jugs, jugs with oval or beak-shaped mouth and a quantity of cups with or without a handle. There were also some vessels with figure-eight-shaped handles and with an internal partition pierced with holes around a central opening.<sup>58</sup> However, we cannot be sure that all of this material fell from the upper floor, since it could have been stored in wooden cases attached to the walls of the ground floor room, as in Room XIII.<sup>59</sup>

- A large part of the contents of Room XV, found higher in the fill.<sup>60</sup> It includes vases of medium and small size: jugs either with a single handle or without, and about

ten cooking pots. In addition, a group of small faience bowls, a stone vase and fragments of others and, finally, some pieces of plastered offering tables. The loomweights found on the floor, probably belong to the contents of the ground floor room.

- Some more fruit-stands found together with jugs and small stone basins in the fill of the corridor, between Rooms XIV and XV.

### Summary

Location. It was located above Rooms XI, XIV and XV, which have been considered as rooms connected with the Shrine.<sup>61</sup> There is an immediate connection with a hall above the Hall of Ceremonies (XXVIII) and with the south lying room from which a number of bronze tools had fallen to the ground floor.

Approaches. From outside, up Staircase XXX and through the hall above the Hall of Ceremonies. From the ground floor of the West Wing, up Staircase X.

Lighting. From the central lightwell. Probably, in addition to lighting from the rooms to the west.

Architectural form and construction. A large room based upon a system of beams. Plastered walls made of mud-bricks.

Contents. a) Raw materials: steatite, ivory tusks, copper ingots. b) Unfinished objects: some polished fragments of steatite. c) Waste material: no evidence. d) Tools: bronze tools of various types; chisels, punches, axe, razor. Probably a knife and tools with toothed ends.<sup>62</sup>



The remaining contents. Large storage vessels, finely decorated. A number of smaller decorated vases, including some which probably had a ceremonial use. Some objects made of other materials (faience, stone).

Other equipment. No evidence.

Date. LMIB, dating to the final destruction of the palace. (The chronology is confirmed by the pottery.)

#### Discussion and Evaluation

The discussion will begin by trying to locate the material in the hypothetical restoration of the upper floor room.

The steatites were probably in heaps along the west wall of the room, above Corridor XIV, extending up to the SW corner (above the NE door of XVI). It is probable that they were stored in sacks or wooden boxes, rather than on the floor.<sup>63</sup> The copper ingots and the ivory tusks were stored beside the north wall.<sup>64</sup> The tools, found in groups, may have been located: 1) beside the west wall of the room, above Corridor XIV, close to the NE corner of Room XIII (chisels); 2) beside the west wall of the room, above the doorway between the ground floor rooms XI and XII (punches); 3) over the middle of Room XV ('razor', axe). The tools with toothed ends perhaps belong to the contents of another room.<sup>65</sup>

If the room was separated into two parts by a wall above the wall separating the ground floor rooms XI and XII, then the copper ingots, the ivory tusks and the punches belonged to the north part and the steatites, the chisels, the axe and the razor to the south half.

The steatites were numerous but smaller than those of Room XXVI. However, this variety resembles the steatites of Room XXVI as regards colour and texture. The absence of every kind of working<sup>66</sup> probably means that the material was in store, but does not exclude the possibility that the working was intended to be done in situ.

With regard to the copper ingots there is no doubt. They were obviously imported from abroad and were being stored until their use for melting. The latter process has no connection with the room under discussion. The existence of some pieces of bronze and fragments of a bronze cauldron probably indicates bronze-working at a later stage, which will be discussed elsewhere.<sup>67</sup>

The ivory tusks were stored together with the ingots. It could be accepted that their working, or a part of it, was done in situ, but there is no evidence to confirm it, at least for the last days of the palace.

Of the tools, the double axe and the razor were not in storage, since they were found in the middle of the room. Moreover, they are unlikely to have been included in the equipment of a stone workshop. The axe was not suitable for working small objects and the 'razor' is usually considered to have been used for working leather.<sup>68</sup>

The chisels and the punches were probably intended for the working of steatite. This is confirmed by being found in the same area. However, the possibility of their storage in boxes is not excluded, since they were found in groups of the same tool types.

The remaining contents of the room had a storage

character. Even so, the quality of the material is very high, so one could consider that the room was used for storing the vessels themselves (some of these were probably used for ceremonial purposes). Consequently, the area could well have been used as a repository for pottery used in the Shrine.

It is very possible that most of the upper floor rooms of the West Wing were used as workshops, since a lot of bronze tools and raw materials were scattered throughout the rooms on the ground floor. The finding of the steatites together with bronze tools above Rooms XI, XIV and XV makes it possible that the area was used as a stone workshop.

On the other hand, the remaining contents lead to a different conclusion: the function of the room was for storing pottery, other objects and raw materials.

By juxtaposing the two different points of view, one might suggest that the same place was used for two different purposes, which was not unusual in Minoan society. The hypothetically restored room would have been sufficiently spacious for storing and working in the same area.

#### Production and Function

The workshop discussed above dealt with steatite and probably other similar stones, as did the workshop in Room XXVI. Once again the evidence is not adequate to form an idea about production and function.

It might have been furnished with auxiliary equipment for the workmen, such as a wooden table and seats or a bench. The tools belong to two categories: a) those which could be used in the first stage of working (such as the chisels with



the wide cutting edges), b) those which could be used for details (punches, thin awls and a small chisel-like tool).

What the workshop produced is difficult to say. The fragments are generally smaller than in the first workshop and could not have been used for making vases. In addition, there is no evidence for drills<sup>69</sup> or specialized tools, which could support such a hypothesis. Perhaps the workshop was used for making small objects (as that of Room XXVI).

### 3. Workshop above the West Magazines?

Apart from the possible workshop described above, some others may be hypothetically restored on the upper floor of the West Wing by using the evidence provided by the material fallen from above. The evidence, once more, is mainly based on the existence of raw materials and tools found in association.

The area above the West Magazines and the 'Corridor of the Bays' presents evidence related to workshop equipment. The annual reports of 1962 and 1963<sup>70</sup> provide information that two groups of steatites were found in two different, but neighbouring areas of the ground floor: in the doorway between Rooms V and ,<sup>71</sup> and on the steps of the entrance hall to the magazines (Area II). Bronze tools directly associated with this material were not found.<sup>72</sup> However, some tools found in the fill of Magazines III and IV, fallen from the upper floor, can be included here since the architectural arrangement of the upper floor is not easily defined. The finding of rubbers with traces of pigments

and of a number of loomweights, which had also fallen from above,<sup>73</sup> suggests that the upper floor rooms were used for various working activities.

a. Location (Fig. 12)

The architectural arrangement of the rooms above the West Magazines cannot be defined by using the plan of the ground floor. All the walls on the ground floor are thick enough to support corresponding walls on the upper floor. So the area above Rooms IV, III, II, I, V, VI, VII and VIII was probably arranged in the same way. On the other hand, one could define larger rooms by joining two rooms into one, in various combinations: IV and III, I and II and V and VI, VII and VIII or IV, III and VII and VIII, I and II and V and VI.

Conversely, an arrangement similar to that of the ground floor may not have been necessary, since a 'Corridor of the Bays' on the upper floor would not have led to magazines like those on the ground floor and consequently would have been redundant.<sup>74</sup>

The material found in the fill and in the storage jars of Magazines IV and III could have fallen from a single room on the upper floor. A lot of decorated pottery, including vases of small to medium size, such as handleless cups or cups with a single handle, jugs, bowls, rhytons of conical or ovoid shape and cooking pots probably belong to the same context.<sup>75</sup> In Magazine III were also found, mainly in the east part, about two dozen loomweights of two types. Similar loomweights were also found in Rooms VII, VIII and II, on its two sides. Consequently, it is possible that all the

loomweights were from the same upper floor room.

Both of the groups of steatites found in neighbouring areas might have fallen from a single upper floor room. So it seems possible that there was a single room above Rooms II, III, VI, VII and VIII, although in this case Room IV and the oblong area above I and V would not be included.

From the discussion above, it may be deduced that there is not sufficient evidence for separating rooms on the upper floor in the West Magazines area.

#### b. Approaches

The principal approach to the area above the magazines of the West Wing would be up Staircase XXX and through the hall above Room IX. Perhaps there was a door above the one on the ground floor which led to the 'Corridor of the Bays', or above the west wall of Room IX, leading to the room above Magazine IV. The northern part of the same area was probably accessible up Staircase LII and the room above large Room XXXII. The communication between the area above Room IV and the basement apartment was probably by the narrow Staircase X, leading to a door at its SE end.

#### c. Lighting

There is no doubt that the room or rooms above the magazines were sufficiently and directly lit by windows on the west facade of the palace, as on the ground floor.

#### d. Architectural form and construction

The walls of the upper floor rooms were made of mud-bricks covered by white or blue plaster, as is suggested by the building material fallen from above. Some of these were painted with simple motives, deduced by the finding of pieces



of paintings with successive brown bands. Other fragments depicting rosettes were found in the fill of Areas VII and VIII.

Some porous stones found in the fill of the magazines are probably the remains of the superstructure of the exterior walls at the upper floor level. The floor was probably made of pebble cement, since many fragments of this material were found in the fill, fallen from above.

e. Contents

The hypothesis that there was a workshop area above the West Magazines is based once more on the finding of raw materials and tools in association. That the area was used for working activities is also confirmed by the presence of many loomweights, together with rubbers for pigments.

1) Raw material

a) Steatites (in two groups).

- (S. cat. no. 20; fig. 66)

Provenance: on the second step of the stairs leading down to the magazine level (Room II). The unworked steatites, small and medium-sized fragments, were in a heap. They were similar to those found in other areas of the West Wing.

- (S. cat. no. 19; fig. 65)

Provenance: in the doorway between areas V and VI, in the fill. A heap of unworked steatites, mainly large-sized (e.g., 9,5 x 7,95 x 6,2 cm.), but including some smaller ones. They were of a bluish to black colour but some were partly white. A considerable quantity (total weight: 12,650 kg.).

b) Obsidian (O. cat. no. 223; fig. 46)

A core found in Jar H of Room IV. From its surface, five blades have been detached.

2) Tools

a) Bronze axes

- Provenance: on the steps of Area II. Double axe of the ceremonial type with curved outline and central hole for the shaft. Its use as a tool can be excluded.

- (Br. Ax. cat. nos. 7, 8; fig. 124; pls. 37, 39).

Provenance: west side of Storeroom IV, close to Jar M. Two bronze double axes with two opposite cutting edges and a central hole for the shaft. Their width increases towards the cutting edges.

b) Small chisel or drill (Br. S. Dr. cat. no. 2; fig. 136; pl. 44).

Provenance: near the middle of Room IV, close to Jar E. In the lower burnt layer, immediately above the floor. A small chisel-like tool, square in section, with thin, tongue-shaped cutting edge. Perhaps it was used as the end of a drill.

c) Punch or drill (Br. S. Dr. cat. no. 1; fig. 136).

Provenance: near the middle of Room IV, close to Jar E. In the lower burnt layer, immediately above the floor. Punch or drill, square in section, with an almost conical point.

d) Sledge hammer (Br. Sl. H. cat. no. 1; fig. 126)

Provenance: Storeroom IV, inside Jar B, on the

east side of the room, beside the door. Two symmetrical surfaces for beating and a central hole for the shaft. Irregular shape, blunt surfaces.

e) Knives<sup>76</sup>

- Provenance: Storeroom IV, at the SE corner, low down in the fill. Two small blades of bronze, probably from knives.

- Provenance: NW corner of Room III. A curved bronze knife of the type with a single cutting edge, the other edge curved. Three nails for fixing the wooden handle.

3) Material connected with working activities

a) Rubbers for working pigments (fig. 104).

Provenance: near the middle of Room IV, close to Jar I, in the fill. Light and porous-like stones, probably due to the effects of fire. Five of them have traces of a light blue colour on the surface. The sixth has a light green colour. A flint blade was found with them.

b) Loomweights<sup>77</sup>

- Provenance: in the whole area of Storeroom III, mainly on the east side. Many loomweights, principally of trapezoidal form en face and lentoid type (pl. 59).

- Provenance:<sup>78</sup> on the steps of Area II. At least two dozen loomweights of lentoid type.

- Provenance:<sup>79</sup> west side of Area II. Loomweights similar to the ones on the stairs.

- Provenance:<sup>80</sup> 'Corridor of the Bays' (VI, VII, VIII). In the fill, many disk-shaped loomweights together with a pyramidal loomweight.

In the same area, a flake of obsidian and a



whetstone(?) with a hole for hanging were also found.

4) The remaining contents

From the remaining contents of the magazines we could separate a number of objects probably fallen from above. It may be considered that the objects found inside the storage jars or in the higher layers of the fill were fallen from the upper floor rooms.<sup>81</sup> The most significant of these are the following.

a) A great amount of fine ware found in Magazine III (cups with a single handle or without, decorated bowls and jugs).

b) A piece of a plastered offering table in Magazine III.

c) A great amount of fine ware similar to Magazine III types, fallen in Magazine IV.

d) Various stone vessels, found in the storage jars on the north side of Magazine IV, or lying close to them, certainly fallen from above.

e) The mouth of the rhyton with the relief scene of the Peak Sanctuary, fallen from the area above Magazine IV.

#### Summary

Location. Above Rooms IV, III, II, VI, VII and VIII.

A more exact hypothetical location is problematic.

Approaches. Through other upper floor areas, by passing through the hall above Room IX or through the hall above Room XXXII. There was probably a direct communication with the ground floor apartment of the Shrine, down Staircase X.

Lighting. Direct, by windows on the west facade.

Architectural form and construction. A large room with pebble cement floor. Walls plastered, sometimes painted, made of mud-bricks.

Contents connected with working activities. a) Raw materials: steatites. b) Unfinished objects: no evidence. c) Waste material: no evidence. d) Tools: bronze axes, a small chisel-like tool (or drill), punch (or drill), knives. e) Other equipment: no evidence. f) Material of related activities: loomweights, rubbers for working pigments.

The remaining contents. A quantity of fine ware, some stone vases and a fragment of the rhyton with the relief scene of the Peak Sanctuary. Bronze axe of the ceremonial type.

Date. LMIB, dating to the final destruction of the palace.<sup>82</sup>

#### Discussion and Evaluation

The various tools and raw materials fallen from above in this part of the ground floor were not found close together. The bronze tools were mainly found in Room IV, with the exception of a long bronze curved knife found in Room III. Conversely, the steatites had fallen upon the steps of Area II and in the doorway between V and VI. The long distance between the places where the two groups were found (the tools and the raw material), diminish the possibility that they had fallen from the same room. So the association between the raw material and the tools which could support the identification of a workshop area, is uncertain. On the other hand, the presence of a lot of loomweights and some rubbers

used for working pigments,<sup>83</sup> is indicative of various working activities in the same area. Consequently, since there was raw material, the possibility that work on stone was done simultaneously should not be excluded.<sup>84</sup> However, this is very difficult to prove, since there is insufficient evidence.

#### Production and Function

There is no more evidence for the production from the workshops concerned with steatite. There were some large fragments of this material, possibly used for making very small vases or Bird Nest's Bowls, but the smaller ones were suitable only for small objects and ornaments. The tools, probably connected with their manufacture, were similar to the other workshop tools described above: axes, knives, a small chisel-like tool, or drill, a punch. It is unlikely that the axes could be used for such delicate work. Of the other tools, knives could be used for a preliminary stage of working, such as shaping the core, and the punch and small chisel for the details. As for the last tools, there is a possibility that they were used as the ends of rotating drills.<sup>85</sup>

Other areas where unworked  
steatites were found

#### Treasury of the Shrine.

In the group of bronze objects from the Treasury are included some tools (chisels and a plain axe), which are considered to have fallen from a storeroom above.<sup>86</sup> In the same room, on the north side, were found two groups of



unworked steatites, similar to the previous ones. The presence of the tools and the raw material in the same place suggests that there was probably one more stone workshop in a room on the upper floor.

a. Location (Fig. 7)

The arrangement of the upper floor rooms at this point is not clear. It is possible that a single room corresponded to Rooms XXV and XXVI.

b. Approaches

Access to the room was probably by a single approach similar to that of the ground floor, above the Hall of Ceremonies (XXVIII).

c. Lighting.

By windows on the south wall of the room, above the south wall of the Treasury.

d. Architectural form and construction

There is no evidence. One could imagine that the partition walls were made of mud-bricks and were plastered, exactly like the walls of the upper floor rooms in other areas of the West Wing.

e. Contents

The hypothesis for the identification of a workshop area is once more based on the finding of unworked steatites in connection with bronze tools.

1) Raw materials

a) Steatites (S. cat. no. 2; fig. 57; pl. 5).

- Provenance: close to the north wall of the room.

- Provenance: on the NW side of the room, under

a fallen oval-mouthed amphora.<sup>87</sup> About fifty fragments of

unworked steatite, of small or medium size, including two polished pieces coloured bluish-black with olive patches.

## 2) Tools

a) Bronze axe. (Br. Ax. cat. no. 5; fig. 121; pl. 38).

Provenance: from the middle of the room. It is thin, with rough surfaces, with not very regular shape and a central hole for the shaft.

b) Small knife. (Br. Kn. cat. no. 3; fig. 116; pl. 29).

Provenance: SE corner. A small bronze knife, pointed, with two straight edges.

c) Chisels. (Br. Ch. cat. nos. 5, 6; fig. 114; pl. 29).

Provenance: SE corner. Two bronze chisels of the wide type with two cutting edges. The first one straight, the other one curved.

## 3) The remaining contents

Besides the finds described above, part of the material found in the Treasury probably belongs to the same ensemble. (Perhaps some of the domestic pottery.)

## Discussion and Evaluation

The three tools fallen from the upper floor of the Treasury were found all together in the SE corner. The axe was found near the middle of the room and the raw materials on the north side. This material included only two small groups of steatite fragments. Although the tools, principally the chisels, could have been connected with the working

of stone, the association between them and the raw materials is not very strong. They may have been kept separately, in boxes, around the walls of a storeroom. On the other hand, it has been argued that raw materials had fallen from above into the neighbouring Room (XXVI). So, if there was a single room above Rooms XXV and XXVI, the possibility that it had been used as a workshop increases, since there is the additional evidence for Room XXVI.

The Treasury is dated to the final period of the palace (LMIB).

Heap of steatites in Room A of Building Z on the SW hill (Fig. 13)

One more heap of unworked steatites was found, in Room A of Building Z on the SW hill (S. cat. no. 13; fig. 62; ).<sup>88</sup> From the same room, used as a storeroom during its last period, there were no other working materials or tools, except for a long bronze awl (Br. P. A. P. cat. no. 5). However, a connection between this tool and the unworked steatites is excluded because the awl was found on the west side of the room together with pottery belonging to the period of the storage jars. Conversely, the steatites were found at the SE corner, in a layer under the LMIB floor of the room, together with fragments of cups and cooking pots. Since this pottery is not yet studied we cannot be sure about the date of the steatites.<sup>89</sup> Perhaps they belong to the LMIA period or to an early phase of LMIB. Moreover, the steatite is different from that found in the palace. It has a light green olive to brown colour and is from a more pure vein than the others. It seems that it was mined at a



different time or place from the palace steatites, as is also suggested by the stratigraphical data. The quantity is not great, (1,65 kg.), but this is the only instance in which a group of this material was found in a building of the town. The working of the material in Room A, at an earlier period (before the room was used for storing), might not be excluded, though there is no confirmation of this from the material in the same stratum.<sup>90</sup>

#### 4. Room XLIII (palace)

For the use of Room XLIII in the South Wing of the palace as a working area, there is a reference in Zakros<sup>91</sup> where it was mentioned that a large lump of red-veined, marble-like stone was among the raw materials used in a workshop. However, because of the absence of any additional evidence, N. Platon considered that the spacious room might have been used as a sitting room for the craftsmen. This hypothesis was also based on the existence of plastered benches along the north wall and on the SE corner.

The red-veined marble is not mentioned in the annual report of 1965,<sup>92</sup> while in the excavation diary there is a short reference to the find location rather than a description. In all cases, the material was described as completely unworked.

From examination of the stone,<sup>93</sup> it became clear that some kind of working had already begun, but that it was incomplete.<sup>94</sup> There is a saw-cut close to the rough exterior of the block, creating a flat smooth surface. This working, very similar to that of the Spartan basalt blocks at Knossos, is strong evidence in support of the conclusion that Room

XLIII was used as a working area.

Bronze sheets of various (not very clear) shapes, some resembling double axes, were also found in the lower strata of the fill and had probably fallen from the upper floor. If it is accepted that the ground floor room was used as a stone workshop, it is also possible that the room upstairs was used for bronze-working.

a. Location (Fig. 14)

Room XLIII, lying almost in the centre of the South Wing of the palace, is surrounded by rooms which are thought to have been working areas (e.g., Rooms XLVII, XLV, LXVa and XLIV). There is no doubt that Room XLII was used as a storeroom, at least during the last period, although owing to its locality and the door in the north wall, it might have been an ante-room for Room XLIII.<sup>95</sup>

b. Approaches

Access to Room XLIII was through a door in its NW end, leading directly from the Central Court along a short corridor which started from the middle of the facade of the South Wing, or from the west passage XLIX, through the Corridor XLVIb. There was also another possible access through Room XLII by a door in its south wall, although its use as a storeroom would have hindered circulation. Communication would have been difficult with the southern rooms (XLVa, XLIV), because there was no doorway in the south wall and, consequently, access might have been through Rooms XLVII, XLVIII and XLV. Staircase XLVI led to the upper floor, easily accessible from the NW door of the room.

c. Lighting

The room would have been lit directly, by a window on the east facade, traces of which are not preserved.

d. Architectural form and construction (Fig. 15)

The room was the largest and the most luxurious of all the rooms in the South Wing. Its outline was almost rectangular and its dimensions were 7 x 4,75 m. (33,25 m<sup>2</sup>).

The walls were thick and plastered, though not well preserved.<sup>96</sup> Perhaps, their superstructure was made of mud-bricks, as was suggested by the presence of a reddish layer of earth in the lower fill of the room. They were not preserved to any significant height.

The north wall of the room was intersected by two doorways, which it seems were in use at different times. At the eastern doorway there is a poros stone in situ, which probably formed the base of the wooden jamb of the door. The wall is 0,50 m. thick and was plastered (its plastering is preserved).

The west wall, which is not at right angles to the other walls of the room, consisted of a row of blocks with a filling of smaller ones. It is 0,70 m. thick and preserves traces of plastering.

The south wall of the room is similar to the west one and has the same thickness (0,70 m.), but it is not so well built.

The east wall is the thickest one (0,75 m.) and is part of the east facade of the whole South Wing. It consisted of a row of limestone blocks completed by an interior row of smaller ones. This row is not preserved, but is



assumed to have existed because of the empty space which is between the plastered floor of the room and the row of blocks.

The room had three doors. The western one, at the NW corner, was the principal door which communicated with the outside area and the upper floor. It was 0,80 m. wide and it preserved the jambs and the gaps for the wooden door posts. The middle door, at the centre of the north wall, was 0,90 m. wide. It seems to have passed out of use during the last phase, when another doorway, a little further to the east, was opened. Both the doors opened into Storeroom XLII and from there probably to the Central Court.

The floor of the final phase was made from pebble cement. In a previous phase,<sup>97</sup> the floor was decorated with two carpet-like squares of tiles, laid on either side of the central column. The floor upstairs was probably made of a mixture of lime and small pieces of tiles, since many pieces of this material were found in the fill.

Two plastered benches were built along the north wall and the west part of the south wall. A part of the north wall's bench had been destroyed in the making of the NE door. The rest of it extended on each side of the central door and was 0,45 m. wide. The bench on the south wall extended only along its eastern part and was 0,42 m. wide. In the corner, on this bench, a small bronze cauldron was found in situ.

#### e. Contents

The hypothesis that the area was used as a workshop is principally based on the finding of the sawn block of red-veined marble. The contents of the ground floor room

XLIII included some objects which probably had no direct connection with the working activities.

1) Unworked material

a) Veined marble (Oth. St. cat. no. 9; fig. 74; pl. 11).

Provenance: from the lower fill of the room.

A small piece of black stone with two parallel unequal veins.

2) Material in process of working

a) Veined reddish marble (Oth. St. cat. no. 11; figs. 76-77; pl. 10).

Provenance: on the floor of Room XLIII, to the SW of the column, at a short distance. A block of veined reddish marble-like stone with a deep saw-cut. From the block a fragment with a rough surface had already been detached and the sawing continued on the other part of the stone. The cut surface is smooth and flat with various nice veins and spots giving an idea of the luxury of the material. The worked piece presents the first stage of manufacture and one could not say exactly what product was intended. It is possible that the detached piece was also used, though it would be too thin for making a large object. Possibly, the ultimate aim of the craftsman was the manufacture of an offering table (or a stone vessel?).

b) Bronze sheets of various shapes

Most of them were found in the fill at a height of 0,30-0,40 m. above the floor of the room, which indicates that they had fallen from the upper floor. So, they do not have any connection with the sawn block. Perhaps the room upstairs was used for bronze-working.

### 3) Material related to working activities

#### a) Obsidian

Three flakes and two blades of obsidian were collected from the lower fill of the whole area.

#### b) Steatites

Four prismatic, three-sided steatites and one with two parallel surfaces from the same material, black-blue in colour, were also collected in the fill.

#### c) Punch (Br. P. A. P. cat. no. 14; fig. 141)

Provenance: from the fill of the SE corner.

A bronze punch, square in section.

#### 4) The remaining contents

From the remaining contents one should also mention:

a) The bronze tripod cauldron, on the SE bench.

b) A fragment of a small ornament of rock crystal, probably in the form of a nautilus.

c) A two-wicked lamp from steatite, decorated with curled spirals around its rim, from the lower fill of the south part of the room.

d) A figurine of Petsofas type, found between the cauldron and the lamp in the lowest fill.

It is possible that 'b', 'c' and 'd' described above, had fallen from the upper floor.

### Summary

Location. In the centre of the South Wing, where more workshops have been identified.

Approaches. Through a corridor from the Central Court and the west passage XLIX. Another approach was probably through Room XLII.



Lighting. By a window in the east facade.

Architectural form and construction. It is a large, almost rectangular room with a central support column. The floor was made from pebble cement, originally decorated with two carpet-like squares of tiles laid on either side of the column supporting the ceiling. The walls were plastered.

Contents related to the working activities. a) Raw materials: a small piece of marble-like stone. b) Unfinished objects: a sawn block of reddish veined marble. c) Waste material: some obsidian flakes. d) Tools: no evidence, except there is a possible punch. e) Other equipment: two plastered benches, probably used for sitting on by the craftsmen.

The remaining contents. A bronze cauldron, a stone lamp, a figurine of Petsofas type, some small prismatic steatites and a pendant of rock crystal.

Date. LMIB, dating to the final destruction (by using the evidence from the adjoining areas).

#### Discussion and Evaluation

There is no doubt that the block of veined marble was in situ. It was found on the floor and it had not caused any damage to it, as would have been the case if the block had fallen from a height. On the other hand, one cannot be sure about the rest of the contents. The cauldron on the SE bench was also in situ, but the lamp, the figurine and the pendant could have fallen from above, as well as the punch, the steatite fragments and the obsidian.

Even if some of the above described objects were included in the ground floor context of Room XLIII, the

use of the area remains problematic. The punch, that is the only tool, is very unlikely to have had any connection with the working of the marble block, and the few pieces of obsidian and steatite are not enough to suggest any organized production. We have no more evidence for the identification of the place as a workshop area. However, since the half-sawn block was found in situ, it may be accepted that its sawing was done in the same area. Of course, such an activity could be done in a neighbouring area or in the room upstairs, but this is less probable for two reasons: a) Room XLIII was not a storeroom (for which there was no evidence), and its arrangement was luxurious; b) The room is suitable for such an activity (as the sawing of the block), because it was spacious and equipped with benches and was sufficiently lit, in contrast to the neighbouring rooms.<sup>98</sup>

Nevertheless, Room XLIII could not be considered a permanent workshop area because of its fine architectural fittings. This is a typical example of a large and spacious ground floor room used as a centre for daily life, while simultaneously it was suitable for various working activities. The bronze cauldron from the SE corner was probably used for cooking and the benches could have been destined for the craftsmen or the other occupants of the palace to sit on.

#### Production and Function

The material found in the first stage of its working was considered in Zakros to be reddish-veined marble.<sup>99</sup> Pieces of slabs of the same material were also found in the

old palace annex of the East Wing, in the doorway between Rooms Γ and Δ.<sup>100</sup> The quality of the material suggests that it would probably be used for luxurious objects, such as offering tables or ceremonial stone vases.

From the sawn block itself there is not sufficient information to deduce what product was intended. However, it seems possible that it was intended for the manufacture of slabs similar to those of the old palace annex, which have been considered to belong to an offering table.<sup>101</sup> Nevertheless, it is also possible that we have the initial preparation of a block for making a stone vase.

The block might be cut by a long saw for stones, namely a saw without teeth. Such a saw was found in Room XXIV of the West Wing of the palace, fallen from the upper floor. It might have had two handles, one at each end, and have been used by two craftsmen on their knees, facing each other. Emery, powdered quartz, or sand was also probably used, while wetting with water would have been necessary. When the cutting of the stone had progressed, using other tools (chisels and axes), or the saw itself, they detached the sawn piece with the rough surface, perhaps to make the continuation of the work easier, or in order to use the detached fragment for making something else.

It is not possible to know if, after the sawing, work would have been continued in the same area. It is probable that it was done by a specialized craftsman in another area, perhaps in the room upstairs.



## 5. Workshop in Room XLIV

The view that the SE corner room of the South Wing was used for working various materials for the manufacture of small artifacts and jewellery was first expressed in the annual report of 1966.<sup>102</sup> The same point of view, confirmed by additional evidence, was presented in Zakros, where it is also mentioned that the same area was probably used for the manufacture of stone vases and other objects.<sup>103</sup>

The main evidence for such a conclusion, apart from the many finished stone objects, is the finding in the same area of a lump of rock crystal together with finished objects from the same material. Also the finding of some bronze tools and other pots was related by the excavator to the same activities.<sup>104</sup>

A general connection between Room XLIV and the other southern rooms of the South Wing is that all had basements, ground floor rooms and upper floor rooms. So the material found scattered in the fill belongs to three different contexts and separating them is very difficult and conjectural. Additional problems were created by the subsoil of this area, since the height of the water-table prevented a normal stratigraphical excavation, necessary for separating the material. So a great number of finds from the same fill must be studied together in order to draw some more concrete conclusions.

Nevertheless, the finding of raw material together with finished objects from the same material, suggests that there was a stone workshop, above the basement of Room XLIV.

a. Location (Fig. 14)

Room XLIV is on the SE corner of both the South Wing and the palace itself. It is close to two areas also considered as workshops, Rooms XLVa and XLVII. However, communication with the latter was not easy, since there was no door in the wall between them. It is possible that initially the facade of the South Wing was at this exact point and Rooms XLIV, XLVa, XLV and XLVIII were added at a later period. This fact is indicated by the ill-proportioned walls in the whole south part of the South Wing.

b. Approaches

Room XLIV was necessarily entered from Room XLVa through a door at its NW end. This door is hypothetical, since no traces of it are preserved. However, the corresponding door of the basements, blocked in the last period, is preserved. Room XLVa was entered from Room XLV and the latter from XLVIII. The necessary connection between these rooms, due to their location, probably means that they had similar needs for their functioning.

Room XLIV was also probably accessible from the room upstairs by a ladder.

c. Lighting

The lighting would be by a window, or windows, on the east or south facade.

d. Architectural form and construction (Fig. 15)

Room XLIV was of medium size (3 x 3 m.); it had an irregular shape because of the deviation of the south facade to the NW. There was a basement, a ground floor room and a room upstairs. The basement is divided into two parts

(north and south) by a partition, probably the remains of an older building, and it had a floor of irregular unsmoothed stones. The walls do not preserve any plastering and were constructed in two different ways. The north and the west ones consisted of two rows of medium-sized stones, filled by smaller ones. The south and east walls were parts of the strong facade of the South Wing and were thick and built of a row of limestone blocks, with smaller ones to complete their interior. The north wall was 0,65 m. thick, the west 0,60 m. the south 0,80 m. and the east 0,90 m. For the floor and the walls of the ground floor room and the room upstairs there is insufficient evidence. The walls on the ground floor would have been built in the same way as the basement ones and the floor was probably wooden. Of the walls of the <sup>room</sup>upstairs,<sup>105</sup> the north and the west were probably made of mud-bricks and the south and east of ashlar masonry.<sup>106</sup> Some fragments of painted plaster in the form of bands, found in the higher fill of the room, probably decorated the walls on the ground floor or the room upstairs.

Only one door has been preserved in the basement room. It was at the NW end of the room, 0,90 m. wide, and was blocked in the last period. A similar door corresponding to the basement one can be hypothetically located over this, since the mortar on the SE corner of Room XLVa would have prevented passage at this point.<sup>107</sup>

e. Contents related to the working activities

1) Raw materials

a) Steatites

Provenance: two from the fill of the room and



a third one found outside its south wall. Small unworked fragments, two of a blue-black colour and a third which is purple-brown.

b) Flint

Provenance: Room XLIV, beside the north wall.

A small fragment of green colour.

c) Rock crystal (S.pr.S. cat. no. 21; fig. 87; pl. 17).

Provenance: Room XLIV, close to the NW corner, 0,66-0,80 m. below the surface of the west wall. A large lump of rock crystal with seven preserved surfaces, broken in three fragments (some more detached fragments were not traced). The lump is almost opaque.

2) Other materials probably worked in situ

a) Prismatic steatites

Provenance: from the fill of the room. Five prismatic steatites and two others of a pyramidal shape, broken. Five of them were blue-black in colour, one purple-brown and the seventh brown-black.

b) Obsidian

Provenance: from the lower fill of the room. Two blades of obsidian (fragments) and two small flakes. Different qualities: black glossy and translucent, black not very glossy, grey-black not very glossy.

3) Tools

a) Stone tools

- Grinders

- Provenance: near the north wall of the room, in the higher fill together with fragments of plaster.

Flattened, ovoid grinder of grey stone containing a little quartz (whetstone?).

- Provenance: in the NE corner of the room, lower fill. Two fragments of a broken stone grinder.

- A piece of stone with marks created by a drill. (St.w.S. cat. no. 9; fig. 82)

Provenance: close to the SE corner, beside the east wall, 0,80 m. below the surface of the west wall. Fragment of a blackish stone with a segment cut out by a drill.

b) Bronze tools

- Chisel. (Br. Ch. cat. no. 1; fig. 113; pl. 30).

Provenance: beside the east wall of the room, at a medium depth, in the fill. A large bronze chisel of the flat type, but quite thick. The front end forms a wide cutting edge while the back is narrower and thicker, perhaps to create a blunt point for beating, using a hammer.

- Axe? (Br. Cut. cat. no. 7; fig. 138; pl. 35).

Provenance: beside the east wall of the room, at a medium depth, in the fill. Although it has been described as a small bronze axe,<sup>108</sup> it is better described as a cutting tool. The existence of two small holes along its one side indicates that a wooden haft would have been fixed there. So the tool worked with the other cutting end.

- Cutter. (Br. Cut. cat. no. 2; fig. 139)

Provenance: perhaps belongs to the contents of Room XLIV.<sup>109</sup> A small fragment of the flared cutting edge of a cutter or pendant.

#### 4) The remaining contents

As we have already said, it is very difficult to separate the material found in the fill of Room XLIV into three different groups belonging to the three successive rooms existing above the same area. It seems that a great amount of the material had fallen from the ground floor room (it was found in the lower fill, 0,60-0,80 m. below the preserved surface of the walls). Another part of the contents found in the fill could be considered to have fallen from the room upstairs. On the floor of the basement nothing was found in situ<sup>110</sup> and consequently we cannot be sure of its contents.

From the group of objects found in the fill of the room, we could consider that the following had fallen from the room upstairs.

a) Sixteen (16) pyramidal weights with a single hole for hanging, fallen mainly close to the north wall.

b) At least 12 clay loomweights of lentoid type and two holes for hanging.

c) Fragments of plaster decorated with bands.

d) A great number of the clay vessels found, such as small amphorae with tall necks and two jugs with oblique spout.

e) A stone triton-shaped rhyton, the fragments of which were found in different levels of the fill.

f) In the same layers one of the grinders ('a') was also found.

The material mentioned below was found in lower layers of the fill and it is consequently probable that it



had fallen from the ground floor room. However, it is not excluded that a part of this material had fallen from the room upstairs. Two interpretative drawings from two different levels of the fill are given, but they must not be considered as definitive, since they refer to the same archaeological stratum.<sup>111</sup>

Drawing 1 (Higher fill, Fig. 16)

5. Cylindrical vase with perforated partition in its interior, together with fragments of similar vases.
6. Amphora-like vessel.
7. Cooking pot.
8. Brazier.
9. Small amphora with tall neck.
10. Lamp made from rosso antico.
11. Bird's Nest Bowl of stone.
12. Bowl without handles.
13. Stone pyxis with lid.
14. Vase with perforated partition in its interior.
15. Stone kernos?
16. A fragment of a cup with a single handle.

In the same level beside the chisel, the axe, the lump of rock crystal, the second grinder, the flint and the steatites, were also found:

- a) Four large pinheads of rock crystal,
- b) spindle-whorls and ornaments of steatite, ivory and glass-paste,
- c) pieces of unshaped faience,
- d) beads of glass-paste,
- e) inlays of ivory and bone,

- f) bone punches, and
- g) a fragment of slag.

Drawing 2 (Lower fill, Fig. 17)

- 17. Tripod cooking pot.
- 18. Jug with wide mouth.
- 19. Vase with cylindrical foot and perforated partition in its interior.
- 20. Bronze cauldron.
- 21. A group of cups.
- 22. Two deep cups with a single handle.
- 23. One similar to (22).
- 24. Amphora.
- 25. Amphora.
- 26. The lower part of a vase.
- 27. The fragments of an amphora and of a cooking pot.
- 28. Fragments of a jar.
- 29. A large clay basin of cylindrical form, together with half of an amphora.

In the same level were also found some ivory inlays and obsidian.

#### Summary

Location. The room lies on the SE corner of the South Wing. It is surrounded by rooms thought to be workshops.

Approaches. A single approach, from Room XLVa. Probably also from the room upstairs by a ladder.

Lighting. There would be sufficient and direct lighting through a window in the walls of the facade.

Architectural form and construction. Irregular shape, medium size. Probably painted walls in the room upstairs.

Contents related to working activities. a) Raw materials: unworked core from rock crystal. b) Unfinished objects: no evidence. c) Waste material: no evidence. d) Tools: a bronze tool (a chisel) and some others of bone and stone. e) Other equipment: no evidence. f) Finished objects produced from extant raw material.

The remaining contents. Various stone vessels of high quality. A lot of pottery of various types.

Date. LMIB, dating to the final destruction of the palace.<sup>112</sup>

#### Discussion and Evaluation

The principal difficulty for the identification of a workshop in Room XLIV is the mixing of the contents of three different levels in one. The separation of the material into three groups is difficult and speculative. It should be based firstly on the types and function of the objects found, and secondly on their exact provenance. The material described above allows the following suggestions.

- Much of the material comprises clay vessels which do not seem to have any connection with working activities. The fact that quantities of pots were found in a not very large space, probably indicates storing of vessels.

- The stone vases found were either in store also or, as has been suggested,<sup>113</sup> were made in the same area. However, detailed study of the material did not show that some of these were unfinished, since traces of the cylindrical drill



are sometimes visible in finished vases too. On the other hand, a stone cup with rough surface (pl. 56)<sup>114</sup> and the stone with the segment cut out by a drill probably used for working in the interior of stone vessels,<sup>115</sup> do suggest that working of stone vases in the same area should not be excluded. For such work the chisel (a tool which we know was used by Minoan lapidaries) could also have been used.

- The existence of various semi-precious materials and ornaments produced from them suggests the manufacture of the objects in the same area. The rest of the material will be discussed elsewhere. Nevertheless, the finding of the unworked lump of rock crystal together with the large pinheads produced from similar material confirms this point of view. However, the possibility of storing the precious raw material together with finished objects made from it must not be excluded. The presence of a few fragments of steatite found in the fill together with the peculiar prismatic objects of the same material suggests their working in the same area, although such an activity did not require a well defined area.<sup>116</sup>

- The stone and clay loomweights and the stone weights, it seems, had fallen from above where there must have been a loom.

It is very probable that in the room upstairs there was a loom and a number of clay vessels stored in cases or on the floor. The stone vases and ornaments of various semi-precious materials would have been in the ground floor room, kept in cases or in boxes. Their working, especially the production of small objects rather than stone vases, could

have been done in the same area. This point of view seems strengthened by the following suggestions:

- The evidence for the manufacture of stone vases is insufficient (absence of specialized tools, of unfinished objects and of raw materials).

- The evidence for the production of small objects and ornaments from rock crystal and steatite, which is also insufficient, could be combined with the evidence for the working of other materials, such as ivory and faience.<sup>117</sup>

Consequently, it is more probable that Room XLIV was used as an area in which precious and semi-precious materials for making small objects, inlays and ornaments were worked. The possibility that stone vases were also made in the same area could not be excluded, though the requirements for such an activity are somewhat different.

A remaining problem for the identification of the room as a workshop area is the presence of a lot of clay vessels unrelated to such activities. They were probably included in the contents of the room upstairs, while a part of the material could have been stored in boxes or cases on the walls of the workshop.

#### Production and Function

In the workshop unfinished objects were not found (with the exception of a cup with rough surfaces) and the tools which could be related to working activities are few and not specialized. The cutters could not be used for such activities since they were only suitable to cut soft materials. They were probably used in ivory-working as well as the bone

punches which could not be related to stone-working. The bronze chisel, which could be used for forming a rough exterior shape or for cutting out cores from the interior of a vase, does not add any more evidence to that already known from elsewhere. The stone with the segment cut out by a drill would be used as a wedge to keep the drill or the reed straight inside the vase during the working of its interior.

Consequently, three stages of a stone vessel's manufacture are present.

1. The rough shaping of the vase, before the working of its interior (probably done by the chisel).

2. The cutting out of bore cores from the interior, by using the cylindrical drill and wedge.

3. The final polishing of the surfaces (cup with the rough surfaces).

There is no evidence for the way in which the rock crystal and the steatite were worked. Nevertheless, we know what objects were produced. Of rock crystal there were pin-heads in various shapes and sizes (three mushroom-shaped, one spherical).<sup>118</sup> Probably also produced were other small ornaments and inlays, such as the small disk-like inlay from the Banquet Hall<sup>119</sup> and the similar ones in the form of flowers from the Hall of Ceremonies.<sup>120</sup> Vases of rock crystal were probably made in the same workshop, although the lump found was not large enough to be used for the manufacture of a vase. Nevertheless, it is probable that the rhyton from rock crystal found in the Treasury was made in this area. Of steatite were produced a drop-like bead,



a small mushroom-shaped spindle whorl<sup>121</sup> and two small prismatic objects discussed below.

6. Workshop outside the North East Gate of the palace (Φ)<sup>122</sup>

Area Φ, to the NE of the main entrance of the palace of Zakros, was first considered by N. Platon to be a workshop area in the annual report of 1969.<sup>123</sup> The same point of view was briefly expressed in a paper presented by him at the Fourth International Cretological Congress, the workshop being connected with the kiln which lies a little further to the east.<sup>124</sup> The finding of a lot of prismatic objects of steatite together with unworked and partly worked fragments was sufficient to suggest the above conclusion. The presence of two bronze tweezers, of a grinder and a stone with a segment cut out by a drill in the same stratum, confirms this suggestion. In spite of this, the architecture of the area, in successive periods, is not yet absolutely clear.

a. Location (Fig. 18)

Area Φ is immediately to the east of Area LXVIII with the small corner room at its NE end, and immediately to the south of the paved Harbour Road. To the east extends the large rectangular Area X, containing the kiln, while its southern boundary was not preserved, having been destroyed by ploughing. Today, immediately to the south of Area Φ, lies the old palace annex of the East Wing at a lower level which was certainly filled in during the period in which the workshop was in function. Although the neighbouring areas LXVIII and X were considered by N. Platon as working areas,

there is no evidence to confirm it except the presence of the kiln belonging to an earlier period.<sup>125</sup>

b. Approaches

The bad preservation of the buildings in this area and the confusion created by earlier and later walls do not permit a hypothetical restoration of the approaches during the period under consideration. It is possible that the area was accessible from the south, since its north and east walls do not have any opening. It is not excluded that there was a western approach between trapezoidal Area LXVIII and the small rectangular area at its NE corner.<sup>126</sup> A pavement found in a level below the final floor at this point probably corresponded to the floor of Area  $\Phi$ .

c. Lighting

It has been considered that Area  $\Phi$  was open-air. This is possible since there was no evidence for a partition wall or anything else to support a roof.<sup>127</sup> Perhaps the north wall of the area, running alongside the road, was merely a low surrounding fence.

d. Architectural form and construction

The evidence related to this is insufficient. From the northern, eastern and the preserved part of the western wall, it is suggested that the area was rectangular, though the southern wall is not preserved at all. The walls are quite thick (about 0,70 m.) and the enclosed area is 20 m<sup>2</sup>. During the period in which the area was used for working activities the floor was made of trodden earth with a substratum of rubble stones.

e. Contents

1) Raw material

a) Unworked steatites (S. cat. nos. 67, 98; figs. 70, 72)

Provenance: Area  $\Phi$ , mainly from the NW and northern part, in a stratum 0,10-0,60 m. below the preserved height of the west wall. Small steatite fragments of a yellowish-green-oil colour.

2) Material in process of manufacture

a) A lump of steatite (S. cat. no. 47; fig. 68; pl. 6).

Provenance: Area  $\Phi$ , central part, at a distance of 3 m. from the west wall and at a depth of 0,50-0,60 m. from the preserved height of the west wall. A large fragment of steatite with one smooth, flattened surface, the other curved and unworked. On the flat surface are visible marks, parallel incisions forming angles, probably created by a tools. Colour from olive to green.

b) Unfinished prismatic steatites (S. cat. nos. 67, 98; fig. 70)

Provenance: Area  $\Phi$ , mainly from the NW and northern part. Found at a depth of 0,10-0,60 m. from the preserved level of the west wall. Irregular in form, steatites with at least one polished surface. Were they in the process of manufacture? Colour grey to olive-green.

c) Lapis lazuli (S. Pr. S. cat. nos. 2, 3; fig. 85)

Provenance: Area  $\Phi$ , mainly from the NW part, at a depth of 0,30-0,50 m. from the preserved level of the west wall. Two small pieces of lapis lazuli: the first one has



two parallel worked surfaces and two curved and narrow sides. The second has a three-sided shape and is slightly broken at one end.

3) Finished production?

a) Prismatic steatites (S. cat. nos. 67, 98; figs. 69, 70, 72; pl. 7).

Provenance: Area  $\Phi$ , mainly from NE and northern parts, at a depth of 0,10-0,60 m. from the preserved level of the west wall. A large number of three-sided, spindle-shaped steatites with slightly convex surfaces. The material is similar to that of the unworked fragments. They have a green-olive colour and incisions created by polishing on all their surfaces. More than two hundred pieces. Total weight: 540 gr.

b) Blade of obsidian

Provenance: Area  $\Phi$ , from the fill. Triangular-section blade of obsidian.

4) Tools

a) Bronze tweezers (Br. Tw. cat. nos. 4, 5; fig. 144; pl. 51).

Provenance: Area  $\Phi$ , NE part together with the prismatic steatites, at a depth of 0,10-0,20 m. from the preserved level of the west wall. Two pairs of bronze tweezers with flared ends, slightly turned in. The first pair is joined at one end by the plate itself turned in. The second pair consisted of two different parts ending in a point, which were probably joined by a hammered bronze wire.<sup>128</sup>

b) Bone punch

Provenance: Area  $\Phi$ , NE part together with the tweezers, at a depth of 0,10-0,20 m. from the preserved level of the west wall. The small slender root of an animal tooth, which was probably used as a punch.<sup>129</sup>

c) Grinder

Provenance: Area  $\Phi$ , NE part, at a depth of 0,20-0,30 m. from the preserved level of the west wall. A fragment of a grinder in a blackish, hard stone.

d) Stone with a segment cut out by a drill

Provenance: Area  $\Phi$ , NE part, at a depth of 0,20-0,30 m. from the preserved level of the west wall, at a distance of 1,50 m. to the SE of it. A fragment of a blackish stone with a segment cut out by a cylindrical drill.

5) The remaining contents

a) Four small fragments of stone vases, at a short distance from the north wall (one from the rim of a rhyton).

b) About ten cups without handles, intact or in fragments, as well as some sherds from other pots.

c) Two loomweights, one cuboid, the other parallel-sided.

d) Two or three pieces of slag.

f. Date

The date at which the place was used as a working area is defined in the annual report of 1969<sup>130</sup> and is based on the study of the pottery from the same stratum. This is the first period of the new palace at Zakros, namely the LMIA phase. In addition, a floor which corresponds to the workshop's floor, with a substratum of rubble stones, passed

over the kiln which is located a little further to the east and dates to the MMIIIA and B periods.<sup>131</sup> During the last period of the palace (LMIB) the floor of Area  $\Phi$  had been artificially raised, since the place had been filled with rubble stones. Probably at this time also the area was open-air, since there is no evidence for a partition wall except for a not very well built wall which limited the area to the south.

One more observation can be made at this point, connected with the dating of the material itself. The kind of steatite with very glossy texture and grey-olive-green colour, is very similar to that of Room A of Building Z described above. There also, the material was dated to an earlier stage than that of the final use, by using stratigraphical data. Conversely, all the groups of this material found in the West Wing of the palace dated to the final period (LMIB) belong to another kind of stone, which is not pure steatite but a mixed type, steatite-serpentine. This could mean that two different veins of material were mined, at different times.

#### Summary

Location. Beside the Harbour Road, to the east of the NE gate of the palace. Adjoining areas considered as working ones.

Approaches. Unidentified. Probably from the south.

Lighting. Open-air area.

Architectural form and construction. The area was large and probably rectangular. Its floor was of trodden



earth on a substratum of rubble stones. The north wall was probably a low surrounding fence.

Contents. a) Raw materials: pieces of steatite, lapis lazuli. b) Material in process of being worked: one large fragment of steatite, with traces of working. c) Waste material: probably some irregular steatite fragments. d) Tools: bronze tweezers, a bone punch, a stone with a segment cut out by a drill and a grinder. e) Other equipment: no evidence. Perhaps a temporary wooden roof.

The remaining contents. Fragments of stone vessels, cups without handles and two loomweights.

Date. LMIA.

#### Discussion and Evaluation

There is no doubt that the area was used for working activities during LMIA period. The finding of a lot of small and unusual spindle-shaped objects from steatite together with unworked and partly worked fragments is sufficient evidence for the identification of this place as a workshop area. The presence of the bronze tweezers in the same stratum makes it possible that they also were used during the manufacturing process, although the exact manner of use is not clear. The bone punch could be connected with the same activity, while the presence of the stone with the segment cut out by a drill suggests that stone vases were probably made in the same area.<sup>132</sup> Nevertheless, the absence of other evidence, such as tools used for making stone vessels, diminish the probabilities. On the other hand, the absence of bronze tools used for manufacture can easily be explained, if the workshop was not in use during the last period of the

palace. It seems reasonable that bronze tools were precious and therefore were removed when the workshop was no longer functioning.

The existence of the two small, partly worked fragments of lapis lazuli suggests that the area was not only used for making the peculiar prismatic objects, but for other, similar activities as well.

From the location, its architectural form and construction, it appears that the area was only used temporarily. Perhaps a craftsman or a group of craftsmen worked for a short while in this open-air area, which in any case did not offer the relative comforts of a permanent workshop.

#### Production and Function

It seems that the principal occupation of the craftsmen working in this workshop was the production of the unusual small, prismatic, spindle-shaped objects of steatite, which have also been found scattered throughout the whole area of the palace at Zakros and principally in its North and South Wings. With regard to the function of these objects, it may be noted that:

- The hypothesis that they were waste material from stone-working must be rejected because: a) there is no confirmatory evidence, since in no instance has an unfinished object been found in association with them. b) If waste material, the objects themselves would not present the 'secondary' working, recognized as polish on their three surfaces, nor all the same definite shape. c) They were usually found isolated and were scattered throughout the

palace.

- They are not unfinished objects, seals or ornaments, since in no case is a further stage of working seen.

Since in all cases they have almost the same shape, and in the area of the workshop were found in a great number together with partly worked and unworked fragments, we can conclude that these objects themselves were the final product. Nevertheless, their function remains unclear since they could not be used as blades, because the material was soft and not suitable for cutting.

It is improbable that their working was done by using very thin pointed tools. Such an activity would demand a great deal of work and would leave their form and convex sides unexplained. Another problem for interpretation is the finding of some fragments with only one polished surface. The traces of polishing are short incisions, almost parallel to one another, which do not resemble marks produced by a tool with a point or cutting edge. They are marks produced by the repeated rubbing of one surface upon another. This is confirmed by the direction of the incisions, which is vertical to the long sides of the object. This probably means that the final stage of their manufacture was a polishing produced by rubbing on another surface, which was certainly of a harder material. It is improbable that the objects were fixed and rubbed by using a tool or grinder, since their surfaces are very small and the fixing would be difficult and impracticable. So, it seems that the workman had the object between two fingers and rubbed it on a large, probably slightly convex surface, to create the curved



sides. These could also be produced on a flat rubbing surface if, from time to time, the object was directed at an angle to it. As the rubbing progressed, the workman would turn the object in such a way as to begin producing a second surface, similar to the first. Then, with the object held between the fingers by the two surfaces which meet at an angle, the third similar surface would be created, to form a prism. For achieving equal surfaces, during the rubbing continual changes of position would be required. The surface on which the objects would have been worked may have been of a harder stone than steatite, which is one of the softest materials.

This probable procedure for the manufacture of the prismatic objects by rubbing, suggests a possible function. Perhaps the end product was not the objects themselves but the powdered material, produced by rubbing the steatite. It is known that powdered steatite (talc) was and is used today for medical and cosmetic purposes. A similar or other use of this powder in Minoan times cannot be excluded.<sup>133</sup>

This last point of view raises some questions:

- What is the connection between the fragments of lapis lazuli and such an activity?
- What was the use of the tweezers and of the stone with the drill-marks if the whole procedure was rubbing?
- What was the reason for organized production, since the same simple activity was done in many different areas?

On the other hand, there are partly worked fragments. The small unworked fragments could be used as they were for rubbing, since their dimensions were suitable. The case

of the largest partly worked piece is unlike that of the smaller ones. It is not possible that the whole core was rubbed upon another surface, since the marks are different from the incisions on the smaller fragments. Here, the marks are only a few, in two or three groups, not very close to one another, forming V-shaped points. In this case, one could suggest that a tool was used, which left its marks on certain points of the flattened surface of the core. Perhaps this tool had a triangular point, judging from the order of the marks. A harder stone tool or a similar one of bronze was probably used for this stage of working. It is probable that the purpose of this activity was the cutting of the large core into smaller fragments, which were destined for rubbing. However, if we accept that, it is clear that the real end product could not be the steatite powder (as it would be easier to rub the large core), but the small prismatic objects themselves, whose function is mysterious.

On the other hand, tweezers were usually used to steady a small object in order to work upon it with another delicate tool. Probably the tweezers found together with this material were used in the manufacture of small objects from other materials such as lapis lazuli.

By using the above described evidence we can picture the production procedure of the small prismatic steatite objects in two stages: 1) the rough shaping of small cores by cutting and partly working the larger ones; 2) the rubbing of the small fragments on a harder material in such a way as to produce the three polished (rubbed) surfaces.

The manufacture of small objects from lapis lazuli



probably followed a different procedure, similar to that used for the production of stone ornaments and seals, where thin delicate tools (and probably the tweezers which were found) would be used.

Other areas at Zakros which  
were used for stone-working

Small fragments of unworked steatite <sup>and</sup> partly worked pieces of prismatic objects from the same material were found scattered throughout the whole area of the palace and town at Zakros. It must be made clear that the frequency of the material in the area of the palace is greater than that of the town, a fact which suggests that the material was rare and valuable, and consequently the production was centered on (or controlled by) the palace. Nevertheless, it seems that prismatic steatite objects were also made outside the palace, in the town houses. This happened because a method such as that described above did not necessarily demand specialized working in a certain area. This is also the case with obsidian, since blades and flakes from this material were found scattered throughout the whole area of the palace and town, principally in layers corresponding to the older periods of occupation at Zakros. For this material, no particular distinct area for its working was found as it was at Mallia, and it is very possible that no such place existed.

In addition, the frequency of isolated fragments of other materials such as the marble-like stones and flint, as well as of tools, in various places which could not be



considered as working areas, is impressive. This probably means that except for certain areas used for organized working activities, limited work was done in other areas. Even the unfinished seal (S. cat. no. 113; fig. 73; pl. 8). found in one of the houses on the SW hill, could not be related to a permanent workshop for the production of seals. Probably, once again, it was the result of a private initiative, although in this case it is clear that the craftsman may have been experienced.

Some of the tools found fallen from the upper floor of the palace, in the Hall of Ceremonies (XXVIII) and the dog-leg corridor beside the Lustral Basin (XXIV), could be connected with stone-working. It seems that these tools were in store at the moment of the destruction, and not in use.<sup>134</sup> This can be confirmed by the following evidence:

- They were found concentrated in a single area together with tools used by the craftsmen of other workshops and tools for agriculture (bronze cutters, saws with teeth, hammer, picks).

- A toothless saw used on stone and another carpentry saw were found folded. This folding could not have resulted during their fall or from being flattened under heavy materials.

We could not, therefore, speak of a lapidary's workshop in this particular area upstairs above the Hall of Ceremonies (XXVIII). Nevertheless, we have already discussed<sup>135</sup> neighbouring working areas and consequently one could accept that the lapidary's tools were probably used in these or in another unidentified workshop.

The tools which could have been used for stone-working are as follows:

a) A long bronze saw without teeth, folded (Br. S. cat. no. 1). It was found fallen on the steps of the Lustral Basin together with a stake-head (pl. 55).

b) Two thin, delicate, chisel-like tools, the one longer than the other, with a tongue-shaped cutting edge and stem of square section (Br. S. Dr. cat. nos. 4, 5; figs. 136, 137; pl. 43). They were probably used as the ends of a solid drill.

c) A bronze tool, tubular at one end and solid and thinner at the other (Br. H. Dr. cat. no. 1; fig. 136; pl. 44). Probably a tubular drill, or punch (depending on the way of working).

d) Four bronze chisels, three of the flat type with tongue-shaped cutting edge, and the fourth square in section (Br. Ch. cat. nos. 7-10; figs. 114, 115; pls. 30, 32). They were found close to the lightwell area.

e) Two small tools, the first one flat with a tongue-shaped cutting edge and disk-shaped at its top end, and the second square in section with the point broken away (Br. Cut. cat. no. 2; fig 138; pl. 48 and Br. S. Dr. cat. no. 1; fig. 136).

f) A big bronze knife made from a thin leaf, probably used for rough shaping of a lump of stone, from which the desired object would be made (Br. Kn. cat. no. 6; fig. 117; pl. 33).

g) A blackish stone with a segment cut out by a drill (St.w.S. cat. no. 2; fig. 79; pl. 12).

Of the above, the saw could have been used for cutting the unworked block into smaller fragments or for cutting rectangular blocks and slabs. The chisels and the big knife were probably used for the first stage of working the exterior surface of a vessel, the drills and perhaps again the chisels for cutting out the interior of the vases, although the tubular drill was more suitable for such an activity. At the same stage, the stone with the segment with the drill-marks could have been used to keep the drill straight inside the vase at the desired point. Finally, the delicate small chisels were probably used for detailed working.

#### B. Bronze Workshops (Category A, Type 'c')<sup>136</sup>

##### Introduction

The presence of a great number of bronze objects and tools, and the discovery of bronze raw material in the form of ingots in the West Wing of the palace, confirm that one or more specialized bronze workshops functioned in the area of the Zakros palace. The products of this particular workshop (or workshops) can be divided into the three following categories.

a. Bronze tools. The variety of forms and sizes of the bronze tools is impressive.<sup>137</sup>

b. Domestic bronze objects. The most usual ordinary bronze object is the three-legged cauldron.<sup>138</sup> Some other vases in a bad state of preservation<sup>139</sup> and bronze mirrors<sup>140</sup> have also been found.

c. Luxury bronze objects, probably of a ceremonial use. One can mention here the brazier with the incised motive of



the ivy leaves on its interior coming from Room XLVa,<sup>141</sup> the double ceremonial axe with the floral incised decoration from the Treasury<sup>142</sup> (Room XXV), the bronze hoop with the relief decoration of the double axes coming also from the Treasury,<sup>143</sup> and finally two almost square plates with floral decoration (Room XXIII).<sup>144</sup>

Though it seems certain that these bronze objects were made in Zakros, since the raw material for their manufacture was found stored only a short distance from them, there is not enough evidence directly related to bronze-working; a piece of a steatite mould probably for the manufacture of a double axe, and a clay crucible with traces of metal in its interior coming from a house which lies to the south of the Harbour Road (Building of the Niches, Room XVII). However, both of these finds cannot be used for the identification of a workshop because the first was found unstratified, while the second was found in an older filling, in a context which is dated with difficulty.<sup>145</sup>

On the other hand, N. Platon connected some peculiar masses which resembled slags coming from bronze melting, with a kiln which was discovered in 1973 in an area to the NE of the palace entrance.<sup>146</sup> He concluded that the kiln was used for bronze melting, but this particular interpretation was disputed by other scholars on the basis of evidence coming from similar structures in other Minoan sites. The so-called slags of Zakros have not yet been analysed, and their relationship to the kiln remains hypothetical. N. Platon himself admitted that his first view was that these particular masses found throughout the whole palace came from Thera, after the

volcanic eruption.<sup>147</sup> Despite the fact that analyses of these masses have not yet been made and consequently a positive interpretation of them cannot be expressed, a list of their find places is given in Volume II.

The second stage of bronze-working should be carried out in other areas, namely in bronze smithies. In this case also, the evidence coming from Zakros is weak. Certain areas in the West and South Wing of the palace, which provided some amorphous sheets of bronze or pieces of bronze objects, were considered by the excavator to be bronze workshops dealing with the forging, assembling and finishing of bronze objects. However, there should be taken into account here the possibility that this particular material comes from the breaking off of finished bronze objects; then, the areas where these fragments were found cannot be related to workshops. The very bad state of preservation of the above material does not allow a safe identification.<sup>148</sup>

#### The Kiln

N. Platon published<sup>149</sup> a kiln which was discovered in 1973, immediately to the NE of the Zakros palace, and suggested that it was used for bronze melting. This view was mainly based on two points:

a. On the discovery of a great number of peculiar masses, which seemed to contain sulphur, in the kiln's area. He suggested that they are slags coming from a bronze melting.

b. On the existence of four channels, which could be used for improving air circulation in the kiln's chamber. He postulated that this system was used in order to achieve

a higher temperature which would not be necessary if the kiln was used for pottery making.

It should be noted here that similar kilns with channels have been found in other Minoan sites also, such as in Vathy-petro, Knossos, H. Triada and Phaistos, but in none of these cases have they been interpreted as bronze kilns.<sup>150</sup>

#### 1. Location (fig. 18).

The kiln lies to the NE of the central entrance of the palace, within a short distance of it, just to the south of the Harbour Road, at the opposite of the Building to the north of the Harbour Road. However, its architectural location in Area X remains problematic, because of their difference in dates. The kiln's channels were discovered just under the destroyed plastered floor of Area X, which should be dated to the LMIB period.<sup>151</sup>

The architectural form of the area around the kiln during the period of its use cannot be described because significant changes took place in the succeeding LMIB period. For instance, the south wall of Area X was built over the kiln chamber. In any case, the kiln's area was probably easily accessible from the north directly from the Harbour Road.

#### 2. Architectural form and construction (pls. 57, 58).

The kiln was built into an older pavement destroying part of it.<sup>152</sup> It mainly consisted of a chamber in the shape of a horseshoe, the dimensions of which are 2,20 x 2,20 m., and of four parallel channels, which start from the chamber and go to the north. Their preserved length is 2,50 m.



approximately.

The chamber had concave walls and its width decreased towards the bottom, which was roughly levelled. The chamber's walls were covered by fired clay, damaged in some places. In the south side of the chamber, 0,70 m. from the bottom, an opening was formed, under which a short channel passed ending in two built circular cavities, not well preserved, in the area immediately to the south of the kiln. This channel was covered by slabs.

On the SW side of the chamber, almost on the same level as the channels, a broad opening with a porous slab was formed (dim. 1,40 x 0.50 m.). The slab was about 1 m. above the bottom of the kiln chamber.

A fair amount of mud-brick pieces coming from the tholos of the kiln chamber has been preserved, fallen within the chamber; one of them was almost in situ, to the east of the chamber's mouth.

Of the four channels only the lower part has been preserved, presenting a semi-cylindrical form. They were parallel, one beside the other, slightly sloping from north to south. They also were covered with fired clay, which has been strongly fired again, during the function of the kiln. Their NE end appears to turn upwards forming an angle.

### 3. The contents related to the kiln's function.

a. Some masses, considered by the excavator to be 'slags coming from bronze melting', are probably related to the kiln's function. Small pieces of such masses were found in the second, the third and the fourth (from west) channels, as well as in the lower level of the chamber's fill.

b. Two of the small prismatic steatite objects were found in the fill of the second (from west) channel. Their connection with the kiln's function is not very probable.

#### 4. The remaining contents.

In the fill of the channels were also found the following: a) two one-handled cups and fragments of conical cups, b) a piece of a boar's tooth.

In the chamber's fill were also found: a) a sherd of a cup with decoration in bands, in the 'dark on light' style, b) conical cups and sherds of one-handled cups, c) a small piece of an unworked steatite, d) a piece of a clay grill of the fish-bone type.

#### 5. Date

The pottery found in the channels and in the chamber was dated by the excavator to the MMIIIB-LMIA period.<sup>153</sup> According to him, it is probable that the kiln was used during the first neopalatial phase (MMIIIA-B).

#### Summary

Location. Just to the NE of the central entrance of the palace, to the south of the Harbour Road. It was probably directly accessible from the the Harbour Road.

Architectural form and construction. Chamber in horseshoe shape connected with four plastered, parallel channels. Probably covered by dome. Opening with a short channel (mouth) on the south side of the chamber; a second opening with paved slab on its SW end.

The contents related to its function. Masses of unidentified material (interpreted as 'slags').

The remaining contents. Pottery, mainly of conical cups and one-handled cups. A piece of a clay grill.

Date. MMIII period.

#### Discussion

N. Platon considered that the kiln was used for bronze melting and described the method of its operation as follows: the metal was placed, in layers, over a structure made of pieces of wood and branches of trees. Then the structure was lit and the channels opened in succession, allowing the air to come into the chamber. Then the temperature increased to the melting point of bronze. The heavier materials settled and the melting metal flowed through the short south channel to the receptacles placed into the cavities outside the kiln. There the casting was done. The opening to the south side of the chamber would have been used for controlling the melting procedure. Further details of the melting procedure are not given.

On the above interpretation the following could be noted.

a. The masses interpreted as slags coming from bronze melting have not yet been analyzed; consequently, they cannot constitute a strong positive evidence. Moreover, masses coming from the similar kiln of H. Triada,<sup>154</sup> which have been analyzed, appear to be only vitrified clay (the percentage of the contained metal was insignificant).

b. The presence of channels actually shows a difference from the known type of pottery kilns, but this fact does not necessarily suggest a bronze kiln.



On the other hand, the same interpretation is confronted by a fair amount of difficulties.

a. The kiln chamber is very large for bronze melting. The metal kilns should be much smaller for two main reasons:

1) A large chamber needs a great amount of raw material.

2) A small chamber makes the control of the temperature easier; clay bellows could further be used to increase the temperature whenever necessary.

b. The kiln, because of its location close to the palace and beside the town houses, would create problems for the residents when it would be in operation. However, in this case one notes that the operation of a kiln inside the residential area creates problems in all cases, even if its use is not connected with bronze melting.

c. The casting of the bronze without the help of crucibles seems unlikely.

d. It is not likely that such a great amount of raw material ever existed in Zakros, to fill such a large chamber up to the level of the channel for flowing out.

From the above discussion it is evident that the Zakros kiln could not easily have been used for bronze melting. One can keep the reservation to discuss this hypothesis again after the chemical analysis of the masses, which have been used to support the above discussed argument. The kiln's function will be discussed again below after the detailed presentation of the Minoan parallels.<sup>155</sup>

## Bronze Smithies

N. Platon in Zakros suggested that three or more bronze smithies were located in the West and South Wing of the Zakros palace. Following is a more detailed presentation of these particular areas.

### 1. Bronze smithy over Rooms XII-XIII of the West Wing of the Palace

In Zakros, it has been mentioned that a bronze smithy, together with a stone workshop, was probably located over Rooms XII and XIII of the West Wing. The evidence connected with such an identification includes bronze sheets, pieces of bronze objects and some bronze tools.

#### a. Location (fig. 10).

The room over Rooms XII and XIII<sup>156</sup> should be located just behind the west palace facade. If we are actually dealing with a single room, this room would be almost rectangular and spacious (dim. 7 x 4,60 m.). Its north corner would be projected into the open-air area to the west of the palace.

The room under discussion should be accessible from the east through that one over Rooms XI-XIV-XV and through another room over Room IX, up to the staircase of the central entrance of the West Wing (Area XXV). The communication with the ground floor apartments was probably easier, through the room over Rooms XI, XIV and XV, and down Staircase X.

The room was probably directly lit by windows on the west facade of the palace.

b. Architectural form and construction

A few words only can be said for the architectural form of the room under discussion. Probably its south and east walls were made of mud-bricks, since they were simply separation walls. Its north and west walls constitute parts of the palace facade and were probably built from large ashlar limestone blocks. It is likely that the room was decorated with frescoes, since some decorative fragments of stucco were found together with the 'workshop's material' fallen from upstairs.<sup>157</sup>

c. Contents related to the workshop

As it has been discussed already,<sup>158</sup> a stone workshop was probably located immediately to the SE of the room under discussion (Room over Rooms XI, XIV, XV). Unworked steatites and bronze tools have been connected with this stone workshop. Moreover, the bronze tools are mainly chisels belonging to type '2' of the writer, and it is not probable that they were used for metal-working.<sup>159</sup> The part of the material which can be related to a bronze workshop consists of:

1) Bronze sheets.

2) Pieces of bronze objects: a handle and a foot of a large bronze cauldron. The handle was found in ground floor Room XIII and the foot in ground floor Room XII (pl. 51).

d. The remaining contents

Apart from the above described material, only some fragments of stucco can be safely identified with a material fallen from the room upstairs. It is probable that some of the clay vessels could have fallen from the same room, but it is difficult to set apart these vessels from those



belonging to the ground floor's content.

e. Date

The room under discussion belongs to the palace which was finally destroyed at the end of the LMIB period.

Summary

Location. On the West Wing of the palace, just behind the west facade. Lighting by means of windows on the west facade. Difficult approach through other upper floor rooms and down the central staircase of the West Wing (XXX). Adjoins a stone workshop.

Architectural form and construction. Spacious rectangular room, probably decorated with paintings.

The contents related to the workshop. Bronze sheets and pieces of a bronze object.

The remaining contents. Material connected with the stone workshop (unworked steatites, chisels), clay vessels, and fragments of wall paintings.

Date. LMIB period.

Discussion

Despite the fact that the room under discussion would be suitable for a bronze workshop, the evidence for such an identification is not strong enough; the 'pieces of bronze objects', are only a lug and a foot of a giant cauldron and are probably broken off from the same object. A short study of the above described material led the writer to the conclusion that these pieces could very well come from a finished heavily damaged object. The bronze sheets could also belong to finished objects. Consequently, the location of a bronze

workshop in the above discussed area remains conjectural.

However, since the material was found in the same context with material coming from a stone workshop, one must take into consideration the possibility that a bronze workshop was also located in the same area, namely above Rooms XI-XIV-XV.

## 2. Workshop over the Hall of Ceremonies

The possibility has already been discussed that some of the tools which were found on the floor of the Hall of Ceremonies (XXVIII) and the short dog-leg corridor beside the Lustral Basin (Room XXIV), belonged to different workshops, which functioned in adjoining rooms of the upper floor.<sup>160</sup> Of this group of tools, the following could be used in a bronze workshop:

a. One stake-head with six rough-shaped facets of an almost square section. One facet is blunt from use. This particular object might have been used by a bronze smith to shape bronze vessels from disks or sheets. The flat end was probably used for planishing.<sup>161</sup>

b. Two chisels, the one of type '1' and the other of type '3'.<sup>162</sup> The heavy chisels can be used as tools for bronze-working (Br. Ch. cat. nos. 7, 10).

c. Three thin bronze chisels or solid drills: two small (10-12 cm. long), and a larger one (23,7 cm. long). They could be used for making holes in bronze sheets (Br. Dr. cat. nos. 3, 4, 5).

d. Two punches, one much longer than the other (P.A.P. cat. nos. 1, 4). Their use for perforating sheets should not

be excluded.

e. Two small tools with two ends, the one flared, the other pointed. They were probably also used as punches for making holes in bronze sheets.

Of the above mentioned tools the stake-head and the chisels resemble the typical tools for bronze-working. Consequently, the existence of a bronze smithy on the upper floor of the West Wing of the palace should be considered likely.

### 3. Workshop over Room XLIII?

N. Platon in Zakros<sup>163</sup> suggested that a bronze workshop can be located over Room XLIII, on the South Wing of the palace. This hypothesis was based on the discovery of numerous small bronze sheets, some of which resemble the form of a double axe, in the ground floor filling.

Room XLIII was used for stone-working and its architectural form and construction have already been described.<sup>164</sup> Only a few notes could be added regarding the hypothetical reconstruction of the upper floor apartment, from where the sheets fell.

#### a. Location (fig. 14).

It is likely that the upper floor room was located just above the ground floor one (Room XLIII). The four walls of the ground floor room are thick enough to support equivalent walls on the upper floor. However, the possibility of having a single room over ground floor Rooms XLII and XLIII should not be excluded.

The material which had fallen into the ground floor



room does not provide adequate evidence for an architectural reconstruction of the upper floor room.

The upper floor room was probably accessible by means of the wooden staircase in Area XLVIa, b, directly from the Central Court of the palace. Lighting could be direct, by means of a probable window on the SE facade of the South Wing.

b. Architectural form and construction

The room over Room XLIII probably had the same form and equal dimensions as the equivalent ground floor room.<sup>165</sup> The floor was made of a mixture of clay and lime, as it has been proven by the discovery of pieces of this material in the fill of the ground floor room.<sup>166</sup> The SE wall of the room, which constituted a part of the facade of the whole wing, would be built from ashlar blocks, while the remaining separating walls were probably made of brick.

c. Contents related to the workshop

1) Numerous pieces of small bronze sheets, cut in various forms. Some of these had the form of double axes.<sup>167</sup>

2) The point of a small bronze punch, of square section.<sup>168</sup>

d. The remaining contents<sup>169</sup>

1) A piece of an amulet from rock crystal.

2) Two small objects, one of clay, the other of faience, resembling a human foot.

3) A lump of steatite.

4) A piece of a female figurine of the 'Petsofas' type.

5) A piece of obsidian and a small prismatic steatite.

6) A great deal of pottery.

e. Date

The room under discussion safely belongs to the final phase of the palace, namely the LMIB period.

Discussion

Despite the fact that the location of the room could be suitable for a bronze workshop, since other workshops have already been identified in adjoining rooms, the evidence for such an identification is not strong. Apart from the sheets and the possible use of the punch in bronze-working, the remaining contents cannot be associated with a bronze workshop. Moreover, the rock crystal amulet and the faience object could be connected with the existence of the neighbouring workshop in Room XLIV, which specialized in the manufacture of jewellery from various materials.<sup>170</sup>

Once again, the bronze sheets are not adequate proof in themselves to support the identification of a bronze workshop, since they could constitute damaged pieces of finished objects. Consequently, the location of such a workshop over Room XLIII remains conjectural.

4. Workshop in Room XLVa of the South Wing

N. Platon in Zakros,<sup>171</sup> suggested that Room XLVa of the South Wing contained a workshop for joining bronze pieces belonging to larger bronze objects. This view was based on the discovery in this particular room of a great number of bronze objects of different shapes and sizes.

a. Location (fig. 14).

The room lies on the SE part of the South Wing, west of Room XLIV, south of Room XLIII, and east of Room XLV. It was originally approached directly from the passage lying to the south of the wing, by means of a narrow door, which was probably blocked during the last phase.<sup>172</sup> The approach from the Central Court and the rest of the rooms of the South Wing was difficult, through Rooms XLVII, XLVIII and XLV. The room under discussion was probably directly lit by means of a window on the south facade of the wing.

b. Architectural form and construction (fig. 15).

The room is of an irregular trapezoidal form and its dimensions are approximately 2,80 x 2 m. The south wall constitutes part of the facade and is 0,65 m. thick. It consists of a single row of large ashlar limestone blocks with smaller stones used as fillers. The west and the north walls also consisted of a single row of large stones packed with smaller ones. The west wall is 0.60 m. thick and the north 0,70 m. The east wall consisted of two rows of middle-sized stones packed with smaller ones, and is 0,60 m. thick.

The basement room had a narrow door for communication with Room XLV to the west, located on its SW corner. A second door located on the NE corner of the room led to Room XLIV, but it was blocked during the last phase.<sup>173</sup> Traces of an equivalent ground floor door have not been preserved, but one could conjecturally locate it above the one of the basement.

The floor of the ground floor room has not been preserved;<sup>174</sup> it was probably made of packed earth.



c. Contents related to the workshop

All the bronze objects found in Room XLVa seem to be finished, but they are poorly preserved. They are the following:

1) A brazier with an impressive incised decoration of running ivy leaves on its interior.

2) A small jug in a bad state of preservation.

3) A straight handle of a bronze object.

4) A shallow cauldron. Its feet, detached from the body, were found in a lower level of the fill.

5) Amorphous sheets, probably coming from a damaged object.

A stone with a segment cut out by a drill was found together with the bronze objects, suggesting stone-working in the same area. In the SE corner of the room, found in situ, was a mortar which cannot, of course, be related to bronze-working, but suggests a household working activity.

d. The remaining contents<sup>175</sup>

1) A number of clay vessels of various forms and sizes: the lower part of a large pot with thin walls, a cylindrical vase with arched handles, two cooking pots, the lower part of an amphora-like pot, etc.

2) Some fragments of stone vases.

3) The body of a small figurine and an incised small disk which bears signs resembling  $\Psi$ .

4) Pieces of pumice and some masses which have been identified as bronze slags.

e. Date

The room should be dated to the final phase of the

palace, namely the LMIB period.

### Summary

Location. On the SE part of the South Wing of the palace. Adjoining the stone workshop of Room XLIV. Approaches during the last phase, through Rooms XLVII-XLVIII-XLV. The lighting was probably direct by means of a window on the south facade of the wing.

Architectural form and construction. Small dimensions, trapezoidal form. Narrow door towards Rooms XLIV and XLV. Floor of packed earth.

Contents related to the workshop. A number of finished bronze objects. Amorphous sheets (probably coming from a completely damaged object).

The remaining contents. Clay vessels, some pieces of stone vases, a clay figurine, pieces of pumice and unidentified masses (bronze slags?).

Date. LMIB.

### Discussion

Despite the fact that the noticeable concentration of bronze objects in this particular room can suggest a bronze workshop, the evidence is very weak. If one puts aside the bronze sheets (which could very well come from the breaking off of a bronze object), nothing else from the contents could be associated with a bronze workshop. No trace of tools was found except for a stone with a segment cut out by a drill, which was probably used in the adjoining stone workshop (Room XLIV).<sup>176</sup>

It is likely that Room XLVa was used for the storage of bronze and clay vessels, which were used in other rooms of the South Wing of the palace. The presence of a mortar in the same area suggests some additional household working activities.

### General Discussion of the Zakros Bronze Workshops

From the above discussion it has become clear that no bronze workshop can safely be identified in a particular room of the Zakros palace. However, the concentration of the products and raw materials in the West and South Wing of the palace indicates that at least the bronze smithies should be located somewhere around there. The presence of some tools which were frequently used for metal-working on the upper floor of the West Wing of the palace, suggests that at least one workshop should be located in this particular sector. One more bronze workshop probably functioned on the upper floor of the South Wing of the palace.

For the first stage of bronze-working, namely melting, the evidence is even weaker. The kiln published by N. Platon<sup>177</sup> as a bronze kiln, does not seem to have any connection with bronze melting. The only certain indications for this stage of bronze-working in Zakros are one clay crucible and one piece of steatite mould.



## C. Ivory Workshops (Category A, Type 'd')

### Introduction

The discovery of the three long elephant tusks in the fill of Room XI on the West Wing of the palace, suggests that local ivory workshops functioned at Zakros. Numerous small ivory inlays of various forms were found scattered (probably fallen from upstairs) throughout the SE part of the West Wing of the palace and especially in Rooms XXVI and XXV.<sup>178</sup> Among these inlays was a unique ivory butterfly with raised wings.<sup>179</sup> According to N. Platon these particular inlays, together with inlays made of other materials constituted the decoration of small wooden boxes, which have not been preserved.<sup>180</sup>

Apart from this area, a large concentration of ivory objects was also observed in two other cases:

- a. In Room XLIV of the South Wing of the palace.<sup>181</sup>
- b. In Room B of the East Building.<sup>182</sup>

#### 1. Ivory Workshop in Room XLIV of the South Wing

It has been suggested that Room XLIV of the South Wing was used for the working of various materials for the manufacture of small artifacts and jewellery. The discovery of some ivory pieces among the other small artifacts coming from this particular room suggests that the same room was also used for ivory-working.

The location and the architectural form of the room have already been discussed above, as has its date.<sup>183</sup> The material which could be related to an ivory workshop is

the following:

a. Small ivory artifacts or pieces: one piece of a mushroom-shaped spindle whorl (F.-I.-Gl. cat. no. 12) which resembles the rock crystal pin-heads, two small parallel-sided bars with one row of small perforations on one side, a small bar-like inlay in the form of semi-columns (F.-I.-Gl. cat. no. 13) and some flakes from other ivory objects.

b. One end of a small flared bronze cutter, and another longer of similar form, with two holes for the fixing of a wooden handle.

c. A small flake of flint.

The remaining contents have been described above.<sup>184</sup> Here, should be noted the presence of a great number of similar small artifacts from other various materials, faience, glass-paste, bone and steatite.

#### Discussion

It has already been proven<sup>185</sup> that Room XLIV probably contained a workshop dealing with the manufacture of small artifacts from various rare stones such as rock crystal. The finding of similar objects of other materials, even if they seem to be finished, constitutes strong evidence for local manufacture of these particular objects. Consequently, it is likely that the manufacture of the ivory pieces took place in situ, probably by the same craftsmen who also worked on other materials. The flint and the two small bronze tools were probably used for carving and shaping these small artifacts.

## 2. Ivory Workshop over Room B of the East Building(?)

In Room B of the East Building, which lies to the south of the Harbour Road, in a very compact fill containing dissolved mud-bricks, numerous pieces of ivory artifacts were found together with various small objects from other materials. The ivory pieces were fragments of inlays, pieces of small ivory boxes of various types, and a small piece of an ivory comb.<sup>186</sup> N. Platon, because of the presence of a great number of small artifacts and objects which seem to be relevant to the use of make-up, supported that the room over Room B was used by women for the application of cosmetics; this particular activity appears to have religious significance.<sup>187</sup> On the other hand, the concentration of such a great number of small artifacts from various materials could probably be connected to a workshop for jewellery, such as the workshop located in Room XLIV of the South Wing of the palace.

### a. Location (fig. 20).

The material was found in the fill of basement Room B of the East Building. This layer seems to have been sealed at the final phase of the building,<sup>188</sup> since it was covered by a new floor, on the same level as the central entrance from the Harbour Road. Since the material under discussion was found scattered on different levels of the same fill, it seems probable that it came from a ground floor room located over basement Room B. The precise location of this room cannot be defined, but it is certain that it lay in the west part of the building, just inside the west facade. The room



would easily be accessible through the central entrance from the Harbour Road and through an ante-room.

It is likely that the room was directly lit by a window on the west facade of the building.

b. Architectural form and construction

There is no evidence for the form and construction of the room under discussion. However, it would probably have the form of the basement room, and about the same size (10 m<sup>2</sup>). The discovery of a great deal of broken off mud-bricks in the same fill<sup>189</sup> suggests that the superstructure of the separating walls was probably made of mud-bricks.

c. Contents related to the Workshop

1) Ivory pieces (F.-I.-Gl. cat. nos. 8, 9, 10, 11).

a) Parts of ivory pyxides of various shapes (elliptical, parallel-sided, multi-faceted).

b) Ivory fragments from small, thin, relief plaques.

c) Small thin inlays in various forms of which some bear rows of small holes on their sides.

All these pieces were in a bad state of preservation and have different colours because of the effect of fire. No piece is unfinished or waste material. Some ivory flakes probably belonged to finished and broken off ivory objects.

2) A piece of a bronze punch (or of tweezers? P.A.P. cat. no. 3).

3) Obsidian blades and flakes.<sup>190</sup>

d. The remaining contents<sup>191</sup>

1) A number of clay vessels of various types and sizes, of which some are coarse, belonging to the LMIA period.

2) Two amulets and a small elegant vase of faience. U 70

3) Two bronze punches or pins with curved ends, a bronze handle of a vase in the form of  $\Pi$ , and a bronze mirror.

4) A piece of worked wood and other carbonized pieces of wood.

5) Two rectangular stone tables, one of which had short legs (two preserved). Three rubbers were found in association with the tables.

6) A rectangular whetstone.

7) Eight stone vases (or their pieces) from luxurious stones (veined marble, rosso antico).

8) Half of a small silver double axe.

9) Sea shells and animal bones.

e. Date

The layer which corresponds to the possible workshop is dated by its pottery to the LMIA period.

### Summary

Location. On the west part of the East Building, on the ground floor. Easily accessible by the central entrance from the Harbour Road. It was probably directly lit by a window on the west facade of the building.

Architectural form and construction. Uncertain. Probably the room was rectangular, corresponding to the basement one (Room B).

Contents related to the workshop. a) Ivory pieces, inlays in pyxides, fragments of small ivory boxes. b) Small bronze cutter (or part of tweezers). c) Obsidian blades.

The remaining contents. Clay vessels of various shapes and sizes, a few objects of faience, bronze pins and mirror,

a piece of wood, stone tables and rubbers, whetstone, stone vases, fragment of a small silver axe, and sea shells and animal bones.

Date. LMIA

#### Discussion

Despite the fact that the material coming from Room B of the East Building resembles the material coming from the small artifacts workshop in Room XLIV of the palace, the evidence for an ivory workshop in this area is not strong. It is not possible to prove that the ivory pieces were in an unfinished state or waste material coming from ivory-working, because of their poor preservation. Tools which could be connected with an ivory workshop have not been found except some obsidian pieces, which would be used for fine carving, and a probable bronze punch. On the other hand, the concentration of finished stone and clay vessels in the same area constitutes negative evidence for the conjectural location of a working area in this particular room. The discovery of some objects relevant to make-up (small tweezers, mirrors, stone tables probably used as colour-tables, and ivory pyxides) suggests that the area over Room B was used as a well equipped room for body embellishment.<sup>192</sup>

#### D. Faience and Glass Workshops

(Category A, Type 'd')

A fair number of faience objects has been found in the Zakros palace and town. From the Treasury of the palace come three plastic rhytons (two in the form of a bull's head and



one in the form of a lion's head), and a unique object in the form of an argonaut shell.<sup>193</sup> Other small faience objects, which were probably used as inlays, come from other rooms of the palace, such as Room XXVI and Room XLIV of the South Wing. It is noted that small artifacts from faience were usually found in association with equivalent objects from other materials, such as ivory, bone and steatite.

N. Platon suggests in Zakros<sup>194</sup> that a faience workshop functioned in Room XLIV, where other workshops dealing with the manufacture of small artifacts from other materials have also been identified.<sup>195</sup> This hypothesis is based on the discovery of some faience objects in the form of pressed, truncated cones, resembling the lower part of idols. Among others, a small fragment from the hand of a faience idol is mentioned.

The careful study of the material by the writer showed that the pieces mentioned are irregular, of almost parallel-sided or truncated conical form, but they do not bear any trace of working on their surface. Unfortunately, the piece of the little hand mentioned by the excavator was not found and studied. The pieces studied could have belonged to finished faience objects (pl. 19).

On the other hand, since other workshops have been located in this particular area, the possibility that some of these faience objects had been finished in situ, should not be excluded. Nevertheless, the evidence for an identification of a faience workshop remains weak.

In the same area fourteen beads of glass-paste were also found. Once again, there is no strong evidence for

an identification of a specialized glass workshop.

#### E. Perfume Workshops (Category C, Type 'a')

##### 1. Perfume Workshop in Room XLVII of the South Wing

N. Platon, following a theory first proposed by L. Pomerance, considered that one room on the South Wing of the palace, namely Room XLVII, was used for the manufacture of perfumes.<sup>196</sup> This hypothesis was mainly based on the discovery of a relatively large number of peculiar utilitarian pots, the interpretation of which has been widely discussed among scholars.<sup>197</sup> H. Georgiou<sup>198</sup> recently published a corpus of these utilitarian pots from Minoan sites, including the Zakros specimens, and she believes that a perfume workshop could probably be located in Room XLVII of the palace. C.W. Shelmerdine,<sup>199</sup> who studied the question of the perfume industry in Pylos, also considered that this particular room was used for some kind of perfume manufacture.

##### a. Location (fig. 14).

Room XLVII lies on the west sector of the South Wing of the palace, surrounded by Rooms XLVI (to the north), XLIII (to the east), and XLVIII, XLV (to the south). West of it lies an open-air passage (Area XLIX). Room XLIII to the east was used for stone-working,<sup>200</sup> while Rooms XLVIII and XLV were considered areas in which other working activities took place.<sup>201</sup>

Room XLVII was accessible from the Central Court of the palace through a short corridor-ante-room, as well as

from open passage XLIX by means of a corridor which passes under the second wing of a wooden staircase (XLVIb). Both approaches ended in front of the door of the room under discussion at the eastern end of its north wall. Another narrower door, at the west end of the south wall of the room, led into Room XLVIII, through which the remaining southern rooms of this wing were accessible.

b. Lighting

The room was probably directly lit by a window on the west facade of the wing. However, traces of this window have not been found, since the west wall is not preserved up to a window level.

c. Architectural form and construction (fig. 21).

The room is spacious (approximately 6,25 x 4,50 m.) and has an irregular trapezoidal form. It is divided into two parts by a brick partition wall from south to north. This partition wall begins from the south wall of the room and is 3,25 m. long and 0,70 m. wide. Between its north end and the north wall of the room there is a doorway, about 1 m. wide, to connect the two parts of the room.

The west wall constitutes part of the west facade of the whole wing and is constructed of large ashlar limestone blocks in a single row packed with smaller stones. It is 0,75 m. wide. The construction of the east wall, which is 0,70 m. wide, is similar. The south wall is constructed of middle-sized stones in two rows filled with smaller ones and is 0,55 m. wide. The north wall (which also constituted the south supporting wall of Staircase XLVI) was made of mud-bricks and is 0,65 m. wide. Its west end forms a



projecting angle into the room.

In the larger eastern part of the room (approximately 3 x 4,5 m.) some walls belonging to an older building were used as low benches. The partition wall and the eastern wall of the room were based on such older walls. The floor was made of packed earth.<sup>202</sup>

d. Contents related to the workshop (pls. 25-26)

a) 'Fireboxes'. The material coming from Room XLVII has been published already by H. Georgiou<sup>203</sup> in her study on the 'Minoan Fireboxes'. The published material includes ten 'fireboxes' classified in Categories Ia and III of Georgiou (four of them to Category IA and the remaining six to Category III). These two categories, according to Georgiou, have the following general features.<sup>204</sup>

'Type IA. Round hollow capsule, slightly flattened. Top of capsule is usually solid. Underside is pierced with a single hole, several holes, or slits. A wide upward curving flared rim spreads out from underside forming a shallow disk. The area between the lip of the rim and the capsule is a channel following the periphery of the capsule. The rim edge is plain or indented on two sides, or provided with two or four symmetrically placed tab handles. The rim is wheel-turned, the top of capsule may be wheel-turned. Rim diameters vary from 4,6 to 32,2 cm. but these are extreme sizes, the average diameter being approximately 10-12 cm.'

'Type III. Vessel with high, hollow, cylindrical foot. Slightly flaring solid base, Vertical loop handle rises above rim and indents it. Wide upward curving rim curves outward at top of foot forming a shallow bowl. Rim is

flatter opposite handle forming a shallow scoop. Domed hemispherical capsule is situated directly above foot in centre of shallow bowl. Capsule has a solid curved upper surface and is hollow inside. Rim forms channel around capsule. Wheel-turned. Foot is pierced by several rows of small holes or slits following the circumference. One larger hole below or to the side of handle. Height of rim at handle varies from 11,2 to 15 cm., rim diameter varies from 18,4 to 20 cm.'

H. Georgiou published the ten specimens of Room XLVII giving all possible details, dimensions, sketches, and photographs. The numbers of the Zakros specimens in her catalogue are the following: Type IA: 72, 73, 74, 75; Type III: 7, 8, 9, 10, 11, 12.

Some of the above pots have been located in Room XLVI, g(?). After the study of the excavation diaries it seems probable that this number had been originally given to the north part of Room XLVII. Moreover, N. Platon mentioned that in Room XLVI nothing was found apart from some pieces of obsidian and steatite, and one horseshoe-shaped loomweight.<sup>205</sup> Consequently, all ten specimens published by Georgiou come from the same room, namely Room XLVII.

e. The remaining contents<sup>206</sup>

1) At least ten small pithoi, along the partition wall, and five to six more near a rectangular built enclosure in the NW corner of the room.

2) Numerous small pots, such as cups and one-handled cups, were found within the same enclosure, as well as near the west wall and beside the bench of the south wall.

3) A wide basin-like bronze object and fragments belonging to another of unidentified shape.

4) Jugs and amphorae.

5) Clay disk-shaped lids.

6) Disk-shaped convex loomweights and clay weights.

7) A rubber and obsidian flakes.

8) Pieces of pumice.

9) Two very large tripod cooking pots situated along the south wall, and other common vases of various types.

10) Other smaller cooking pots and a spouted pot, beside the east wall of the room.

11) Pieces of a flat-convex clay pipe, found in the lower levels of the fill.

#### f. Date

Room XLVII, such as the other rooms of the South Wing of the palace, safely belong to the LMIB period, as it has already been proven from the pottery and the fact of the simultaneous destruction of the whole palace. H. Georgiou<sup>207</sup> wrongly dates the South Wing to the MMIII-LMIA period. In the reference given,<sup>208</sup> N. Platon attributes to this particular period the remains of an older building found underneath the last floor, not the last use of the whole wing. It is certain that Room XLVII should be dated to the LMIB period.

#### Summary

Location. On the west sector of the South Wing of the palace. Easily accessible from the Central Court and west passage XLIX through short corridors.



Lighting. The room was probably lit by means of a window on the west facade.

Architectural form and construction. Spacious room, divided into two parts by a partition wall. Floor made of packed earth.

Contents related to the workshop. Ten 'fireboxes'.

The remaining contents. A great amount of clay vessels: pithoi, cooking pots, amphorae, jugs, and smaller pots. Loomweights, obsidian flakes, pieces of pumice, and pieces of a clay pipe.

Date. LMIB period.

#### Discussion

H. Georgiou,<sup>209</sup> after systematic study of the known specimens belonging to the category of 'fireboxes', comes to the conclusion that these pots could be used for the preparation of highly volatile aromatics. Consequently, following the opinion of N. Platon, she considered that Room XLVII of the South Wing was probably used for perfume-making. This view was mainly based on:

a. The concentration of a great number of peculiar 'fireboxes' in a particular room. This concentration cannot be connected to pottery-making, since there is no evidence for such activity in this area. Despite the fact that many of the pots which have been found in this room could well belong to the equipment of a kitchen, fireboxes have not yet been found in areas in which certain kitchens have been identified, such as Room XXXII of Zakros.

b. The method of function of fireboxes, which has

been described in detail:<sup>210</sup> they would have been used with the perforated sector downwards and they would have contained substances within the rim channel. According to their type, fireboxes would be located either over a coal fire or over vats which contained boiling or heated water. Georgiou considered that the lower part of the capsule did not contain coals; this was probably used only as an insulator by trapping the heat and allowing air to circulate.<sup>211</sup>

C. Shelmerdine<sup>212</sup> agrees that Room XLVII was probably used as a perfume workshop on the basis of the following evidence:

a. The concentration of the material in a room which is suitable for perfume-making and the possible use of fireboxes for this purpose.

b. The presence of certain other objects which would be used for such an industry, in the same room: large three-legged kettles, a large shallow basin and a terracotta grill.

In spite of this, C. Shelmerdine notes two difficult points regarding the process of perfume manufacture.

a. It has not been explained exactly how the process worked nor how the essences were then captured and the perfumes produced.

b. The proposed distillation is interesting but there is no Mycenaean evidence for such a process.

It has become clear that the scholars dealing with this subject come to the conclusion that Room XLVII was actually used as a perfume workshop. Here one should add two points:

a. The architectural location of the room supports such a function: it was spacious, easily accessible from

two different areas, probably well lit and ventilated.

b. The presence of other probable workshops, adjoining the room under discussion.

On the other hand, regarding the above discussion, one can notice the following.

a. The presence of a great number of objects irrelevant to the workshop's activities remains unexplained. Certainly some of them could have fallen from the upper floor while others could have been used as auxiliary pots in the particular workshop. The loomweights, the weights and the obsidian do not seem to have any connection with the workshop. On the other hand, the clay pipe and the cylindrical spouted pot could be used for decanting liquids. The pithoi would be used for storing the production.

b. Despite the fact that a large part of the room's contents could be related to a perfume workshop, only fireboxes have a specialized function. All the other finds could as easily have been discovered in a kitchen or in a common storeroom.

c. Chemical analyses have not been done to prove that vegetable substances have been used in the Zakros fireboxes. Consequently, the method of function proposed remains conjectural.

In conclusion, Room XLVII could have been used as a perfume workshop. The architectural location, the concentration of a fair number of specialized pots, and the presence of satisfactory auxiliary equipment agree with such an identification. Nevertheless, the evidence related directly to this probable workshop is limited to the



presence of the fireboxes, the function of which is not yet certain. For these reasons, Room XLVII could be characterized as 'a probable perfume workshop'.

## F. Workshops for Dyeing Textiles

(Category A, Type 'g')

### 1. Room XX

N. Platon<sup>213</sup> considered that an installation found in the SW sector of the West Wing of the palace (in Room XX) was used for industrial purposes probably connected with pigments (pl. 59). In Zakros,<sup>214</sup> he suggested that the activity concerned the dyeing of textiles. This view was mainly based on the interpretation of the installation's form and not on the discovery of certain finds.

#### a. Location (fig. 22).

Room XX lies at the SW end of the SW sector of the palace, which seems to have been added to the original west facade of the palace during the LMIB period.<sup>215</sup> The room was accessible from the open-air area south of the palace by means of a narrow doorway and through Rooms XXI, XVII and XIX of the same sector. It is likely that it was well lit by means of a window (not preserved) on the west or the south facade of the sector.

#### b. Architectural form and construction

Room XX is rectangular and communicates with Room XIX by means of a 'polythyron' consisting of four doors. The eastern door gives direct access from Room XIX to the installation under discussion. This latter consists of two rows (6 and 3) of small, almost square, built troughs. Between

the rows was a larger, rectangular, shallow tank; this tank had been filled with a kind of stucco during the final phase.<sup>216</sup> The dimensions of the installation in its entirety are: 2,20 x 1,40 m. Each of the smaller troughs measures 25 x 35 cm. and the central tank 1,25 x 0,50 m. On the interior surfaces of the smaller troughs there are traces of successive layers of plastering. There is no communication between the troughs.<sup>217</sup> Underneath the whole installation passed a drain, ending outside in an open area at the south of the palace. A direct connection between this drainage system and the installation under discussion was not confirmed.<sup>218</sup>

c. The contents<sup>219</sup>

Room XX yielded only some clay vessels found in the western part of the area: a basin, a cylindrical pot and a thin, fragmentary vessel.

d. Date

Room XX with the installation under discussion can be dated to the final phase of the palace, namely the LMIB period.

### Discussion

Before discussing the purpose of the above installation, we must refer to another very similar construction, discovered by D.G. Hogarth in House I.<sup>220</sup> In a narrow chamber, west of the large Room V of the house, an installation clearly similar to that of Room XX of the palace was found. It consists of five built plastered troughs, the four in one row, the fifth alongside, in contact with the fourth, which was the

western one. In this case also, an open channel of baked red clay passed in front of the installation. According to the excavator, this drain took the surface water of Room V outside the west facade of the house. It should be noted here that Room V was probably roofed, since it was plastered with blue and red stucco. Consequently, the presence of the drain would rather be related to the installation with the troughs. Hogarth describes the troughs as being only 'kitchen troughs' and he does not give any other, more specific, interpretation (fig. 23).

Clearly, in both cases, we have to do with some activities of a domestic or industrial character. The covering of the troughs with plaster (in the case of Room XX, in successive layers), and the existence of a drainage system<sup>221</sup> points to activities dealing with water.

The presence of a number of similar troughs in rows can mean two different things.

a. A group work, which would be similar for each trough.

b. A separation of materials used, or of types of materials.

The first interpretation does not seem very probable, since there is not enough space (at least in the case of Room XX of the palace) for a group work.

In conclusion, it seems reasonable to consider that in such installations some working activities which needed a separation of the materials used (or types of materials) took place. In these particular activities water would have been used, as the presence of drainage systems and the



plastering on the interior surface of the troughs indicate. The hypothesis of N. Platon that such installations could be used for dyeing textiles cannot be excluded. The few pots found in Room XX could probably be used as auxiliary equipment for such an industry (as containers, vessels for mixing liquids, etc.). On the other hand, this hypothesis cannot be confirmed, since nothing of the materials used was found. Consequently, these areas could be characterized as 'probable working areas'.

## 2. Other Areas for Working Pigments

Two other areas of Zakros provided some evidence for activities related to the working of pigments. Nevertheless, in both cases, these activities appear temporary and they are insufficient for the identification of a relevant workshop.

### a. Building of the Niches, Room X<sup>222</sup> (fig. 24).

In the fill of Room X of the Building of the Niches, on the SW corner of the room, some small pieces of a blue-black colour substance were found. The same fill yielded an irregular rubber, a small fragment of a steatite cup, and some sherds belonging to the MMII and III periods. A tongue-like rubber, and a bar-like stone tool with broad, disk-shaped end were found on the floor of the same room. Certainly, the small pieces of the colour substance show a relevant activity, which could be connected with the presence of the two rubbers and the stone tool (which resembles a spatula) found in the same area. However, the layer in which all these objects have been found belongs to an earlier period

and it is difficult to be architecturally located in a particular room without additional evidence. Consequently, though an activity related to the working of pigments is obvious, a relevant workshop could not be safely identified in the particular area.

b. Magazine IV on the West Wing of the palace<sup>223</sup>

It has already been discussed that a probable stone workshop can be located over the magazines of the West Wing.<sup>224</sup> Among the objects which seem to have fallen from the upper floor were some pebbles bearing traces of pigments on their surface. The colours were mainly a blue and secondly a greenish one. The presence of these tools safely indicated an activity related to the working of pigments, but is not enough to identify a relevant workshop. Nevertheless, it can not be excluded that some activities which took place in the workshops already described were connected with such a kind of working. The material is dated to the LMIB period.

G. Weaving Areas (Category A, Type 'e')

Numerous loomweights were found scattered throughout the whole site of Zakros. Clearly, the weaving was mainly a domestic activity taking place in various areas of the ground and upper floor apartments, beside other relevant activities. Usually loomweights are found isolated, or in small numbers; in these cases, the identification of a loom or looms is uncertain. Nevertheless, in a few cases the discovery of some large groups of loomweights can support the identification of looms and organized textile workshops in the particular areas.

## Palace

### 1. Textile Workshop over the West Magazines<sup>225</sup>

N. Platon in Zakros considered that over the West Magazines of the palace, on an upper floor room, some weaving activities took place. The probable identification of a stone workshop in a room over Rooms II, III, VI, VII and VIII of the West Wing of the palace has already been discussed.<sup>226</sup> It is likely that at least one loom stood in the same area, since numerous loomweights were found fallen and scattered in ground floor Rooms II and III. The loomweights constitute two separate groups.

a. The first group was found on the steps of the stone staircase which descended into Area II. Two dozen at least loomweights of the disk-like type are mentioned.

b. The second group consists of loomweights found in the fill of Magazine III and especially in the area near its SE wall (pl. 59). A great number of loomweights, mainly of the disk-like but also of the trapezoidal type, is mentioned.

On the basis of the above information, it seems very probable that at least one or two looms were housed in the same area where the stone workshop was located. The coexistence of two different types of workshops in the same area is not unusual, since there are many similar examples from other Minoan sites.<sup>227</sup> Date, LMIB period.

### 2. Weaving Area over Room XLIV of the South Wing of the Palace<sup>228</sup>

N. Platon identified one more loom in a room over



Room XLIV of the South Wing of the palace. Room XLIV was probably a workshop for the manufacture of small artifacts from various materials.<sup>229</sup> Its architectural location and form, as well as its contents, have been presented above. The identification of the loom was based on the discovery of two groups of loomweights in the upper level of the fill, in the NE part of the room.

a. The first group (Oth. St. T. cat. nos. 12, 13, 14) consisted of sixteen weights of an almost parallel-sided to truncated pyramidal form, made of a grey-black stone. They had a suspension hole on their broad surfaces usually located just over the middle.

b. The second group consisted of twelve clay loomweights mainly belonging to the disk-like, convex type (only one specimen belongs to a tongue-shaped type).

In the same fill, pieces of red plaster and a bronze mirror were found.

It is very probable that the room located over Room XLIV was used as a weaving area, since it was equipped with one or two looms at least. Date, LMIB period.

### 3. Loom on the Upper Floor of Room H of the 'Old Palace'<sup>230</sup> (fig. 18)

Basement Room H belongs to a building which extended under the East Wing of the new palace. N. Platon believes that this particular building constituted a part of the earlier Zakros palace.<sup>231</sup> In the fill of the room, several loomweights were found.<sup>232</sup> They belong to the following types: cuboid, pyramidal, trapezoidal, parallel-sided, tongue-shaped, disk-shaped. The same area yielded pieces

of stone vases, a rubber, a piece of stalactite and a number of ordinary clay vessels.

If there actually was a textile workshop in this upper floor room, there would be strong evidence of an organized textile industry directly controlled by the central authority as early as the MMIII period.

The layer in which the loomweights were found is dated to the MMIII B period.<sup>233</sup>

### Town Houses

#### 1. Basement Room under Room Z of the House of the Polythyron<sup>234</sup> (fig. 25)

Room Z, lying on the second terrace of the House of the Polythyron was paved during its last phase. Under the pavement, a basement room belonging to the LMIA period was investigated. This small basement communicated with another basement space, a kind of corridor, by means of a narrow doorway on its NW corner.

In the fill of the basement room under Room Z, twelve loomweights were found, of which seven were of the disk-shaped convex type, three of the parallel-sided type, and two of the tongue-shaped. In the same fill several pieces and complete ordinary clay pots were found.

Despite the fact that it is unlikely that the small basement room was used for weaving, a loom could probably be located in the room upstairs or in another adjoining room. Date, LMIA.

2. Room XV of House B on the NW Hill<sup>235</sup> (fig. 26)

Basement Room XV was a small doorless space of a rectangular shape. This room originally communicated with another basement lying to its south by means of a door on its SE end, which was found blocked. During the last period this basement would probably be accessible only from upstairs.

Sixteen loomweights were found in the fill of the basement room: twelve were of the disk-shaped, convex type with one or two suspension holes, one of the parallel-sided type, one of the pressed-spherical, and one of the tongue-shaped.

The same fill yielded a great amount of pottery which mainly consisted of conical and one-handled cups. Among the other finds were also a column-like foot of a stone offering table, and a clay imitation of a chamois' horn, which probably belonged to a plastic rhyton.

This narrow basement would be uncomfortable for weaving. Nevertheless, the evidence leads to a conjectural location of a loom in the room upstairs or in an adjoining room. Date, MMIII-LMIA.<sup>236</sup>

#### Discussion of

#### Weaving Areas in Zakros

On the basis of the above brief presentation of areas in which weaving activities probably took place, one can conclude the following.

a. In most of the cases, weaving activities seem to have a domestic character. Only in a few cases the areas



used for such activities have equipment indicating a larger production.

b. On the other hand, two areas in the palace provided evidence for well organized textile workshops. The looms were located on the upper floor, probably in areas in which various working activities took place.

#### H. Working Areas for Basic Food Production

##### Introduction

Another category of working areas includes those used for basic food production. In this category, areas for the preparation of food (kitchens) will not be included. It should be noted here that it is very difficult to distinguish the areas used for a short while for limited production from the areas which were permanently used for production intended to be consumed by wider social groups. Especially in the case of flour production, as well as for the general process of grinding, this distinction becomes more difficult since permanent built installations used for this purpose are very rare in Minoan Crete.

On the other hand, wine- and oil-making needs more permanent installations, not easily transportable, such as wine and oil-presses, large receptacles, and oil-separators. The discovery of such installations is enough to identify a working area dealing with a specific production.

An important point should be added here: if such installations were intended to produce on a limited scale for the residents of the house in which they were situated, then these activities could be named 'household activities'.

On the other hand, if the production was intended to be consumed by wider social groups, these installations could be simply the equipment of workshops for basic food production. This latter seems more likely for the following reasons.

a. Of the approximately thirty houses of the town of Zakros excavated to the present, only six yielded installations for wine-making. It becomes clear that these installations were intended to cover the needs of a whole quarter of the town.

b. No similar installation has been found in the palace area. Consequently, it should be supposed that the palace magazines were filled by production coming from the town.

c. The absence of any distinctive oil-making installations could mean one of two things:

1) that the oil-making installations were primitive (quernstones, troughs), and their products were to be consumed by limited social groups.

2) that extensive and permanent oil-making installations actually existed somewhere, but they have not yet been investigated.

In conclusion, areas in which installations for wine- and oil-making have been found can be named 'workshops for basic food production'. On the other hand, the areas used for grinding activities could have either been permanent or temporary. Nevertheless, a distinction between these last different kinds would be risky; this is the reason such areas have been presented as a whole, with all the possible evidence provided, and they have simply been named 'working areas'.

## Wine-presses (Category B, Type 'a')

Six wine-presses have been found in Zakros town. Three of them lay in houses of the north-northwest hill of some distance from each other, and they were excavated by D.Q. Hogarth, while the remaining three were concentrated in the SW quarter of the town, on the SE hill, and have been excavated by N. Platon.

### 1. Wine-press in House A of the NW hill<sup>237</sup> (pl. 60)

A wine-press installation was found in the entrance hall (Room IV) of House A, investigated on the NW hill by Hogarth. House A was a very important building, built with cyclopean ashlar limestone blocks. The principal find of the house was a large collection of clay sealings with representations of a religious significance,<sup>238</sup> which belonged to an archive, as it has been proven by the discovery of a Linear A tablet in the same area.

#### a. Location (fig. 23).

Room IV lies just inside the main entrance of the house, on its south part, and was used as a kind of ante-room for the other ground floor rooms. It was easily accessible through the main door of the house, in which a ramp beginning outside of the SW corner of the house ended.<sup>239</sup> The room was probably directly lit by means of a window on the south facade, traces of which have not been found.

#### b. Architectural form and construction<sup>240</sup>

The room is paved with pebble concrete. A plastered square pillar base rested on a rough stone plinth, almost



opposite the main entrance (D.G. Hogarth believes that this pillar was of a religious significance, a kind of sacred 'Pillar of Establishment').

The south wall constituted part of the south facade of the building and was constructed of large limestone blocks. The east wall of the room is constructed of two rows of medium-sized stones.

The installation of the wine-press consisted of three clay basins. The largest lies to the east and communicates through a wide vent with the easternmost of the smaller ones, the rim of which is level with the bottom of its feeder. The third small basin was on the same level, but independent. Nothing but earth was found in these basins.

The upper basin was backed by a wall of packed earth and small stone on the further side of which was a vertical face of thin plaster. This plaster face, turning horizontally, continued for a short way to the south, over the concrete floor. It seems that these were the remains of a shallow plastered tank at the south part of the entrance hall. This tank seems to have a connection with the group of basins.

c. The remaining contents

In the entrance hall was found nothing apart from fragments of two small jars, probably fallen from the upper floor.

d. Date

House A has been dated (from the pottery) to the LMIB period.<sup>241</sup>

## Summary

Location. Room IV was the entrance hall of House A, directly approached from the main entrance of the house. Probably directly lit.

Architectural form and construction. Spacious room with an independent plastered square pillar. The wine-press consisted of three basins, of which the larger had a wide vent in the lower part. The whole installation was in direct connection with a shallow plastered tank.

The remaining contents. The room was found empty.

Date. LMIB.

## Discussion

It is clear that this installation was used as a wine-press. The largest basin would have been used as press-bed, the second was a receptacle, and the third would probably have contained the grapes. The overflowing juice would not be lost, but would be gathered in the shallow tank. The easy approach from outside would serve the quick supplying of grapes.

### 2. Wine-press in House I of the North Hill<sup>242</sup> (pl. 60)

One more wine-press was discovered by Hogarth in House I of the north hill. This house was one of the most significant houses excavated in Zakros, since it provided 'the most elegant and complete ground plan' and contained more than seventy vases. In this case the wine press was installed in an independent area, numbered as Room XVI.

a. Location (fig. 23).

Room XVI lies just inside the NE facade of the house and was accessible through Areas XIX, IX and XII. There is a possibility of direct lighting, if there was a window on the north facade, traces of which have not been found.

b. Architectural Form and Construction

The room was almost rectangular with thin internal walls, plastered on both faces as well as on top, a fact which shows that they have been preserved in their original height. The floor was also plastered and the narrow door does not go down more than half-way to the floor. The room could thus be filled with water or other fluid to a certain depth. In the SW corner was a slight recess, where a clay receptacle was sunk to its rim in the floor. On the west, the wall broadens out as a platform of stones and clay with a step on south and west and in this are sunk, one below the other, two large basins, the upper of which drains through a wide vent to the lower. On the east is a lower platform of stones.

c. The contents

Nothing was found in Room XVI or within the basins.

d. Date

House I, on the basis of its pottery, should be dated to the LMIB period.

### Summary

Location. On the north sector of the house, just inside the north facade. Access through a corridor and an ante-room. Possibility of direct lighting, by means of a window on the north facade.



Architectural form and construction. Independent room, with sunk plastered floor, a kind of a shallow tank. Three basins sunk into a platform or into the floor, of which the larger drains through a wide vent into the second. The third basin is independent.

The contents. The area was found empty.

Date. LMIB.

### Discussion

The installation of House I has some common features with that of House A, already described: a shallow plastered tank and three basins, of which the one stands independent, while of the other two, the larger drains through a vent into the smaller. The installation was probably used for wine-making. Once again, the tank would be used for gathering the waste juice, while the independent basin probably contained the grapes. It seems that in this case the distribution was done by means of a window on the north facade and not through the main entrance of the house.

### 3. Wine-press in Room IV of House E<sup>243</sup>

A third installation, similar to the described ones, is mentioned by Hogarth on the occasion of the description regarding the wine-press in House A, and it has been located in the entrance-room (IV) of House E. This installation is also mentioned in the description of House E which follows,<sup>244</sup> without details.

#### a. Location (fig. 23).

The installation lies in Room E IV of House E.<sup>245</sup>

Despite the fact that Hogarth considered that there was probably a door on the south wall of the room, the existence of this door was not confirmed by the recent excavations; a door in this place seems to be unlikely, since another building,<sup>246</sup> and not an area open to the sky extends to the south of this particular room. If there actually was no door in this place, Room IV would be accessible only from the upper floor by means of the small staircase in Area II.<sup>247</sup> The lighting of this room remains unknown. If there was no wall between Areas IV and V, the room would probably be lit by a window located on the west facade of the house (but traces of such a window have not been found).

b. Architectural form and construction

Room E IV is a small, rectangular room, with a direct access to Staircase E II. West of it lies Room E V, which was paved with concrete. These two rooms were separated by a conjectural partition-wall, from south to north, traces of which have not been preserved.

In the north part of the room was a group of four basins resembling those of House A. No other information for the shape of this installation has been given.

c. The contents

The only finds which have been mentioned by Hogarth are two bronze lids found on the floor.

d. Date

Rooms E IV-V constitute the southern part of the Oblique Building<sup>248</sup> which is dated to the LMIB period.

Summary

Location. The room in which the installation was

found, lies on the south part of the Oblique Building. Difficult access, from upstairs only. The lighting remains problematic, if a party wall actually existed between Rooms IV and V. If there was no such wall, the room would probably be lit by means of a window on the west facade of the house.

Architectural form and construction. Not especially spacious, rectangular room. The installation consisted of four basins, resembling those of House A.

The Contents. Two bronze lids.

Date. LMIB.

#### Discussion

Despite the fact that a detailed description of this particular installation has not been given, it has been mentioned that its form resembled that of House A. However, the location and the lighting of Room E IV make it unsuitable for such a function. Nevertheless, there must be taken into consideration the information given by the excavator that this particular installation was similar to the installations in Houses A and I, interpreted as wine-presses. Consequently, this also can be considered as a possible wine-press.

#### 4. Wine-press in Room M<sup>249</sup> of House B on the SW Hill<sup>250</sup>

Room M lies on the western part of large House B, on the SW hill. In this room, one of the three known wine-presses of the SW quarter of the town was found. The installation was found in 1961, but the room was completely excavated in 1962, when the whole system of the wine-press was investigated.



a. Location (fig. 27).

Room M was just beside the main west entrance of the house. It was easily accessible from the main entrance, through an ante-room (Room N). It was probably lit by means of a window on the west facade of the house, traces of which have not been found.

b. Architectural form and construction (pls. 61-62)

Room M is spacious enough, almost square, and paved. The installation of the wine-press is defined by means of a low built enclosure in the NE part of the room. A large spouted tub (fig. 101, pl. 61) stood in this enclosure, and in front of it was a rectangular, deep, built recess where a receptacle for the juice was probably originally located. This receptacle was not found in situ. The spout of the press-bed was turned over the built area. A piece of a clay drain pipe probably used for cleaning the paved area with water was also found in the same fill.

The spout of the tub is of a section of inverted  $\Pi$ ; the pot had two handles starting immediately above the spout, in a slightly oblique position to the walls of the vessel. The walls slope slightly outwards and the rim is convex on its top (fig. 101).

c. The remaining contents

The objects found in Room M were only a few and common: a one-handled cup, a spouted bowl, a small cooking pot, and two pyramidal loomweights.

d. Date

House B is dated to the LMIB period.<sup>251</sup>

## Summary

Location. Just behind the west facade of the house. It was easily accessible from the main west entrance. Possibility of direct lighting by means of a window on the west facade.

Architectural form and construction. The installation lies in an almost square, well paved area. On the northern part on a low built enclosure, stood the spouted tub with a kind of a built tank in front of it.

The remaining contents. Only a few common vases and two loomweighes.

Date. LMIB.

## Discussion

The installation in Room M of House B is a typical wine-press. It lies in an independent room easily accessible from outside which would have made the supplying of grapes and the transportation of the production in areas lying outside of the house easier. There was a possibility of direct lighting by a window on the west facade, traces of which have not been found. The pressing was done with the tub and the liquid drained into a receptacle which was probably placed within the rectangular structure. The overflowing juice would collect in this built tank, or on the paved floor of the room which could easily be cleaned and drained by means of the clay drainage pipe found in the fill.

5. Wine-press in Room  $\Lambda''$  of the  
NE House of the SW Hill<sup>252</sup> (pl. 63)

A second, similar wine-press installation was excavated by N. Platon in 1963, in the same quarter. The installation belonged to a building of which the NE part had been swept away, down the slope.

a. Location (fig. 13)

The wine-press lay on the western part of the building just behind the west facade in oblong Chamber  $\Lambda''$ . The adjoining Areas  $\Lambda'$  and  $\Lambda'''$  seem to have been used as store-rooms. Since the larger part of the building has been ruined it is difficult to suppose how the wine-press area was made accessible. Nevertheless, it is likely that the room was directly lit by means of a window on the west facade, traces of which have not been found.

b. Architectural form and construction

The room was divided into three oblong chambers by means of narrow party walls. The wine-press was installed in the middle chamber. The floor of the room was paved with a mixture of clay and stucco. A retaining wall closed Areas  $\Lambda''$  and  $\Lambda'''$  to the east. The installation consists of (pl. 63).

1) A wide spouted tub (Clay cat. no. 2; fig. 102) with two, almost vertical handles over the spout. A thicker, also vertical, handle lies on the other side of the vase, almost at the opposite point of the spout. The rim slopes slightly outwards and is of an almost circular section. Below it is a horizontal decorative rope-like band.

2) A pithos which was used as receptacle for the



juice; it was placed in front of the spouted tub with its rim level with the spout. The vessel had rope-like horizontal decorative bands in pairs, and a small vent in the lower part for the decanting of its contents.

On the partition wall between Areas A' and A'' there was an opening with a slab laid on it; this structure was probably used as a seat for resting workmen.

c. The remaining contents

In Room A'' and in the surrounding area were found the following:

- 1) Clay drain pipes of inverted II section.
- 2) Several loomweights and stone spindle whorls.
- 3) A stone trough.

d. Date

The pottery coming from the building where the installation was found has not yet been studied. Nevertheless, the building probably belongs to the LMIB period, as the other houses of the same quarter.

### Summary

Location. Just behind the west facade of the building. It is not possible to define the access to this particular room, because the larger part of the building has been completely ruined. Possibility of direct lighting by means of a window on the west facade of the building.

Architectural form and construction. On the west part of an oblong chamber. It consists of a spouted tub used as a press-bed and a clay receptacle. Possibly a seat for workmen.

The contents. Pieces of clay drain pipes, clay loomweights, stone spindle whorls, stone trough.

Date. LMIB(?)

### Discussion

The installation of Room A'' of the NE building on the SW hill seems once more to be a wine-press: the tub used for pressing drains into a tall pithos which had a small vent on the bottom part for decanting the liquid into storage vessels. The slab on the opening of the party wall could actually be used as a seat for workmen to rest. The clay drain pipes which were found in the same area could be used in decanting the juice or in cleaning the floor of the room, by using water. The remaining contents (loomweights and spindle whorls, stone trough) do not seem to have any connection with the installation described.<sup>253</sup>

In this case, as it has already been mentioned, the location of the room into the house can not be precisely defined. Nevertheless, its location just behind the west facade of the building is probably due to reasons connected with the easy supplying of grapes, and good lighting.

#### 6. Wine-press in Room A of House A on the SW Hill<sup>254</sup>

A sixth wine-press installation, different in form from the others, was excavated by N. Platon in 1962. It was found in Room A of House A, which also lies in the SW quarter of the Zakros town.

##### a. Location (fig. 28)

Room A, in which the installation under discussion

was located, lies just inside of the NE facade of the house. It is easily accessible through a corridor open to the sky (Corridor O), and was probably directly lit by means of a window on the NE facade (traces of which have not been found).

b. Architectural form and construction

Room A is almost rectangular and especially spacious. In its centre there is a rather irregular square stone, probably used as a base for the central supporting beam of the roof. A narrow door, approached by three steps, on the NW corner of the room, led to the adjoining rooms (Rooms I, O).

Approximately in the middle of the NE side of the room lies a built installation (pl. 62) consisting of a rectangular plastered area and another area enclosed by a wall on which, in a lower level, a huge receptacle had been placed. The higher, plastered area had at one end a vent which consisted of two vertically placed slabs, from where the liquid would drain into the receptacle.

This latter (Clay cat. no. 3; fig. 103) was a large, barrel-shaped pithos with an irregular, almost elliptical mouth and also an elliptical bottom. It had four horizontal handles just below the rim. In both of the ends of the ellipses, below the rim, vertical and slightly curved grooves start, which end just over the base of the vessel.

Close to this vessel one more large auxiliary pot was found.

c. The remaining contents

Room A as a whole seems to have been used for various



working activities;<sup>255</sup> stone troughs, rubbers and loomweights were found in the fill or on the floor of the room. Especially, in the area of the installation under discussion were found the following:

- 1) Quernstones.
- 2) Four stone weights.
- 3) Several conical cups and one-handled cups.

d. Date

The layer to which the installation belongs is dated to the LMIB period (from the pottery).

### Summary

Location. In a spacious room (A), just inside the NE facade. Easily accessible through a corridor (O) open to the sky. Possibility of direct lighting by means of a window on the NE facade (conjectural).

Architectural form and construction. The installation was in a room where other working activities also took place, in the NE part. Built, rectangular, plastered area, equipped with a spout constructed of two vertical slabs, which drained into a barrel-shaped receptacle, placed in a lower level. Beside it, an auxiliary pot.

The remaining contents. Quernstones, stone weights, numerous medium-sized clay vessels.

Date. Probably LMIB.

### Discussion

The installation of Room A in House A is different in form from the two others found in the same quarter. In this case, there is no clay spouted tub used as press-bed;

instead, a built rectangular area was used for pressing. Nevertheless, one could not exclude the possibility that originally there was a transportable clay vessel which was taken away before the final destruction.<sup>256</sup> Then, the plastered rectangular area would probably be used as a shallow tank for gathering the spilled or overflowing juice, as in the cases of the wine-presses in Houses A and I of the N-NW hill. The receptacle was in a lower level and should be pulled out every time it became full. The grooves observed on its walls were probably used for better grasping of the vessel by ropes, which would be used for pulling out this huge receptacle. In this case also, the auxiliary pot would probably be used for the grapes before pressing.

The location of the installation is very suitable for its function. It was easily accessible, with the possibility of direct lighting.

#### General Discussion of the Wine-presses in Zakros

Without any doubt, the six installations of the Zakros town described above were used as wine-presses. In five cases, the receptacles for the juice were found in situ. In the sixth case, a built area in which the receptacle would probably be located was discovered. The receptacle was probably taken away before the final destruction of the building.

In five cases also, a clay spouted tub of a known Minoan type was used for pressing: almost cylindrical, wide,

with a wide vent on the lower part of its walls. In the sixth case, either the press-bed was a built rectangular area, or the clay tub was taken away before or after the destruction of the building. In one case this tub was permanently installed, sunk in a built stone platform.

In two cases, the whole installation was connected with shallow plastered tanks, which would probably be used for gathering the spilled juice. In four cases, auxiliary pots found in a close association with the tubs were probably used for containing the grapes destined for pressing. In two of the installations clay drain pipes were found in the same areas; these drains were probably used for decanting juice or for cleaning the area with water.

With the exception of the installation of Room IV in House E, for which the information is lacking, all the other installations have a permanent character: plastered tanks, built enclosures, receptacles and tubs sunk into stone platforms or into the ground, etc. Consequently, it is obvious that they had been used for one function only, probably wine-making.

About the location of these installations one can note the following: in three cases the installations lay in rooms which were easily accessible from outside (Room IV of House A on the NW hill, Room M of House B, Room A of House A on the SW hill). In two other cases these rooms were just behind the facades of the buildings (Room XVI of House I and Room A'' of the NE house on the SW hill).

This observation leads to the conclusion that the installations under discussion needed a direct communication



with the outdoor area, probably for a quick and easy supplying of materials, and also for a quick transportation of the production to areas which were outside the building. This location probably also explained their better and direct lighting.

The distribution of the wine-presses in different quarters of the town is another important point. The three wine-presses of the north-northwest hill were found in houses which lay far from each other (House A, House I, Oblique Building), and it is probable that they covered the needs of different quarters. On the other hand, three installations were found in the same quarter, in houses which lay at a short distance from each other (House A, NE house, House B on the SW hill). One can argue that one of the principal occupations of the residents in this quarter was wine production for wider social groups (or for the palace itself?).

From the above discussion one may maintain three points.

a. All the installations seem to have been used for pressing grapes, and were permanent and well equipped. The areas in which the wine-presses were located, should have been easily accessible from outside for the quick transportation of materials and products.

b. The existence of only six installations in a total of thirty houses excavated in Zakros town points to products consumed by wider social groups. This is also proven by the location of the installations, which suggests that the products were destined for wider social consumption.

c. The concentration of some wine-presses, observed in the case of the SW quarter, probably shows a specific occupation of the residents of this particular neighbourhood on wine production. This occupation can either be controlled by the central authority, or independent, on the basis of the land properties.

#### Places for Grinding (Category B, Type 'c')

Numerous places in the Zakros palace and town seem to have been used, temporarily or permanently, for grinding cereals and certain spices. The evidence for identifying such areas is not always satisfactory and in some cases appears to be unequal. For this reason, the following catalogue of the areas in which grinding activities took place does not include evaluations for the identification of permanent or temporary workshops in them.

#### Grinding Places in the Palace

##### 1. Room XLV of the South Wing<sup>257</sup> (fig. 14)

The ground floor room in this area was equipped with a bench along its north wall which was covered by slabs. The western part of this bench was shaped in a lower level and upon it medium-sized vessels had been located.

It is likely that the ground floor room has been used for grinding, since some large saddlequerns and rubbers were found in situ near its NE corner.<sup>258</sup> On the SW corner, the lower part of a pithos was also found in situ.

A number of stone vases and numerous clay vessels

which had fallen in the fill of the basement have been considered part of the contents of the ground floor room.<sup>259</sup> This does not seem very probable, since this room was clearly used for completely different activities. Probably these objects or a part of these belonged to the contents of the upper floor room. The pithos in the SE corner could be used for storing the material which was destined to be ground. Date, LMIB period.

## 2. Room XLVa of the South Wing<sup>260</sup> (fig. 14)

Despite the fact that this room yielded a number of bronze and clay objects which suggested a completely different activity,<sup>261</sup> the discovery of a mortar on the SE corner indicates that a grinding process took place on the ground floor room, for a short while at least. None of the other finds can be related to this particular activity. Date, LMIB period.

### Grinding Places in the Town

#### SW Quarter

## 1. Room A in House A<sup>262</sup> (fig. 13)

Spacious Room A of House A with the installation of the wine-press<sup>263</sup> seems to have been used for various household activities, among which was grinding. In the SE corner, in the lower level of the fill, an irregular stone trough (Tr. cat. no. 5) was found, and another smaller and shallower one was in the same area (Tr. cat. no. 6). Just to the west of the wine-press, two quernstones were found (Q. cat. nos. 6, 7), while a third quern was near the NW wall of the room



(Q. cat. no. 3). Four stone weights and some clay loomweights of the disk-like convex and cubic types point to another household activity, which took place in the same room. Clearly, spacious Room A was used for different household activities. Date, LMIB period.

2. Room Y, House B<sup>264</sup> (fig. 13)

Room Y of House B lies on the SW part of the house without any access from the adjoining room. It was obviously accessible only from upstairs, probably by means of a ladder. This room yielded two stone troughs one of which was almost rectangular in form (Tr. cat. nos. 14, 15). However, no other find coming from the same context can be associated with grinding activity. Date, LMIB period.

3. Area Π, between Houses A and Δ<sup>265</sup> (fig. 13)

Between Houses A and Δ, there was an area open to the sky (Π), probably used as a kind of court and as kitchen. This latter was confirmed by the discovery of a fireplace near the NW wall and of a layer containing ashes, which covered the whole area. A small square-like trough with a semi-globular cavity, querns (Q. cat. nos. 4, 5), and rubbers indicate that work like grinding took place in this area. The same area yielded loomweights, conical cups, pieces of coarse ware, and an elegant, decorated jug. Date, LMIB period.

4. Room Y, House Δ<sup>266</sup> (fig. 28)

Room Y is the most spacious room of House Δ, easily

accessible from the main entrance through a narrow corridor. Along its west wall was a bench constructed of three porous blocks. Two stone troughs (Tr. cat. nos. 7, 8), a mortar (Tr. cat. no. 9), quernstones and rubbers, indicate that in this room also some grinding activities had taken place. The same room yielded some ordinary clay vessels. Date, LMIB period.

5. Room B of House E<sup>267</sup> (fig. 13)

Room B, spacious and almost rectangular, is the main ground floor room of the house. The installations related to the working activities belong to an earlier period, which in this case probably was the LMIB.

Two low curved walls enclosed two different spaces. A small enclosure is formed in the corner of the room. A stone mortar surrounded by stones was just outside this enclosure. At the joining point of the two curved party walls another trough was situated. In the NE enclosed area numerous ordinary vessels had been stored.

The room certainly was a storeroom; nevertheless, it is likely that it had also been used for grinding. It can be dated to the LMIB period.<sup>268</sup>

N-NW Quarter

1. Room B in the Quarter NW  
to the Palace<sup>269</sup> (fig. 29)

Room B in the quarter NW to the palace is a small rectangular basement, probably accessible only from upstairs by means of a ladder. This room seems to have been used in

two successive phases of the same period, namely the LMIA period,<sup>270</sup> as it has been proven by the study of the stratigraphy and the discovery of two different floors.

Along the SE wall, in the lower level of the fill, a number of stone tools were found: rubbers (Rub. cat. nos. 21, 22) and quernstones (Q. cat. no. 57), a stone weight, an irregular perforated stone and a stone with a segment cut out by a drill. The same layer yielded several fragments of ordinary clay pots and some loomweights. The space of Room B is not suitable for working. Perhaps, this area was used as a small storeroom of a working area which could be located on the ground floor. Date, LMIA period.

## 2. Room Γ in the Quarter NW to the Palace<sup>271</sup> (fig. 29)

Room Γ of the same quarter was accessible through a small ante-room (Room Δ), which communicated with large Room A. The basement of Room Γ was accessible by means of a wooden staircase, located at the adjoining narrow space (Area H).

A large collection of quernstones (ten at least) mainly of elliptical or rectangular forms, was found on the south corner of the room (Q. cat. no. 20). Numerous pebbles found in the same area were probably used as rubbers (Rub. cat. no. 52). The area also yielded a great number of clay vessels of various forms while near the SE wall a large bucket-like pot was found in situ. A fragment of a shallow stone bowl and a myrtle-shaped bone tool (B.T. cat. no. 19) come from the same fill.

This room is also unsuitable for grinding activities



because it was in the basement and full of storage vessels. Nevertheless, it is likely that it had been used as a storeroom of a working area probably located in the room upstairs. Date, LMIA period.

### 3. Room E VI of the Oblique Building<sup>272</sup> (fig. 30)

This small rectangular basement seems to belong to the first neopalatial period (which was the LMIA period in Zakros). It was only accessible from upstairs, probably by means of a small ladder.

Two pieces of elliptical quernstones, another complete of a circular form, and an oblong one, were found in the fill (Q. cat. nos. 24, 25, 26, 27). This room yielded also a small tripod cooking pot.

The space available in this basement room is unsuitable for grinding activities. Probably, it was simply used as a small storeroom of a working area, which can be conjecturally located in the room upstairs. Date, LMIA period.

### 4. Room B of the Building of the Pottery Deposits<sup>273</sup> (fig. 31)

Room B of the Building of the Pottery Deposits was spacious (dim. 4,50 x 4,50 m.), almost square in form, and easily accessible through two entrances on its SE and NE ends.

On the west corner of the room an enclosure was formed by a curved low wall. There was probably one more enclosure near the west wall of the room. Among the finds of this room were four rubbers (Rub. cat. nos. 63, 72, 74, 75), two of which were of a conical form, and a large flat quernstone

(Q. cat. no. 28). The same room yielded numerous clay vessels, fragments of stone vessels, a piece of a natural stalactite, a small piece of pumice, and other small objects, not connected with workshop activities.

In Room B some grinding activities probably took place beside other household activities. Date, LMIB period.

5. Room A of the Building of  
the Pottery Deposits<sup>274</sup> (fig. 31)

Room A, in the same building, was a basement of an irregular, trapezoidal form. It was accessible from a passage to the west of Room B, through a wooden staircase, conjecturally located in Area M, just to the north of the room under discussion.

In Room A two quernstones, one more curved than the other (Q. cat. nos. 32, 33) were found, while a third quern found in the fill of the short staircase to the east (Area I) probably comes from the same area (Q. cat. no. 31). A stone with a segment cut out by a drill (St.w.Seg. cat. no. 11) was also found in the fill of the room, as well as a peculiar convex-flat stone tool with a pointed end and a vertical groove on the flat surface. Also among the finds were two pieces of clay drain pipes.

Two more stones with a segment cut out by a drill were found in the fill of the adjoining areas (St.w.Seg. cat. nos. 12, 13). The remaining contents include a number of clay vessels (complete or fragmentary), some fragments of stone vases, two loomweights, obsidian flakes, a worked animal bone, pieces of bronze small punches or pins, sea shells and pieces of pumice.

Room A seems to have been actually used for some grinding activities. Moreover, the three stones with the segments cut out by drills found in the same area suggest that some stone-working of a limited scale took place also in this room. Date, LMIB period.

6. Room  $\Phi$ , Building H<sup>275</sup> (fig. 32)

Basement Room  $\Phi$  of Building H was accessible through an ante-room (Room Y) and a descending stone staircase, which started just outside the largest ground floor room (Room O).

On the south corner of the room was in situ a large deep trough (or mortar) from a whitish stone (Tr. cat. no. 27). Two quernstones (Q. cat. nos. 34) and numerous rubbers (Rub. cat. nos. 90, 91) were found in the same area. The same fill yielded some ordinary clay vessels, two loomweights, a piece of a stone object, and two bone tools (Bone cat. nos. 29, 31).

Room  $\Phi$  seems to have been used (permanently or occasionally) for grinding activities. Date, LMIB period.

7. Room under Room X of the Strong Building<sup>276</sup> (fig. 33)

Below the last floor of Room X of the Strong Building was an older room; along the south wall of this room was a bench with a tall, square mortar situated on its one end. Among the finds coming from this older layer were pieces of common pots, loomweights, a piece and a blade of obsidian and a cylindrical rubber.

During this older period, the room should have been used for grinding, as it has been confirmed by the discovery



of the mortar which was directly connected with the built bench.<sup>277</sup>

8. Room Γγ of the Strong Building<sup>278</sup> (fig. 33)

Room Γγ of the Strong Building had no entrance. It was probably approached from upstairs by means of a small ladder. This room had been added to the original south facade of the building and it was constructed over a part of the south paved road.

In the south corner of the room was a semi-circular enclosure with which was placed a rectangular trough from poros with a shallow cavity (Tr. cat. no. 29). Along the NW wall there was a kind of bench. Two saddlequerns were also found near the NW side of the room (Q. cat. nos. 36, 37), as well as a bar-like convex-flat whetstone close to the SE wall (Oth.St.T. cat. no. 2). The area near the west corner of the room also yielded a great number of conical cups and other ordinary clay vessels, four loomweights of various types and a small obsidian flake.

It seems very probable that a grinding activity took place in Room Γγ. Date, LMIA period.

9. Room A of the Building to the North of the Harbour Road<sup>279</sup> (fig. 34)

Room A of the Building to the north of the Harbour Road was directly accessible from the west paved passage by means of three descending steps. On the NE end of the room was a low enclosure, in which a large trough from poros stone was found in situ (Tr. cat. no. 21). A piece of a cylindrical rubber from a nice stone (Rub. cat. no. 71)

comes from the same fill. The same area yielded the lower part of a clay vessel, a clay lamp and two other common clay pots. Date, MMIII period (?).<sup>280</sup>

10. Room Aa of the Building to the North of the Harbour Road<sup>281</sup> (fig. 34)

Small Room Aa had no entrance and the way of access to it remains unclear.

Below a layer containing a great amount of fragmentary pottery, a small irregular trough from a soft whitish stone was found (Tr. cat. no. 22). Along the south wall of the room was a low ledge, probably used for placing vessels. The fill yielded a cudgel-shaped rubber (Rub. cat. no. 76), and a piece of a rectangular, slightly curved quernstone (Q. cat. no. 29). A piece of a stone object, a loomweight and a small clay vessel come from the same layer. Among the stones of a retaining wall which had been built later over the room, a stone with a segment cut out by a drill was found (St.w.Seg. cat. no. 19).

Room Aa is unsuitable for a grinding activity. It is likely that it was used as a small storeroom for a working area located in one of the adjoining rooms, or in the room upstairs. Date, LMIA period.<sup>282</sup>

11. Eastern Part of the East Building<sup>283</sup> (fig. 20)

Just behind the east facade of the East Building a great number (over thirty) of rubbers in various shapes and sizes were found (Rub. cat. no. 141). All the rubbers were near the east facade, but scattered. The same area yielded two stone tools of an ovoid shape. A bone punch,

numerous loomweights and clay vessels of various types come from the same fill.

Unfortunately this place was completely ruined by agricultural activities. Consequently, it is very difficult to reconstruct the architectural form of this particular area. Nevertheless, it is obvious that a well organized grinding workshop can be identified in this place. Moreover, the presence of numerous loomweights points to one more working activity which took place in the same area. Date, LMIB period.

12. Room over Area H of the  
House of the Polythyron<sup>284</sup> (fig. 25)

Area H of the House of the Polythyron is actually the sotto-scala's area of a double staircase (E-Z-H), which connected large ground floor Room B with the upper floor apartments.

In the fill of Area H, the pieces of two flat quernstones (Q. cat. nos. 63, 64), and a piece of a third elliptical (Q. cat. no. 76), were found. The same fill yielded the pieces of a stone object, a loomweight, a piece of a pithos' base, other fragments of pottery, and a number of animal bones. It seems likely that some grinding process took place in a room located over the staircase area, just to the south or east of it. One more quernstone was found in the fill of Room I<sup>285</sup> (Q. cat. no. 72) and probably comes from the same area. Date, LMIB period.

13. Room Θ of the House of  
the Polythyron<sup>286</sup> (fig. 25)



Room  $\Theta$  was accessible from a large ante-room (Room B) by means of a doorway on the NE end of the latter.

Three quernstones of various shapes (Q. cat. nos. 66, 67, 68) were found in the fill or on the floor of the room. A pyramidal rubber (Rub. cat. no. 175) was found in the same fill, while two more spherical rubbers come from the lower level of the fill, just over the floor (Rub. cat. nos. 186, 187).

The remaining finds of the area include clay vessels, loomweights, pieces of stucco, animal bones and pieces of pumice. Date, LMIB period (?).<sup>287</sup>

#### 14. Room $\Omega$ of the House of the Ramp<sup>288</sup> (fig. 25)

Room  $\Omega$  was used as an ante-room, giving access to staircase  $\Omega_a$ , which connected the ground with the upper floor apartments. It was easily accessible from the entrance hall ( $\Phi$ ), through a narrow door on the SE end of the latter. In the fill of the NE corner of the room two bone punches (Bone cat. nos. 11, 12), a small piece of unworked steatite, and fifteen rubbers from sea pebbles (Rub. cat. no. 218) were found. Numerous clay pots and fragmentary pottery came from the same fill or from the floor level of the room. The same area yielded six loomweights, a stone with a segment cut out by a drill and a disk-shaped stone lid.

Despite the fact that the finds of the NE corner of the room, in combination with the stone preserving drill traces, suggest a working area, the great amount of pottery found is negative evidence for such an identification. Probably a working area could be located in the upper floor

room. Date, LMIB period.

15. Room  $\Psi$  of the House of the Ramp<sup>289</sup> (fig. 25)

Room  $\Psi$ , in the same house, was located just to the north of the entrance hall (Room A $\gamma$ ), and had no entrance. It was probably approached from upstairs.

On the pebble and plaster floor of the room, six rubbers of various shapes were found together with stucco fragments, a piece of a stone lamp, and murex shells. Several ordinary pots come from the same area.

In Room  $\Psi$ , some grinding activities probably took place, occasionally. Date, LMIB period.

16. Room XIVb of House B on the NW Hill<sup>290</sup> (fig. 26)

Basement Room XIVb communicated only with another basement room (Room XIV) lying to the south. Both of these were probably accessible from upstairs only.

In the fill of the room at least six elliptical quernstones (Q. cat. nos. 57, 58, 61), a depressed spherical rubber (Rub. cat. no. 176) and pieces of pumice were found. The same fill yielded a great amount of pottery, small bone and bronze tools and animal bones. On the floor of the room in situ at its SE corner, was a large rectangular trough made of poros stone (Tr. cat. no. 38).

The space of the room is completely unsuitable for any working activities. Consequently, it seems more likely that the room was used as a small storeroom for another adjoining area in which grinding activities probably took place. Date, LMIA period.<sup>291</sup>

17. Room XVII of House B on the NW Hill<sup>292</sup> (fig. 26)

Spacious, almost square, Room XVII lies on the SE part of House B and was accessible by means of few descending steps from the paved road which passes through this quarter of the town. The floor of the room was made of trodden earth and there was probably direct lighting through a window on its west wall.

A stone staircase located to the north side of the room facilitated communication between the ground and the upper floor apartments.

In the NW corner of the room, just outside of an opening giving to the sotto-scala area, a tall cylindrical mortar was found in situ. Three elliptical quernstones (Q. cat. nos. 80, 81, 83) also come from the northern part of the room. Six rubbers of various shapes (Rub. cat. nos. 202, 203, 204, 205, 209, 210), and a piece of a small porous trough (Tr. cat. no. 41) were also found scattered throughout the whole area of the room. Among the other finds of this room were a great amount of ordinary pottery, loom-weights, a small bronze knife (Kn. cat. no. 3), a bronze pin (or punch), animal bones and sea shells.

Room XVII seems to have been used for various working activities of a small scale. Date, LMIA (?).<sup>293</sup>

18. Room A of House Δ on the NW Hill<sup>294</sup> (fig. 26)

Room A lies on the NW corner of House Δ. It is almost rectangular, though its west wall deviates a little to the SW. The way of access to it remains unclear, since it had no obvious entrance.



In the fill of the room, a small rectangular quernstone was found (Q. cat. no. 85). In the same area, a small mortar from a whitish stone (Tr. cat. no. 43), and twelve rubbers of various shapes (Rub. cat. nos. 222-232) were also found. The room also yielded a great amount of pottery, loomweights, animal bones and obsidian blades.

It is likely that in Room A, small scale grinding took place. The date of its first phase (in which the above described equipment seems to belong) was probably the LMIA period.<sup>295</sup>

19. Room Z of House Δ on the NW Hill<sup>296</sup> (fig. 26)

Room Z is an oblong room, lying in the SW part of House Δ. It was originally accessible from the large entrance room of the house (Room H), through a narrow door located to its NE side. The room should be directly lit by means of a window on the south facade of the house.

In the fill of Room Z, four quernstones (Q. cat. nos. 89, 90, 91, 92) and seven rubbers of various shapes (Rub. cat. nos. 241-247) were found. The remaining contents include an amount of pottery, a loomweight and two clay weights.

The room was probably used for grinding activities of a limited scale. Date, LMIB period.<sup>297</sup>

20. SW Room on the Upper Terrace  
of House A on the NW Hill<sup>298</sup> (fig. 26)

The SW room on the Upper Terrace of House A was accessible from the area to the north of it by means of a narrow door on its north wall. The whole building is ruined by agricultural activities and it is difficult to define the

precise way of access to it, from the main entrance of the house. The room is divided into two parts by a party wall from west to east.

In the lower level of the fill in the northern apartment, two saddlequerns (Q. cat. nos. 102, 103) and two ovoid rubbers (Rub. cat. nos. 269, 270) were found. The same fill yielded the fragments of two carinated cups, pieces of conical cups and one-handled cups, as well as animal bones. Date, probably MMIB period (?).<sup>299</sup>

21. SW Room of the NW Building  
on the NW Hill<sup>300</sup> (fig. 26)

The almost rectangular room was originally approached only from the south, by means of a very narrow door in which a sloping ascent ended.

In the lower level of the fill two quernstones (Q. cat. nos. 112, 113) were found, while one more had fallen by the doorway (Q. cat. no. 114). In the same fill, four rubbers of various shapes (Rub. cat. nos. 314-317) were also found. Several ordinary clay vessels come from the same layer. Date, MMIII B-LMIA.<sup>301</sup>

General Discussion of the  
Grinding Places in Zakros

From the above brief description of the areas in which grinding activities probably took place, one should note the following.

a. Almost all the houses of the town provided more or less evidence for grinding activities. However, in no case does the relevant installation seem to have been intended

for production larger than that which characterized a domestic economy.<sup>302</sup>

b. The areas which provided evidence for grinding activities can be classified under three categories:

1) Spacious ground floor rooms, where various household activities probably took place.

2) Small, easily accessible rooms which were almost exclusively used for such activities.

3) Small basements, usually accessible from upstairs by means of ladders. It is likely that these basements were used as small storerooms for working areas, which were probably located in the ground floor rooms.

c. Only a few places in the palace provided evidence for such activities. It is obvious that the palace magazines were filled with products coming from the town.



## CHAPTER IV

### MINOAN AND AEGEAN WORKSHOPS

#### A. Stone Workshops (Category A, Type 'a')<sup>1</sup>

##### Introduction

Different types of stone workshop can be defined on the basis of their production. So, in the Aegean area during the Bronze Age, specialized workshops have been identified for the manufacture of:

- a. stone vases and other objects,
- b. small artifacts and stone jewels,
- c. sealstones,
- d. stone tools of obsidian, flint and other types of stone,
- e. building material.

##### a. Stone Vase Workshops

###### Crete

Only six Cretan stone vase workshops have been identified in Minoan Crete. Of these, four were identified at Knossos and two at Mallia.

##### 1. The 'Sculptor's Workshop' at Knossos<sup>2</sup> (fig. 146)

In the East Wing of the palace, a room adjoining the 'Loggia' with the Bull-leapers frescoes, was identified by Evans as a lapidary's workshop which produced luxurious stone vases for the palace. The evidence presented by Evans includes only two unfinished vases of the same type (three-

handled amphorae).<sup>3</sup> Both of them were of gypsum,<sup>4</sup> creamy, brown-white with darker brown bands. The larger was in a more advanced stage of manufacture and bears relief decoration consisting of shallow linked spirals. The lower part of the amphora remained unfinished (its moulding was not fully completed). In addition, Evans noticed the absence of any trace of bronze oxidization from the rivets which would probably have been used in the perforations of the handles in order to connect two inlaid decorative plates. He believed that this kind of decoration was never completed and the vase remained unfinished.

The evidence provided by the smaller vase of the same type, which was found on the floor beside the larger one, is more suggestive. The vase is simple, without any decorative detail and with its form simply roughed out. It should also be noted that, once more, the perforation of the handles had not been started.

Despite the fact that the two unfinished amphorae prove the existence of a stone vase workshop in this particular room, the general picture of its function remains unclear. There is no other evidence connected with the organization of the area; apart from the two unfinished amphorae, Evans does not mention anything else about the contents of this room. Tools, raw and waste materials were not found. Nevertheless, Evans noticed that there was an architectural connection between the workshop and the basement room which was used as a lapidary's store for 'Spartan basalt'. In this storeroom, unworked and half-worked material was found, but the type of stone is quite different from that used in

the workshop.

As regards the process of manufacture, the evidence provided by the two amphorae is not as helpful as it might have been because both of them were in an advanced stage. Nevertheless, one may note the following points.

a. The final moulding and the smoothing of the exterior surface of the vase is completed after completion of work in the interior. Perforation of the handles and final work on the rim belong to the last stage of manufacture.

b. Engraved and relief work on the exterior of the vase is usually done before the final polishing.

c. Work connected with inlaid decoration and attachment of bronze joints also belong to the final stage of processing and was probably done after the smoothing and polishing of the exterior of the vase.

The 'Sculptor's Workshop' is dated to the LMII-III A<sub>1</sub> period.

la. Lapidary's Store of 'Spartan Basalt'  
(Lapis lacedaemonius) at Knossos<sup>5</sup> (fig. 146)

Directly under the 'Sculptor's Workshop' in the basement room to the east of East Corridor of the palace, was a small storeroom where a heap of imported blocks of 'Spartan basalt' was found. Some of these showed parts of the original rough contour. One piece was roughly rounded in section as if it was intended for a column base. Other pieces showed saw-cut faces and one larger block presents a saw-cut to a depth of 15 cm.; this last shows an unfinished work. All the above points suggest a sudden destruction of the room.



The location and the architectural connection between the 'Sculptor's Workshop' and this storeroom suggest direct access from the one area to the other. Evans proposed a ladder, such as the ladder suggested for the 'Stone Lamps Workshop' at the SE corner of the palace. Such a ladder probably existed in the neighbouring, larger, east 'Room of the Stone Pier', from which the room with the Spartan basalt blocks was directly accessible. Despite the fact that the connection between the 'Sculptor's Workshop' and the storeroom with the basalt is indisputable, some points on the use of the latter remain obscure.

a. It is not likely that the area in which the blocks were stored was used for cutting the material with saws, since the area is very narrow and unsuitable for such work. Besides, there is no evidence from tools for such operations in this storeroom.

b. If the sawing was done in the 'Sculptor's Workshop', the transportation of the very heavy blocks on the ladder supposed by Evans, would be problematic. Such work would be easier on the ground floor, probably in the more spacious 'Room of the Stone Pier'.

c. Subsequent work on the material in the 'Sculptor's Workshop' is just a possibility. If the Spartan basalt was intended for the manufacture of vases, then their processing would probably have been done in the 'Sculptor's Workshop'. Evans considered that the material would rather have been used for dressing the lower parts of walls, or for the manufacture of column bases.<sup>6</sup> Such work is not necessarily connected with the manufacture of the stone vases, which

took place in the 'Sculptor's Workshop'. Nevertheless, the possibility that another craftsman worked on building materials in the same area or a neighbouring one should not be excluded.

The date of the Spartan basalt storeroom is LMIIIA<sub>1</sub> (as the 'Sculptor's Workshop'), though Evans suggested that at least part of the material might probably go back to the MMIIIb period.

## 2. The 'Gypsum Vase Workshop'<sup>7</sup> at Knossos (fig. 147)

Evidence for another stone vase workshop was identified in the palace of Knossos. This identification was based on the detailed study of material coming from Cists 2-6 of Magazine XIII in the West Wing of the palace. This material was preserved in the Stratigraphical Museum at Knossos and was published for the first time in BSA 62 (1967) by Warren.<sup>8</sup>

The workshop was hypothetically located by Warren over Magazine XIII of the palace.<sup>9</sup> Evans considered that the area over the magazine was a Sanctuary Hall, but the discovery of many tablets in the fill suggests that the upper floor did not consist of religious apartments, or at least not religious apartments alone. If the workshop was actually located there it would be well lit, since a window could probably exist on the west facade of the palace. On the other hand, Evely, who studied again the material coming from the workshop giving emphasis to the technological aspects and the methods of manufacture, believes that the workshop should not be located over Magazine XIII but somewhere else on the upper floor of the palace.<sup>10</sup> His view



is based on the fact that the material represents only one stage of the whole process of manufacture; moreover, according to him, one is dealing with rejected material which broke during its working. Tools or other unworked material connected with the material under discussion were not found, and the remnants do not include small chips.<sup>11</sup>

The material from which the vases were made was a pale grey gypsum with the exception of some pieces of limestone and one piece of marble. Half of the pieces were intended for small open bowls, which sometimes had separate lids. Two conical spindle whorls and six rough cores showing traces of a chisel were found in connection with the material described above. The rest of the pieces were waste material with cut, chiseled or completely unworked surfaces.

Evely attempts to describe the whole process of manufacture, after a detailed study of the half-worked material. He proposed the following steps for manufacture.

a. Carving of the base, top and rim area to an advanced stage. In this stage, a blade was usually used, and in some cases a chisel as well.

b. Definition of the shape and size of the vase with the help of guide lines. Such guide lines were mainly preserved on the base and rim of the vases and were incised by a cutting compass. Guide lines on the exterior surface of the vases are rare.

c. Further working of the exterior of the vase, cutting of the rim, shaping of the whole profile and the handles. At this stage, a blade was again used in three different ways.



d. Working on the interior of the vase. Here the chisel was principally used, driven by hammer or mallet. The first step was the opening of a square depression in the centre. From there, the work was directed outwards in a regular manner. In this stage of manufacture the risk of fracture was most acute.

e. The final moulding and smoothing of the exterior was done with the help of some abrading and polishing agents.<sup>12</sup> This was done either by rubbing with a cloth or something similar, or in the interior with the help of a revolving bit. At this stage oil could be added to bring out the colour and the veins of the stone.

The tools used for the manufacture were, according to Evely, three: compass, blade and chisel. The absence of traces made by a drill must be noted. The process of manufacture indicates that all the stages which involve cutting of the material, and consequently run a risk of fracture, were completed before the delicate decoration and the final smoothing of the whole surface.

Apart from the pieces already roughly shaped into vases, conical buttons, blocks, cores and plaques were found in the same context. Traces of working appear in many cases; the function of these objects is still problematic. The cores were probably intended for the manufacture of lids.<sup>13</sup>

The workshop, from the pottery found together with the material under discussion, was dated to the LMII-LMIIIA<sub>1</sub> period.

From the above information it becomes clear that a stone workshop for the production of small round vases of

gypsum, functioned on the upper floor of the West Wing of the Knossos palace. The specialization in materials used and shapes produced suggests one or two craftsmen and a limited time for the manufacture of the vases. The material provides some evidence for the process of manufacture, especially for one of its steps, but not for the organization and the significance of the workshop. Tools or other equipment were not found, while its architectural location cannot be described since the material was not in situ.

3. 'Stone Lamps Workshop' in the 'House of the Fallen Blocks' at Knossos<sup>14</sup> (fig. 148)

Just to the SE of the palace stood a house named by Evans, 'The House of the Fallen Blocks' (because of blocks fallen from the south facade of the palace, which had destroyed it). It consisted of one principal room and two small storerooms adjoining. On the floor of the principal room pieces of eight stone lamps were found. One of them, with a bulbous stem, seems to be unfinished, since the mouths to hold the wicks had not yet been cut out. Near this, the top of a huge lamp of serpentine was found, and Evans considered that this object was intended for palatial use.

The room was lit through a wide window in the west wall,<sup>15</sup> and was probably accessible by ladders from the upper floor. The building, according to Evans, was the house of a craftsman specializing in the manufacture of stone lamps. Its final destruction was dated to the MMIII period.

Evidence for the functioning of the workshop is

lacking. Only its architectural location and form is clear. The workshop functioned in a spacious ground floor room of the house, well lit, accessible by ladders from the upper floor, where probably the living quarters were. The store-room beside the workroom make it possible that the building was actually the house of a lamp lapidary. Moreover, the specialized production suggests a single craftsman, probably helped by an assistant. It is likely that manufacture was exclusively intended for the palace and the craftsman was supported from it.

On the other hand, there is no evidence for the process of manufacture and the equipment of the workshop. Tools, raw and waste material were not found. Our only information is that the last step of the process of manufacture, which followed the final polishing and the decorative carving of the lamp, was the cutting of the mouths for its wicks.

#### 4. Workshop to the North of the Royal Road, to the West of the Arsenal, at Knossos<sup>16</sup>

This workshop, whose precise location is not yet identified, created a great number of bore cores and waste material, principally from serpentine. The material has not yet been published and full description or interpretation is impossible. The cores had a slightly conical form with fine horizontal rings made during the drilling. Forty-eight of the cores (from a total of 52), were from serpentine and the remaining four from banded tufa, breccia, and two from gabbro. This ratio corresponds to the percentage of serpentine among the other stones used for the manufacture of



Minoan stone vessels.<sup>17</sup> Four of the cores bore traces of abrasive powder (emery) which was adhered to their surfaces.

From this particular material only a few observations can be made.

a. Tubular drills from bronze or a kind of reed were used for the manufacture.

b. The interior of the base was extracted step by step, with the drilling of small slightly conical cores in succession. Many of them preserved traces of the drill on their sides, created during the drilling of a neighbouring core.

c. The principal material used was serpentine. There is no other evidence for equipment or tools connected with the material under discussion.

d. Emery (or other abrasive powder) did the actual cutting of the cores in the drilling.

#### 5. Workshop to the North of Polythyron III, 7, at Mallia<sup>18</sup> (fig. 149)

Just to the north of the portico of Polythyron III, 7 in the palace of Mallia in the lowest fill level, pieces of stone moulds for casting bronze tools and unworked stone material were found, together with MMI/II pottery. All of this material was found in the filling which was used as a substratum for the portico.

The material found consisted of:

##### a. Raw material

Unworked pieces of various sizes: a great number of pieces of obsidian for the production of blades, small pieces of talcschist for the manufacture of stone moulds.

In addition, two larger blocks were found: the first 'quartzite rose' (rosso antico?), and the second one from obsidian with white spots (the kind coming from Gyali near Nisyros).<sup>19</sup>

b. Unfinished objects.

Half-worked marble plaques.

c. Finished products

One marble lid and a vase of grey-greenish steatite.

d. Moulds of talcschist

For bronze objects, double axes, small artifacts, and flat disks.

The raw materials were found mixed with moulds and finished products. The location of the workshop cannot be identified securely in the area to the north of Polythyron III, 7, since all the above material was used as filling before the construction of the portico.

On the other hand, the only evidence for stone vase manufacture is the existence of the two larger blocks of obsidian and rosso antico. However, as Warren has already noted, the material under discussion is dated to the MMI period, in which there is no evidence for vases made from obsidian.<sup>20</sup>

Despite the fact that a function of the same area as a bronze workshop has been extensively discussed, the evidence presented is only derived from the stone moulds found in the same filling together with the stone material. The possibility that the stone workshop produced the moulds as well, cannot be excluded. It is possible that the traces of burning on the moulds were left by the fire which destroyed

the workshop, though traces of burning were not mentioned in connection with the remaining objects.

H. v. Effenterre believes that there would have been only one stone vase maker since the material found is limited and it would not require a working group. The evidence given does not provide any significant information about the function and the organization of the stone vase workshops. Moreover, the working area cannot be identified, since the material came from an artificial filling.

#### 6. Stone Vase Workshop in Room XVII, 2, Mallia<sup>21</sup> (fig. 149)

Room XVII, 2 is a small dog-leg room located in the SW quarter of the palace. It seems that it had two periods of use, though the excavators could not separate two different floors. The second period of the room was connected with a new architectural arrangement of the whole area, since at that time a staircase coming from the adjacent spacious area XVII, 1 was constructed.

The fill in the room was mixed. It included a great amount of pottery of the MMI period mixed with MMIII-LMIA pottery. A number of stone vases, two of which remained unfinished, suggest that the area was a stone vase workshop. The adjoining room (XVII, 3) was full of vases, bucket jars, pithoi and one balancing weight. The contents of the room suggest rather a shop.

Two unfinished stone vases were found in the workshop, together with finished products.

1) One high-footed fruit stand of steatite.<sup>22</sup> The walls of the vessel are very thick and its bottom remains



roughly worked. The handles are shaped, but not yet perforated.

2) One bridge-spouted bowl of grey-white mottled limestone. The spout is not carved at all, and the handles are shaped but they are not perforated. In the interior the work had just begun with the drilling of a large core 15,7 cm. in diameter.

The date of the workshop is under discussion. H.v. Effenterre considered that it belongs to the protopalatial period because the type of workshop is not different from that of the workshop under Polythyron III, 7. He adds that the forms of the vases were popular during the MMI period. However, he does not exclude the possibility that the workshop was in use for a long time and it had two different periods. On the other hand, Warren, because of the large size of the bridge-spouted bowl, considered that the workshop was destroyed simultaneously with the palace and consequently he dates the destruction to LMIB. The vase type<sup>23</sup> exists from the MM to the LMI period.

Although the evidence given does not provide any additional information about the organization and the function of the workshop, its identification seems secure. O. Pelon, however, considers that the area was a storeroom.<sup>24</sup> It seems, once again, that there would have been only one craftsman, since the narrow area would not be a comfortable place for a working group. However, in this particular point one should be careful since in this area several architectural rearrangements took place.

Once again, the available information regarding

stone vase manufacture, is not sufficient.

a. The materials used in the workshop were principally two: steatite (serpentine?) and the native grey-white mottled limestone.

b. The working and the perforation of handles and spout was done during the last stage of manufacture.

c. One of the tools used was the drill which was revolving with the help of a large vertical cylinder.<sup>25</sup>

There is no additional evidence for the organization and equipment of the workshop, since its architectural form is not clear and remains of tools or other equipment were not found.

#### 7. Workshop near the Harbour Town of Knossos, Trypeti<sup>26</sup>

A. Evans refers to some evidence for the existence of a local stone vase workshop at the site of Anemomylia, in the Harbour Town of Knossos (Trypeti). This includes pieces of stone vases from native and imported materials, unfinished pieces, and waste products due to untimely fracture. The evidence is stronger for the east slopes of Trypeti near the remains of a significant Minoan building. One unfinished rhyton from grey limestone, and a piece of steatite with a relief scene, were included among the finds.

#### 8. Stone Vase Workshop at Mochlos (?)

From Mochlos come two unfinished stone vessels of serpentine<sup>27</sup> which show traces left by a chisel during the shaping of the exterior and interior surfaces. Moreover,

one extracted core from the settlement,<sup>28</sup> proves the existence of a stone vase workshop somewhere there. The extraction of a large core (dim. 7,35 x 4,3 cm.) from the interior of the vase was done with the help of a drill similar to that used at the workshop in Room XVII, 2, at the palace of Mallia.

#### 9. Stone Workshop at Kommos<sup>29</sup> (?)

It is possible that a stone or a carpenter's workshop functioned in a house on the top of the hill at the settlement of Kommos. In a trial trench under the LMIIIB floor of Room 13b, two bronze chisels, a long bronze tool and a stone whetstone were found together with a seal and a fish-hook. In this case, the evidence is insufficient for such an identification. It is very probable that the tools were in store. It is not likely that the chisels were used for seal-making, since more delicate tools are needed for such work. There is no evidence for the manufacture of stone vases or other objects.

#### 10. Stone Workshop at Phaistos?

K. Branigan suggested<sup>30</sup> that a stone workshop was located in Room LV of the first palace at Phaistos. The finds from this room include eighteen obsidian pieces, various grinders and rubbers, bone plaques used as inlays, bone punches and spatulas.<sup>31</sup> A similar group of finds comes from the adjoining corridor in a sotto-scala.



## 11. Other Stone Workshops

Cores, drilled out from the interior of stone vases with the help of tubular drills have been found in many sites in Crete and indicate the presence of local workshops, for stone vases. Such cores were found in Myrtos, Pyrgos, in the Vat Room deposit in Knossos, in the LMIII settlement of Khondros Viannos and elsewhere.<sup>32</sup>

### Stone Vase Workshops

#### Outside Crete

##### 1. Workshop in the Palace of Pylos<sup>33</sup> (fig. 150)

In the palace of Pylos, Room 55, to the NE of the principal entrance, was characterized as a lapidary's workshop. It was accessible by a little staircase from the 'Great Hall', and its dimensions were 2,70 x 4 m. Its walls were plastered. On the floor, made of trodden earth, were found eight small pieces of worked or half-worked sandstone in various shapes. Burning had left them in a bad state of preservation. Among them, a small curved column upon a rectangular base forms an unfinished base of a lamp. The remaining contents of the room consisted of ten clay vases, one worked piece of ivory, and a piece of bronze.

The room has been characterized as a lapidary's workshop for making lamps and other small stone objects. The material is not presented in detail and consequently it is very difficult for anyone to derive any information about the process of manufacture. The tools and other equipment of the workshop have vanished. The existence of only one

kind of material and its small amount, suggest a specialized workshop and probably a temporary one.

The workshop would have been lit from the 'Great Hall', probably through a window on its NW, or SW, wall. It is dated to the end of the LHIIIIB period.

## 2. Stone Vase Workshop at A. Irini, Kea<sup>34</sup> (fig. 151)

Stone vase manufacture in A. Irini has been proven by the discovery of a number of cores from native marble already from the LMIB period. Some evidence indicates a similar activity during Period V, as well (before 1550 B.C.), but it is not enough to confirm the existence of a local stone vase industry in this particular period.<sup>35</sup>

Stone vase manufacture was probably one of the industrial activities of the residents of House A. In Room 21, four cores were found, and in Room 16 an unfinished rhyton. A fragment from an unfinished jar (which may belong to the context of Period VIII) came from Room 14. Unfortunately, the identification of the workshop with a specific area is not possible and the pieces mentioned as unfinished are not presented in detail. The presence of the cores suggests the use of the tubular drill.

## 3. Stone Vase Workshop at Akrotiri, Thera<sup>36</sup> (fig. 152)

In Room 6 of the west quarter of the 'House of the Ladies' in Akrotiri, one unfinished vessel (dim. 0,60 x 0,40 m.) was found at the level of the upper floor. It is logical to suppose that the process of manufacture of the vessel took place in the same or in a neighbouring area.

Consequently, one could speak of a stone vase workshop in spite of the fact that there was no other evidence proving its existence.

The room occupies the SW corner of the house and therefore it would be well lit through a window on the west or south facade.

The vessel is of red marble, which probably can be identified with a variety of inferior quality rosso-antico. Its form belongs to the 'bucket jar'<sup>37</sup> and is almost cylindrical, bridge-spouted, and with two big handles on the sides.

Warren describes in detail the process of manufacture of the vessel using all the evidence drawn from the careful study of the object.<sup>38</sup> This process can be summarized as follows:

- a. A large block of material was worked all over with hammer and punch to produce the exterior of the vase.
- b. Then the top of the interior was first extracted. For this purpose a drill was used, attached in a revolving cylinder which was placed vertically over the vase. The drilling of the interior was done in successive steps. At first, a large core was cut and afterwards smaller ones inside the large to help its extraction. Warren considers that for the processing of the exterior a double-ended, mallet-shaped hammer with V-shaped incisions on the end faces, was used. Moreover, a kind of mallet and an ordinary punch or chisel were probably used for the first steps of shaping the block.

Warren proposes two probable solutions for the form of the drill: the cutting was done either with cutting points



of emery or obsidian mounted into holders which were attached in a wooden cylinder, or with a metal tube with the help of abrasive powder; this tube would be attached directly to the wooden cylinder.

From the above discussion it becomes clear that the study of this valuable unfinished vase from Thera throws light on the stone vase manufacture in all the contemporary workshops. The technology used by the lapidaries of this period is advanced and suggests a very well organized and equipped workshop. Three more cores coming from vases, two lumps of rock crystal, a block of chlorite-serpentine with a segment cut out by a tubular drill, and a piece of emery probably imported from Naxos, confirm the existence of local stone vase workshops in Akrotiri.

#### Discussion for Stone Vase Workshops

As we have already discussed in Chapter **III**, 1 and 2, Zakros adds little evidence for the functioning of stone vase workshops and for the process of manufacture. Only one room (XLIV), in the South Wing of the palace, provided certain scattered indications for such manufacture;<sup>39</sup> the adjoining big room (XLIII),<sup>40</sup> in which the half-cut block of veined marble was found, may have been used only for a first stage of manufacture. Although here the processing of the material (sawing) is exactly the same as that of the blocks of 'Spartan basalt' under the 'Sculptor's Workshop' at Knossos, the function of the area of Zakros seems to be totally different.

a. At Knossos, the area with the 'Spartan basalt' is certainly a storeroom and not a place of manufacture. For the processing of the material, the 'Sculptor's Workshop' above, was probably used.

b. The architectural arrangement of Room XLIII at Zakros and its contents, exclude the possibility of its use as a storeroom. At the same time, it is not possible to name it 'permanent' lapidary's workshop.

c. Whereas at Knossos there are indications of the existence of a workshop which is directly related to the storeroom of the blocks, at Zakros such a workshop has not been identified. Perhaps there was a relationship between Room XLIII and Room XLIV, yet access from one room to the other was difficult.<sup>41</sup>

In addition, there are some indications that in Room XLIV, which must have been a workshop for the manufacture of small artifacts of precious materials, stone vases were also produced. However, these indications (two bronze tools, a stone with a segment cut out by a tubular drill, and perhaps a stone cup with a rough exterior), do not provide new information for the equipment of such a workshop or for the successive steps of manufacture of vases.

Nevertheless, the following can be noted:

a. The use of the tubular drill and the chisel in the working of the vessel.

b. The last step in the manufacture of vases was the smoothing and polishing of the surface.

c. It is possible that the stones with the segment removed by a drill were used as wedges for the handling of

the tubular drill, as Warren considered.

Points 'a' and 'c' are confirmed by the discovery of stones with traces of a tubular drill, which were found in different parts of the palace and the town.<sup>42</sup> As for point 'b', additional evidence is provided by a piece of a stone bowl, which was found in Room B of the East Building. This piece had already been smoothed, but had not yet been polished, since it bears a great number of incisions which were probably created by the abrasive powder.<sup>43</sup>

The handles of the small stone vase, which imitate a pithos and was found in Storeroom N of the Strong Building,<sup>44</sup> had not been perforated; this confirms that the perforation of the handles was one of the last stages of manufacture. It is possible that the perforation of the handles was never done, because during the working of the material it was realized that the resistance of the stone was not great.

As has become clear, there is little information for the organization, the equipment and the methods of manufacture in the stone vases workshops of Zakros. From the study of the workshops described above, the following conclusions can be drawn:

a. There is a great variety of materials used: obsidian (Mallia, Polythyron III, 7), rosso-antico (Mallia III, 7, Akrotiri), grey-whitish limestone (Mallia XVII, 2, Trypeti, 'Gypsum Vase Workshop'), steatite ('Stone Lamps Workshop'), banded tufa ('Sculptor's Workshop', Royal Road), serpentine (Mallia XVII, 2, Royal Road, Akrotiri), gabbro (Mochlos, Royal Road) and gypsum ('Gypsum Vase Workshop'). Warren noticed that the percentage of serpentine cores is great,



in accordance with the percentage in which it occurs in finished stone vases.<sup>45</sup>

b. The variety of the types of vessels being produced is great. In the 'Gypsum Vase Workshop' of Knossos only one type of vessel was produced, a round bowl of small dimensions. In the 'Sculptor's Workshop' of Knossos two three-handled amphorae were produced; their shape was identical, but they are different in size. Workshop XVII, 2, of Mallia produced a greater variety of shapes, whereas from the Akrotiri workshop we have only the bucket jar. Finally, the workshop in the 'House of the Fallen Blocks' produced lamps only. Consequently, one has to note a specialization of workshops and/or individual craftsmen in certain types or materials.

c. The tools used are similar. In two cases one can infer the use of a large, hollow, cylindrical drill, attached to a revolving cylinder, as Warren has shown (Akrotiri, Mallia XVII, 2). In many cases there is proof for the use of a tubular drill for the extraction of smaller cores (Royal Road, Zakros, Myrtos, Pyrgos, Knossos, Khondros Viannou, Mochlos, etc.).<sup>46</sup> The chisel and the hammer were used in all the cases, while in the case of the bucket jar from Akrotiri, a more specialized tool was used. The use of the blade, especially for shaping the exterior, was studied for the 'Gypsum Vase Workshop', but it must have had a wider use. In this last workshop, a drill was not used at all because of the softness of the material (gypsum). Finally, abrasive powder was widely used and has mainly been proved for the 'Gypsum Vase Workshop', Akrotiri and Zakros.

d. The process of manufacture is the same in all cases.

1) Rough shaping of the exterior form of the vessel and definition of its main features ('Gypsum Vase Workshop', Mallia XVII, 2, Akrotiri).

2) Working of the interior of the vase (Mallia XVII, 2, Akrotiri, 'Gypsum Vase Workshop').

3) Final shaping of the exterior of the vase (Mallia XVII, 2, Zakros, Akrotiri, 'Sculptor's Workshop', 'Stone Lamps Workshop').

4) Relief decoration and smoothing of the exterior surface ('Sculptor's Workshop', Zakros).

5) Polishing of the vase (Zakros).

e. The architectural identification and location of the workshops is more problematic: only four of them are architecturally identified ('Sculptor's Workshop', XLIV Zakros, Mallia XVII, 2, 'Stone Lamps Workshop'). Of these, the two in Knossos are more spacious and probably directly lit. Room XLIV of Zakros could also be directly lit,<sup>47</sup> whereas narrow Room XVII, 2 of Mallia might not have been well lit. One of the workshops was on the upper floor ('Sculptor's Workshop') with a storeroom for raw materials under it, while the other three were on the ground floor. Of the remaining workshops, the 'Gypsum Vase Workshop' and that of Akrotiri must have been on the upper floor, while it is not possible to identify the workshop of House A at A. Irini (Kea), Polythyron III, 7 (Mallia), the workshop near the Arsenal in Knossos and that of Trypeti.

f. In none of the above workshops was any manufacturing or supplementary equipment preserved. On the basis of the above, it becomes clear that, even though the technology of

manufacture of the vases was very advanced, the areas for working the materials were small and uncomfortable for a group consisting of many workers. Besides, the specialized production (in both material and types), as well as the quantity of the material, require only one craftsman, who perhaps had an assistant. Nevertheless, at least six workshops are located in the palaces or in their neighbourhood and seem to be controlled directly from the central authority.

b. Workshops for  
Small Artifacts and Stone Jewels

Although at Zakros there have been identified at least four certain workshops in which small artifacts and jewels of stone were produced,<sup>48</sup> the other Minoan sites have provided very few indications for the existence of similar workshops. On the other hand, a good deal of evidence comes from Mycenaean sites.

Crete

Some scattered indications for the existence of workshops of small artifacts of stone can be summarized as follows:

1. Palaikastro,<sup>49</sup> in Room 5 of Block S

A piece of lead, two beads, a worked piece of obsidian from Gyali, a cylinder-seal and a small mould for jewels of glass were found. The finds suggest a workshop for jewellery but there is no positive evidence for the manufacture of stone jewels or artifacts. The date for this particular material is LMIB.



2. Palaikastro, in Room 24 of House B<sup>50</sup> (fig. 153)

In a lower level, a large core of obsidian was found together with a chisel. It is not certain that the two finds were connected with each other. The date is LMIB.

3. Workshop under Polythyron III, 7<sup>51</sup> of Mallia

It is probable that the stone vase workshop was also used for the manufacture of small stone artifacts, since among the finds two small unworked pieces of greenish steatite were found; it is well known that steatite was principally used for the manufacture of seals or small artifacts. However, there is no additional evidence to confirm such a hypothesis. The date of the material is the MMIB period.

4. The 'Lapidary's Workshop' in Knossos<sup>52</sup> (fig. 153)

A. Evans, in his attempt to identify a seal-making workshop at the South Quarter of the palace of Knossos, referred to some unfinished objects of stone coming from the same area. The workshop for seal-making and the manufacture of gold signets will be described elsewhere.<sup>53</sup>

Among the finds presented by Evans as belonging to the same area were a half-worked spindle-whorl, a worked piece of jasper, beads from shells and some pegs from marble and serpentine. These pegs were shaped from cylindrical cores. It seems, however, that the above mentioned material came from a wider area of the South Quarter (Rooms 2, 4 and 7) and although it indicates the existence of a workshop, the latter cannot easily be identified with a particular area.

From the evidence given, one can note the following

points:

a. The workshop produced small artifacts and jewels from semi-precious stones (jasper, steatite) and shells.

b. For the manufacture of pegs, cylindrical cores which were drilled out from the interior of stone vases, were used. Consequently, a connection between this workshop and a stone vase workshop should not be excluded.

The workshop is dated by Evans to the period of the re-occupation of the palace (LMIII B). Younger,<sup>54</sup> however, dates the seals presented by Evans as belonging to the same find-spot, to the LMIB period.

Workshops for  
Small Artifacts and Stone Jewels  
Outside Crete

1. Workshop for Small Stone Artifacts  
in Akrotiri, Thera

The presence of two cores of rock crystal,<sup>55</sup> one of which is quite large (8-9 cm. wide), confirms that a stone artifacts' workshop probably functioned in Akrotiri. Unfortunately, there is no additional evidence connected with the location and the organization of the workshop. The cores are dated to the LMIA period.

2. Workshop for the Manufacture of  
Jewellery in Kadmeion, Thebes<sup>56</sup> (fig. 154)

In the area of Rooms O and E in the Kadmeion of Thebes, in a blackish layer, a group of half-worked and finished jewels and weapons from various materials was found; many

beads of glass, a bronze spear-head, bronze arrowheads, unshaped lumps of melted lead, many gold disks, a gold wing of a sphinx, a small gold flower of a lily, and three significant pieces of rock crystal. From these pieces, which have not been preserved completely, two were multi-faceted in shape and the third is oblong, multi-faceted, like a blade of an axe (dim. 0,13 x 0.065 x 0,035 m.). Some fragments of crystal, probably broken from the larger cores, were found together with the above described material. The three cores of rock crystal showed traces of sawing. Perhaps they were intended for the manufacture of jewels or other precious small artifacts.

Besides the reference to this particular material, no other information is given connected with the equipment, the location of the workshop, or the methods of manufacture. Consequently, it is possible that the above objects were simply kept in wooden boxes to be worked in the future. One cannot know if their manufacture would have been carried out in the same area in which they were stored. Only the following points should be noted.

a. Sometimes in the jewellery workshops different materials, for which completely different methods of manufacture were required, were worked out. In this particular case, jewels from gold, glass and rock crystal were produced, probably in the same area.

b. The rock crystal was considered a precious material and was kept together with the gold jewels.

c. For the first stage of the processing of rock crystal, small delicate saws were used.



3. Workshop for Agates in the Kadmeion of Thebes<sup>57</sup> (fig. 154)

In a small area (1 m<sup>2</sup>) on the south end of Corridor ΦM, a great amount of half-worked stones from onyx and agate was found together with a badly shaped vase of whitish glass-paste. This latter, perhaps, was used for the manufacture of beads from glass, such as those which were found mainly in Room N and to the south and east of it.

Most of the agates present clear traces of sawing. Many of them have rough surfaces, and others have perforated holes for suspension. Among the agates there are some cylindrical cores extracted from the stone by a tubular drill. Some half-sectioned pieces were also preserved, which were cut for the further processing of the jewels' manufacture.

Some of the agates were almost in the final stage of their manufacture. One had the form of a bird's wing, another the form either of a bull's head, or a lion's head, or even of a Mycenaean idol's head.

In all the pieces, advantage was taken of the veins of the stone. No tools were found together with the above material, apart from some obsidian flakes and a piece of flint, which were probably used for the rough shaping of the agates into the desired forms.

Despite the fact that the publication of the material by Keramopoullos is very systematic, one may note only a few points about the methods of the manufacture of jewels.

a. Once more it is clear that small delicate saws were used to cut the agates to the desired size.

b. The use of the blade in the final shaping of the

jewel was indispensable.

c. The use of small drills for the perforation of the suspension hole is also confirmed.

d. It is clear that they attempted to make use of the veins of stone, for decorative purposes; this influenced the choice of the form of the jewel.

It is possible that here also, we have storage of precious material in a wooden case, and not a workshop. The material was found scattered in a layer which extended up to 1,5 m. from the level of the floor, a fact which indicates that it fell from a high point. If we are dealing with a workshop, it would have been located on the upper floor.<sup>58</sup> Keramopoulos believes that the material was stored in a wooden box lying on a shelf fixed on the wall.

#### 4. Workshop for Jewellery in Thebes, Oedipus Str. 14<sup>59</sup> (fig. 154)

In Room B, at the area of Oedipus Str. excavations in Thebes, another workshop for jewellery was identified. Over three hundred objects of small size were found there. The materials used were gold, bronze, electrum, glass-paste, shells, lapis lazuli, rock crystal, agate, amethyst and steatite. The material which was mainly used for the manufacture of stone jewels was, in this particular case, lapis lazuli. It includes seventy-three pieces of lapis lazuli in various stages of working, while some smaller ones represent the waste pieces.

The material was of high quality. The pieces were at different stages of working. Many of them were in the first stage (cutting of the stone). Others needed only some

incisions to form recognizable shapes. Other pieces do not form any particular shape; perhaps they were to be used as they were. Among the pieces some have been considered as scraps. Included in this material was a large and thin piece of plaque, from which a rosette was cut. It is impressive that the shape was directly cut from the plaque and not from a smaller piece of a round form. This work reveals a good deal of the craftsman's skill and gives evidence of the use of a delicate, small saw.

The jewels made from other stones are not numerous and represent finished products. Some tools, not easily recognizable, were found associated with the above material: a small engraving tool, a fragment of a knife, a pair of tweezers and an iron drill; a fragment of steatite was probably used for abrading.

From the information given above, one should note the following points.

a. Once more, the working of semi-precious stones took place in the same area in which other precious materials were worked.

b. Lapis lazuli, an imported material, was principally used for the manufacture of jewellery in Thebes.

c. The delicate work for such a manufacture indicates that some specialized small tools for cutting and carving were used.

d. For the first time during the Bronze Age we have evidence for the use of an iron tool.

The workshop is dated to the LHIII B period.



5. Workshop for Jewels to the SW of  
the Workshop in Oedipus Str., Thebes<sup>60</sup>

This workshop was very close to the workshop in Oedipus Str. (at a distance of 40-50 m. to the SW of it). It lay in the area of the Mycenaean acropolis and belongs to the period of the second Mycenaean palace. The workshop was used for the manufacture of jewels and other metal objects, as well as for cutting precious and semi-precious stones. Its dimensions were 6 x 3 m.

The floor of trodden earth was covered by a thick burnt layer, which indicates a destruction by fire. The thickness of this layer was 0,30-0,50 m.

In the contents were included:

- Sixteen steatite buttons, probably made in the workshop.
- A small fragment of a loaf-shaped bead of rock crystal, and two other multi-faceted pieces with visible traces of sawing; some other unworked small pieces were also found.
- A flattened cylinder from onyx.
- A bronze chisel, two small bone knives and two whetstones.
- A rectangular stone plaque with two worked faces, probably used as a working table.
- A mould for jewels, two bronze arrowheads and various deformed pieces of lead, pieces of bronze, ivory, bone and faience.

Although the evidence provided does not help in our understanding of the process of jewel manufacture, one

could note some points connected with the type of the workshop.

a. Here, once more, it becomes clear that the manufacturing process of jewellery from various materials took place in the same workshop, even when the techniques for such manufacture were completely different.

b. The workshop produced small artifacts, principally beads for necklaces, buttons and amulets.

c. The material mainly used in this particular workshop was steatite.

d. The manufacture of the artifacts was probably done on a working table.

e. For the cutting and rough shaping, a chisel was probably used, while the two bone tools, which were found in the same area, would be used for engraving.<sup>61</sup>

The workshop is dated to the LHIIIB<sub>1</sub> period.

#### 6. Workshop for Jewellery in the East Wing of the Palace at Mycenae<sup>62</sup> (fig. 154)

In a room of the East Wing of the palace of Mycenae a number of small artifacts was found, indicating the existence of a workshop for the manufacture of jewels and ivory-working. In the workshop a number of semi-precious stones was found showing traces of breaking, a fact which made their further working impossible. The material consists of: five unworked pieces of chalcedony, seven rock crystals, one agate, two pieces of malachite, one of galenite, unworked quartz stones and a large piece of greenish steatite, from which many smaller fragments had been cut out. Among the finds there were also a glass cup and jewels from the same

stone, and finally a rock crystal bowl which was rejected because it cracked during the process of manufacture. In a neighbouring room a lentoid agate was found, unperforated, without any trace of carving, broken on its perimeter. In the same area a bronze dagger and a chisel were also found.

Besides the ivory fragments and the pieces of glass-paste, many plates of gold were found, as well as bronze slags, and some yellowish masses which, when heated, are transformed into a strong glue-paste of a brownish colour.

The evidence given strongly suggests the existence of a workshop for the manufacture of stone jewels and artifacts. However, one cannot draw any information about the organization and equipment of this workshop. Nevertheless, one should note the following points.

a. In this case also, the carving of the semi-precious stones took place in the same area in which jewels from other, different materials were produced.

b. A variety of kinds of semi-precious stones was used.

c. Besides the manufacture of jewellery, the same workshop dealt with the manufacture of small vases from the same semi-precious materials (bowl of rock crystal, cup of agate).

d. Tools used for working stone were not found, with the probable exception of a bronze chisel.

The workshop is dated to the end of the LHIIIB period.



## Discussion for

### Small Artifacts and Stone Jewels Workshops

From Crete there is only scattered evidence connected with workshops for the manufacture of small stone artifacts and jewels. However, in Zakros four such workshops have been identified: in two of them serpentine - steatite was worked in quantities, but limestone and banded tufa were also used. The third workshop (in Room XLIV) looks like a jewellery workshop similar to those from the Mycenaean area; there, rock crystal was worked together with faience, glass-paste and ivory. The fourth was a peculiar workshop which dealt with the manufacture of small prismatic objects of steatite, or with the production of a kind of talc powder;<sup>63</sup> it has no parallels in the whole Aegean area.

Studying the comparative material, one can note some points related to the character, location and organization of the Cretan and Mycenaean workshops for the manufacture of small artifacts and jewels of stone.

a. There is a similarity in the nature of the workshops. Usually, they were for the production of every kind of jewellery. The processing (or at least part of it) of the various materials, which demanded completely different techniques, usually took place in the same area. Thus, different materials in process of manufacture are usually found together: rock crystal, faience, glass-paste and ivory (Zakros, XLIV), rock crystal, glass-paste, bronze, gold and lead (Kadmeion, 2), agate and glass-paste (Kadmeion, 3), various semi-precious stones, gold, bronze, electrum and glass-paste (Oedipus Str., Thebes), glass-paste, ivory, bone and semi-precious stones

(Workshop to the SW of Oedipus Str. Workshop). Sometimes, these different working requirements would probably demand different specialized craftsmen. These specialized craftsmen would manufacture in the same workshop some larger objects and vases from the material with which they dealt (as in the case of the Workshop of the East Wing of the palace, at Mycenae).

b. The processing of the material in the above workshops was done with much skill, which demanded the use of delicate tools. Of the tools used in workshops, only a few have been preserved: bone tools for carving (Workshop to SW of Oedipus Str. Workshop), bronze chisels for the rough shaping of the pieces (Zakros, Mycenae, Workshop to SW of Oedipus Str. Workshop), a thin bronze tool for delicate work (Oedipus Str.), blades (Zakros XLIV, Oedipus Str.), some small tools of obsidian and flint (Kadmeion, 3), tweezers (Oedipus Str., Zakros  $\Phi$ ), and an iron drill (Oedipus Str.). The use of small delicate saws is clear (Oedipus Str., Kadmeion, 2 and 3, Workshop to SW of Oedipus Str. Workshop).

c. Of the jewellery workshops which have been described already, four are located in a well defined area (Zakros XLIV, Oedipis Str., Workshop to the SW of Oedipus Str. Workshop, Mycenae). All these rooms are sufficiently spacious. On the other hand, the precise architectural location of these workshops in the wider area, is sometimes problematic. The clearest picture of such an arrangement is given by Room XLIV at Zakros. This workshop (and that of Mycenae as well) is located in the palace. Inside the palace were also both of the workshops in Kadmeion, while for that to



the SW of the Oedipus Str. Workshop, we know that it was inside the Mycenaean acropolis. It becomes clear that these craftsmen worked under the control of the central authority.

d. Workshops which produced common stone artifacts such as those of the serpentine-steatite at Zakros have not been identified in other areas. Only the workshop to the SW of the Oedipus Str. Workshop, in Thebes, produced, among other things, a series of steatite buttons. The Zakros workshops seem to have been occupied with a very specialized local production for which we do not have enough evidence. Workshop  $\Phi$  which manufactured prismatic steatites, was very specialized and has no parallel in the Aegean area during the Bronze Age.

#### c. Seal-making Workshops

In contrast with the jewellery workshops, seal-making workshops have been identified mainly in Crete. Perhaps the seals on the Mycenaean mainland, when they were of local manufacture, were made in the jewellery workshops.

#### Crete

##### 1. Seal-making Workshop at Mallia<sup>64</sup>

The workshop was housed in a small house (10 x 7 m.) of rectangular shape to the north of the buildings of Quarter Mu (Buildings A and B). This house was accessible from a road which is a continuation of the east road that surrounded the quarter. The building is located 200 m. to the west of the new palace's area and about 100 m. to the NW of Quarter



Aa. The workshop is hypothetically located on the upper floor of the building. The material, which consists of half-worked seals, fell and was scattered on the ground floor when the house was destroyed.

Nine-tenths of the material is of steatite of a light colour. Other materials used were: limestone (white or blue), agate, rock crystal, obsidian and ivory. It is very possible that the high percentage of steatites in relation to the other materials could be due to the fact that this material is fragile; consequently, its processing was frequently unsuccessful. In addition, the hard stones are more difficult to work and steatite is not rare on Crete, like rock crystal or other materials used for seal-making. The tools which would have been used must have been very specialized.

In the workshop many bronze tools were found, strong burins with pyramidal heads, needles, points, scrapers, a tubular drill, delicate tools for engraving and small saws. In addition, bone tools of various types were found. For working steatite, obsidian blades or delicate bronze tools could have been used.

Among the seal shapes, the prismatic one with three or four sides is dominant (more than 90%). Other types include conical, semi-cylindrical, button-shaped, semi-barrel-shaped, and flat-sided forms; four of the seals are stemmed. Apart from the half-worked seals, there are many completely unworked stones, as well as pieces of raw material. In addition, in the same area twenty finished and completely preserved seal-stones were found. The motives that are engraved on the

seals are well known: goat, boar, scorpion, spider, sea-bird, or fish, cross, swastika and spiral.

H. v. Effenterre attempts to illustrate with examples the process of seal-making. This briefly took place as follows:

a. Working started with the cutting of a small stone from a larger block of material. In this stage, the two small bronze saws (dim. 0,04 x 0,06 m.) discovered in situ, would have been used; these would probably cut with the help of Naxian emery powder, or sand.

b. Removal of any irregularities of the stone and shaping of the seal. At this stage, perhaps, the small saws were also used, but the main working would be done with smoothing agents.

c. Perforation of the seal by a punch turned by hand or with the help of a bow, or with a drill.

d. Engraving of the motives. This would be done with very delicate pointed tools, such as burins, or needles and pins with pyramidal heads.

It is noteworthy that in the Mallia workshop, stage 'd' frequently preceded stage 'c', that is to say, the perforation of the suspension hole was the last step. This, of course, involved a great risk, since the perforation was the more difficult job and frequently caused the fracture of the stone.

Dessenne divides the seals into groups on the basis of individual hands and discerns many different craftsmen. On the other hand, Poursat and H. v. Effenterre believe that appropriate unit for the work was the family. There would

have been a main craftsman and one or two apprentices.

One can discern at least two qualities in the work.

On the basis of the study of the above points, Poursat<sup>65</sup> reaches certain conclusions:

a. The workshop was very specialized. The craftsman had a particular style and repertoire. There would certainly have been other seal workshops, even at Quartier Mu.

b. The work was done in a family environment. This building would have been the house of the seal-maker. One can recognize two craftsmen; perhaps, they were father and son.

c. The workshop was not independent. It was related to Buildings A and B of Quartier Mu.

The workshop must be dated to the MMII period. From the above it becomes clear that we are dealing with an organized workshop for the production of seals. One can note the following:

a. The working of the seals indicates great specialization, and the equipment of the workshop proves that advanced technological methods were used.

b. The specialized production in shapes (prismatic) and in materials (steatite), is probably accidental. It is possible that at the time of the destruction of the building, a specific production was demanded or that the available material at that time was that which was found. Something similar, that is, a specific kind of production, is usually also found in the stone vase workshops.

c. It is likely that the workshop was the house of the craftsman, especially since living quarters and storerooms



have been identified in the same building. Yet, it is not clear whether the craftsman had some direct relation to the palace or to another administrative centre.<sup>66</sup>

2. Workshop in the Area of the Palace of Mallia? (Under the Polythyron III, 7)<sup>67</sup>

Two pieces of steatite which have been found along with the remains of workshop equipment could have been used for seal-making. However, there is no other evidence and not even basic equipment for such work.

3. Seal-making Workshop in the South Quarter of the Knossos Palace ('Lapidary's Workshop')<sup>68</sup> (fig. 153)

As we have already seen, Evans identified a lapidary's workshop in the South Quarter of the Knossos palace which produced seals and other small artifacts of stone and which he dated to the LMIII B period. Younger<sup>69</sup> considers that the material was found scattered in various rooms (2, 4 and 7) and does not come from the same context. Yet he assigned two unfinished seals and an engraved representation on a steatite core to a seal-making workshop which he locates in the area of Room 4. The two unfinished seals are lentoids of black and greenish steatite. They have been cut and shaped by a small saw. One has a shallow cavity at one end. Younger believes that this cavity would have been used for fixing the seal, in order to engrave it, and after that it would serve as the starting point for the perforation. Thus, the working stages of the seals would have been:

- a. shaping
- b. engraving
- c. perforation.

On the other hand, in the case of the steatite core, if the desired product was a seal, the engraving has even preceded the shaping. Perhaps this was done in order for the craftsman to be able to fix better the working surface. Younger, however, believes that the engraved representation served as a mould for stamping the motive on a metal foil (probably of gold); this foil would constitute the bezel of a signet or would simply cover a stone lentoid seal. If the small artifacts of stone which have been described above <sup>70</sup> belonged to the workshop, then they might have served for tapping gold foil onto the mould. Thus, two different kinds of job would take place in the same workshop.

a. Manufacture of stone beads and seals.

b. Manufacture of gold plates for rings and seals.

Younger dates the workshop to the LMIB period.

On the basis of the above one can make the following observations:

a. Small saws were used for the shaping of the seals.

The unfinished pieces do not provide any additional evidence for the types of tools which were used.

b. If the working of gold plates for signets took place in the same area, we are dealing with a workshop which, besides seals, possibly manufactured jewels of gold or other precious materials.

#### 4. Seal-making in the 'Sculptor's Workshop', Knossos?<sup>71</sup>

'Spartan basalt' (lapis lacedaemonius) was usually used for seal-making; thus, the discovery of the 'Spartan basalt' blocks in the basement of the 'Sculptor's Workshop'

may mean that a seal-making workshop was located in the same area with the stone vase workshop. However, the large volume of the raw material is against such a possibility.

#### 5. Seal-engraver's Equipment in a Tomb at Knossos<sup>72</sup>

Some magnifying lenses made of rock crystal, found together with a small bronze balance and lead weights in a tomb at the Knossos area, probably belonged to the equipment of a seal-engraver. The tomb is dated (from the pottery) to the LMIII period.

#### Discussion for Seal-making Workshops

As has already been discussed,<sup>73</sup> there is only one piece of evidence for the working of seals at Zakros: the unfinished seal of Room  $\Phi$  of House A. This isolated find cannot define a workshop despite the fact that two curved small knives of bronze were found in the same area.<sup>74</sup> On the basis of the comparative study of seal-making workshops, one can note the following.

a. The seal-making workshops in Crete were well organized and equipped (Workshop in Quartier Mu at Mallia). One of these was housed in a building far from the palace, but it might have been controlled by another central authority (Workshop in Quartier Mu).<sup>75</sup> The other two probable workshops were located in the palaces or in their immediate neighbourhood (Knossos, Mallia Polythyron III, 7).

b. In the two main workshops (Mallia, Quartier Mu,



Knossos) the working of seals took place in three successive stages.

1) Shaping of the seal by sawing.

2) Engraving of the representation with delicate tools.

3) Perforation with the  revolving drill.

On the other hand, the unfinished seal of Zakros shows that in this case the perforation preceded the engraving. The seal broke during this stage and was discarded.

c. Frequently, the working of the seals took place in areas where the working of other materials for the manufacture of jewellery also occurred. In connection with this, the case of the workshop in the South Quarter of Knossos is typical. There the manufacture of gold plates with representation in repoussé work for signets took place.

#### d. Obsidian and Other Stone Tool Workshops

Obsidian was used for the manufacture of tools and razors during the Neolithic and the Bronze Age in the whole Aegean area. The material used comes from Melos and its initial working took place in the area where it was quarried.<sup>78</sup> The secondary working occurred in the areas where it was imported, either by specialized craftsmen in workshops, or by individuals throughout the site. Three obsidian workshops have been identified in Crete and one at Phylakopi in Melos.

## Crete

### 1. The Obsidian Workshop at Mallia<sup>77</sup> (fig. 155)

Location. The prepalatial workshop lay beneath the west wall of the protopalatial 'Estrade' of Ka. It is an oval place, 3 or 4 m<sup>4</sup>, is surrounded by irregularly arranged stone blocks, and is not defined by any particular wall. No floor can be discerned. The area was filled with bones of small animals that bear traces of fire, a few sherds, and obsidian flakes. The layer of flakes was very thin.

Material. Of the obsidian remains 85% are flakes with no secondary trimming (retouch). There were twenty conical cores which end in a point, or are almost cylindrical, fifty blades which were triangular-section or trapezoidal flakes which have been turned into various tools for cutting, scraping and perforating (among them, one would have served as a little saw); two larger pieces were completely unworked.

Tools. Even though the majority of the bones seem to have been food refuse, perhaps some long and pointed ones were used as tools for striking certain blades. Two blocks, one of white marble and the other of haematite, both spherical with a flat base, served for striking.

Organization of the workshop. The flakes were found scattered on the entire surface of the workshop, whereas the blades were only found at the periphery. The cores, the hammers, the unworked pieces and the majority of flakes and blades came from the east side of the area, where the material was found in two piles. The central part did not yield any obsidian remains.

Date. The workshop must be dated to the EMII period.

On the basis of the above, H. v. Effenterre observes the following:

a. We are dealing with one craftsman, who is helped by an apprentice, since the tools and the material are too few to justify the existence of a bigger working group.

b. Production does not look to have lasted for many generations since all the material occupies only a small layer.

In addition, the following can also be observed on the organization of the workshop:

a. The workshop seems to have been well organized, since there are many indications of the tools and since all the stages of working are represented. Nevertheless, no traces of permanent equipment can be observed (shelves, working table, etc.). The quantity of burnt wood which was collected was not enough to indicate the existence of such equipment.

b. The craftsman must have sat in the centre and would work the blocks towards the periphery. The two piles of material which were found perhaps suggest the presence of two craftsmen, even though no difference in quality was observed.

c. We have no additional evidence that would help us understand the process of working the obsidian, since no detailed description of the material is given. Yet, all the known stages of obsidian blade production are represented:

1) shaping of the core,

2) extraction of blades by striking (by bone



or other hard material),

3) secondary trimming of the material for the formation of more specialized tools.

## 2. The Obsidian Workshop on the South Side of the Royal Road at Knossos<sup>78</sup>

Location. This workshop was situated in an EM house, on the south side of the Royal Road. In a layer of ash and beside a hearth, some hundreds of obsidian pieces were found, coming certainly from a workshop.

Material. The remains suggest that working began from already prepared cores. It has been estimated that 20-25 cores were worked out in this workshop.

Organization of the workshop. Once again, a concentration of waste material in the centre and the finished products on the periphery of the area can be observed. Warren interpreted this pattern to mean that the knapper carefully placed the finished artifacts along the wall leaving the waste by-products where they fell.<sup>79</sup>

Date. Warren dates the workshop to the EMIIA period. The information does not provide any additional element for understanding the function of the workshop. Nevertheless, one could note the following points.

a. The first stage of working, namely the shaping of the cores, is not represented. It is very possible that this was accidental.

b. The amount of the material suggests once more a single workman who worked sitting in the centre of the workshop.

c. As in the case of the workshop of Mallia, the area of the workshop seems to be confined, while its architectural location is not absolutely defined.

### 3. The Obsidian Workshop at Khania<sup>80</sup>

Location. One more obsidian workshop was identified in an EM layer under the floor of Room E in House 1 at the Plateia Ag. Aikaterini, Khania.

Material. About sixty obsidian pieces, including some cores, several flakes and some complete blades, were found. From the same context came three percussion stones, one of which bore clear striking marks.

Organization of the workshop. The area was divided into two parts, west and east, by a wall. Most of the floor of the room was covered by a relatively thick layer of ash. Twenty-five to thirty cm. from the wall there was a small shallow hearth or oven. The material was found on the west side of the oven.

Date. The workshop is dated to the EMII period.

#### Obsidian Workshop

#### Outside Crete

### 1. Workshop at Phylakopi, Melos<sup>81</sup> (fig. 155)

Location. Remains of an obsidian workshop were found in grid square BS at the western end of the site. The material occupied an area of about 100-150 m<sup>2</sup> and constituted a layer 20 cm. thick. The workshop was not located in a building. We are probably dealing with an open-air area, not

strictly defined.

Material. Rejected cores, used or rejected blades, and flakes. In some of these, secondary working is discernible. The amount of material was substantial.

Organization of the workshop. The material found in the workshop was mainly waste. Only a few complete blades were preserved among the thousands of flakes and unsuccessful tools. Bosanquet notices that the skill of the Melian craftsmen was not great because the material was abundant in Melos and thus they easily discarded it. All stages of blade production are represented to some degree in the deposit: numerous types of platform preparation flakes, blades ranging in form from those with highly irregular lateral margins and dorsal arrises to the classic trapezoidal prismatic blades and ridged or crested blades. Torrence poses the question whether we are dealing with a workshop or with an area for discarding the waste material of obsidian-working.<sup>82</sup>

Date. Bosanquet dates the workshop to the pre-Mycenaean period. Torrence dates the obsidian deposit to the Early Bronze Age.<sup>83</sup>

From the above evidence one may make the following observations:

a. The working of obsidian in Phylakopi was significant since the amount of the material found was large. Torrence estimates that the entire output of the the obsidian factory was 7,755 kg.<sup>84</sup>

b. It is unlikely that the area of the workshop was simply an area for discarding the waste material because



there would be no such need. The obsidian waste can easily be mixed in the earth and vanish; consequently, there is no need for the careful gathering of the whole waste material for discard in a particular area. The only reason for such a concentration would be possible future reuse. It is more likely that the material represents the waste of a workshop which was not functioning at the time of its destruction. In this last case, of course, the finished products would have already been taken away.

c. Because the material consists mainly of waste, the workshop gives only slight evidence for understanding blade manufacture. Nevertheless, Bosanquet attempts to describe the whole process of manufacture, for some selected finished products.

d. No other information on the organization and equipment of the workshop was preserved. In spite of this, one could suppose from the amount of material found and the dimensions of the working area, that there was a large group working at the same time in the particular area.

#### Discussion for Obsidian Workshops

Torrence,<sup>85</sup> who studied and compared the obsidian workshops concludes the following:

a. In the first two workshops the material found is not enough to justify a long-time function. Moreover, there is no additional evidence, such as permanent equipment or a clear architectural definition of the areas, elements indispensable for the identification of a workshop. Consequently,

it would be better that the above areas be named simply 'working areas'.

b. On the other hand, in Phylakopi a large amount of waste material was found, but not a building. Since only a few complete blades have been found one cannot exclude the conclusion that the area was only used as refuse of the useless material.

Regarding the above, one can observe the following:

a. The relatively large quantities found in the Cretan workshops in comparison with the surrounding areas, and the different stages of working there, suggest that the material was worked in situ. According to Torrence, only sixty hours would be needed for working this material. This means eight to ten days of work for one person specialized in the particular production. If one takes into account that the material in Crete was carefully used, the above areas could be used as workshops for this particular industry. As Torrence supposes, it would be normal for the products which were already finished to have been immediately distributed. This explains the absence of many finished specimens in the workshops. On the other hand, permanent equipment is not indispensable in the case of obsidian workshops, while the problematic architectural definition of the workshops remains one of the significant problems for the identification of any kind of workshop in Minoan Crete.

b. In Phylakopi the conditions are completely different. The material is abundant and entirely justifies the conclusion of a more organized tool production, undertaken by working groups. The demands of such work were probably the reason

for which the area was open-air, in order to be as extensive as possible, and consequently more comfortable. The absence of many finished blades is not negative evidence, for reasons already discussed in 'a'. On the other hand, the possibility that the area was used for obsidian refuse should not be excluded. However, in this case, one must answer the question: why should the obsidian be carefully concentrated in a single area and not thrown away everywhere with other rubbish, for example, with the broken pottery?

In Zakros, there is no evidence for the identification of an obsidian workshop. Scattered flakes and cores of obsidian were found in many areas and in different levels.<sup>86</sup> They were more frequent in the protopalatial layers, a fact which proves once again that the significance of obsidian in the earlier periods was greater.

Workshops belonging to the Late Bronze Age are not yet known. The working of obsidian during this time was probably done by individuals. This possibly means that:

- a. There was no need for production on a great scale,
- b. The material was familiar to the Minoans and how to work it became something more widely known. Consequently, there was no need for a specific working area and for specialized craftsmen.

#### e. Workshops for the Preparation of Stone Building Material

The first stage of working stone building material was done in the quarries. After its transportation to the area in which it would be used, secondary working took place with



tools and methods described by Shaw in his book on Minoan architecture.<sup>87</sup> Hence, we are not dealing with this subject, but we may note that there are some areas which could be considered as workshops for the preparation of stone building material and stone material used for decoration purposes in Minoan buildings.

1. Lapidary's Store of 'Spartan Basalt'  
(Lapis lacedaemonius) Blocks at Knossos

This storeroom and its contents have been discussed already.<sup>88</sup> Evans considered that one of the larger pieces which showed a roughly rounded section, was intended for the manufacture of a column base. Such a use of the 'Spartan basalt' must be dated, according to him, before the MMIIIb period. Some other worked 'Spartan basalt' blocks were also used as building material in certain repairs, such as those of the 'Service Stair' in the adjoining Upper Corridor. It is very difficult for anyone to criticize such a hypothesis. The sawing of the blocks probably was intended for the preparation of slabs for dressing the lower parts of the walls as for the manufacture of thresholds.

Discussion for the Workshops for the  
Preparation of Stone Building Material

As has been discussed, the working of the 'Spartan basalt' blocks in Knossos corresponds closely to that of the veined marble block in Room XLIII of the South Wing of the palace of Zakros.<sup>89</sup> Nevertheless, in the case of Zakros, the working apparently was not intended for the preparation

of building material, since only one block was found, and this single block is not large enough for such use. On the other hand, one should not exclude the likelihood that the slabs of a similar material found on the doorway between Rooms Γ and Δ in the large protopalatial building under the East Wing of the palace at Zakros,<sup>90</sup> were used for the dressing of architectural members, or for the manufacture of thresholds.

If we accept that the lapis lacedaemonius blocks of Knossos were intended for the production of building or decorative material, it is improbable that such an activity was carried out in the 'Sculptor's Workshop' above by the same craftsman who produced the stone vases. Nevertheless, one should not exclude the possibility that a second craftsman, specialized in the preparation of such material, worked in the same area or somewhere in its neighbourhood.

## B. Bronze Workshops (Category A, Type 'c')

### Introduction

Despite the fact that there is a good deal of evidence for bronze-working in most of the Minoan and Mycenaean sites, only in a few cases bronze workshops have been identified. Much of the evidence comes from isolated objects, which were found scattered throughout the sites. Such objects are

usually clay or stone moulds for casting bronze tools, and clay crucibles used for melting the raw material. Permanent installations for bronze melting are the bronze kilns, but in the case of Minoan Crete their precise form remains uncertain.

On the other hand, the identification of bronze workshops dealing with the hammering and finishing of bronze objects is more difficult, especially in cases where such areas were at a distance from the smelting or melting areas. In these cases, the identification is based only on the discovery of relevant tools and unfinished objects in a closed context. Nevertheless, the tools of a bronzesmith are not usually very specialized in form and resemble the tools used for stone-working. Moreover, in most cases, the bronze objects have been poorly preserved; consequently, the identification of unfinished pieces is more difficult to make.

### Bronze Workshops in Crete

#### 1. Bronze Workshops at Gournia<sup>91</sup>

The identification of bronze workshops at Gournia has been based on the discovery of clay crucibles, a number of moulds (in two of the town houses), scrap metal and bronze slags, and bronze tools found together with bronze sheets.

##### a. House Fh

In this house four stone moulds for casting tools



and a stone cover of another mould were found.<sup>92</sup> The types of tools cast were: knife, double axes, nails, punches and narrow blades.

Despite the fact that House Fh was probably the residence of a bronzesmith, the location of the bronze-working area cannot be precisely identified, since the precise find place of the objects mentioned above has not been given. Moreover, there is no information for the remaining contents of this house.

#### b. House Ea

House Ea lies on the west slope of the hill of Gournia. In a large paved room (Room 10) a schist stone block used as a multi-faceted mould was found.<sup>93</sup> The block is irregular, with two flat surfaces on its top and bottom. In different faces of the block, thirteen mouldings represent two types of chisels, nails and bars or needles. A narrow bronze band, twisted twice around the block was used for repairing it. The two ends of the wire have been twisted together, while some wedges located between the block and the wire help the tightening. The block was 31 cm. long, 11 cm. wide, and 22 cm. high.

Room 10 was probably used for bronze-working activities by the residents of House Ea. Nevertheless, the possibility that the room was only used for the storage of tools cannot be excluded.

c. House Cg<sup>94</sup>

A group of bronze tools found together with a folded bronze sheet in House Cg suggests that a bronze smithy was probably located in this house. A stone concave table, probably for working pigments (palette) was found in the same house.

All Gournia workshops are dated in the LMIB period.

2. Bronze Workshop underneath  
Polythyron III, 7, in Mallia<sup>95</sup> (fig. 156)

As has already been described,<sup>96</sup> a stone workshop was probably located under Polythyron III, 7, in the Mallia palace. The identification of a bronze workshop in the same area is based on the discovery of numerous schist moulds which were used for casting various bronze tools. The moulds were found in a heap, at the foot of a column base belonging to the neopalatial polythyron. Some of them bear traces of burning, probably connected with their function.

Chapouthier<sup>97</sup> published the moulds under discussion and classified them in three categories, according to the form of the casting types.

- a. Moulds for double axes.
- b. Moulds for small objects.
- c. Moulds for disks ('disques plats').

Apart from the moulds there was no other evidence for bronze-working in this particular area. There were no crucibles or other tools which could have been used for bronze-working. Nevertheless, in more recent investigation in the same area, a burnt spot containing bronze slags was discovered near one of the column bases of Polythyron III, 7, which

confirms that a bronze workshop functioned in this area.<sup>98</sup>

The architectural location of this workshop is difficult, since the new palace was built over the southern part of the area.

From the information given above, two points are of special interest.

a. The moulds were already used, since some of them bore traces of burning. At the time of destruction they were probably in storage.

b. If these moulds had been used in situ, in the same area in which stone-working took place, it is possible that the craftsmen were the same persons in both industries.

The layer in which the moulds were found has been dated by the excavators to the protopalatial period (MMII). However, the burnt layer with the slags investigated by Pelon was in an intermediate level, between the protopalatial structures and the last level of the palace. Consequently, it seems more probable that the workshop belongs to the MMIII period.<sup>99</sup>

Apart from the area under Polythyron III, 7, some other places in the Mallia palace and town were probably also used for bronze-working. It has been said that numerous slags and pieces of waste bronze were found throughout the north court of the palace, suggesting a probable bronze workshop there.<sup>100</sup> In two of the houses of the SE quarter of the town (Houses Zb and E) some quantities of bronze in storage have also been found.<sup>101</sup> Some bronze-working probably took place near Chryssolakos, where a lot of slags and burnt bricks were noticed on the ground surface.<sup>102</sup> However, an



identification of a bronze workshop in these areas is not safe without the help of additional information.

3. Bronze Workshop in the Unexplored Mansion, Knossos<sup>103</sup> (fig. 156)

A great number of bronze objects coming from the LMII layers of the Unexplored Mansion at Knossos seem to be connected with at least one bronze workshop, the precise location of which remains uncertain. Ninety-five percent of these objects came from Rooms H, L, M, N and P with a few others in E, G and Q.

The bronze objects can be divided into manufactured goods, scrap and waste. In most cases it is difficult to separate the first two categories because of the poor preservation of the objects.

In the fill of the rooms mentioned above, principally fallen from the upper floor, were objects which were used for bronze-melting, such as several clay crucibles and the clay nozzle from a furnace bellow. Other objects related to the casting process were found in the same contexts. These include a bronze wire used for strapping together the two halves of double moulds, droplets and spills of metal lost from crucibles, surplus pieces broken from castings after their removal from the mould, and bronze vessels used for carrying charcoal.

In addition, several tools which could be used in a bronze workshop, as heavy chisels, drills, punches and awls, tiny tracers for decorating sheet metal, small points and little chisels for delicate works were included in the same context. Enough quantities of scrap metal would probably

be used as raw material after their remelting.

H. and E. Catling, who published the relevant material, considered that the absence of other items that would be expected, such as ingots, heavy foundry tools, and moulds, points either to a deliberate rifling, or to a hurried collecting of the more valuable objects before the final destruction of the building. The dispersal of objects might have been in part due to the same cause.<sup>104</sup>

On the floor of Pillar Hall H were the ruins of a small furnace, probably used for bronze-melting. This indicates that this room was the focus of a workshop; however, the adjoining rooms were also probably used for activities relevant to bronze-working. On the other hand, according to D. Evely,<sup>105</sup> the distribution of the finds stratigraphically and from room to room would both argue for any work areas being located on the upper floor.

Clearly, a bronze workshop should be located in the area of the above mentioned rooms of the Unexplored Mansion. It is unlikely that all this material described was in storage to be used in a workshop located outside the building. The workshop is dated to the LMII period.

The most important conclusions drawn from the study of the bronze material in the Unexplored Mansion are:

a. The workshop and the small furnace were indoors, in a group of adjoining rooms. This is a strange fact, since it is well known that bronze-melting causes fumes and noise which would probably create serious problems to residents, if certainly the building was used as a residence in LMII period.

b. The area in which the bronze-melting took place is identical with the place for hammering and finishing of objects

#### 4. Bronze Workshop in Building T at Kommos<sup>105</sup>

In Room 16, in the NE part of Building T of Kommos, some pieces of crucibles for bronze-working were found. Of Room 16 only the southern part has been investigated. The floor was made from hard-packed gray clay and was marked with patches of burning. Beside the fragments of crucibles, fragments of MM and LMI pottery, stone tools (chiefly cobbles), and bits of plaster were found. The fragments of crucibles in combination with the burning on the floor suggest that Room 16 was used for bronze-working activities. However, since it has not been completely excavated, the identification of a bronze workshop in this area remains conjectural.

The area is dated on the basis of its pottery to the LMI period.

Some traces of bronze-working at the same site come from a trial trench of 1978<sup>107</sup> (Trench 23B, NE of the modern well). In the fill, to the east of a paved road, a group of fragmentary clay moulds used for bronze tool casting was found.

In this case, the location of a probable workshop cannot be identified before the final publication of the site.



5. Bronze Workshop in Room 7 at Nirou Khani?<sup>108</sup> (fig. 157)

Xanthoudides considered that Room 7 of the villa at Nirou Khani, in which the huge bronze ritual axes were found, was used for bronze-working.

Small, rectangular Room 7 was approached with difficulty through an ante-room (Room 2) and three other, successive paved rooms (Rooms 3, 4, 5), from the large paved Court 1. The room was divided into two parts by means of a low brick wall; in the northern part the bronze axes were found.

The hypothesis of Xanthoudides is mainly based on the presence of carbonized wood and traces of burning on the floor of the room, as well as on the discovery of the four bronze axes. Xanthoudides suggested that the axes were made in this room, because otherwise their presence in so small a room would remain obscure. Small Space 7a was considered as the fireplace of the conjectural workshop since there numerous charcoals were found together with clay vessels blackened from the fire. Under the two axes, a quantity of bluish, unworked schist pieces was found. Two more heaps of the same material were found in the same room. According to Xanthoudides, this material was probably used for the manufacture of pigments, or for another activity relevant to bronze-working.

The evidence presented by Xanthoudides is not sufficiently persuasive. One can observe the following.

a. The four axes do not seem to be unfinished. Consequently, it is likely that they had been stored in this room.

b. If the axes were fixed on wooden bases, then the presence of a great quantity of carbonized wood is justified.

c. In the so-called 'fireplace' only clay vessels were found, clearly unrelated to bronze-working.

d. No trace of tools relevant to bronze-working was found.

e. The heaps of pieces of schist do not seem to have any connection with bronze-working.

The villa at Nirou Khani is dated to the LMIB period.

## 6. Bronze-working at Pyrgos<sup>109</sup>

Some evidence for bronze-working comes from a building at the site of Pyrgos (near Myrtos), especially from layers belonging to Period III of the site (MMII or MMIII). This evidence consists of:

a. two clay crucibles,

b. a piece of a stone mould for the casting of a spearhead.

Despite the fact that a bronze workshop certainly functioned at Pyrgos, at least for Period III, its precise location cannot be identified; the objects mentioned come from debris and not from destruction layers.

## 7. Bronze Workshop at Trypeti<sup>110</sup>

A. Evans published an unfinished bronze figurine which was found at a site near the Harbour Town of Knossos, named 'Trypeti', and suggested that it came from a local bronze workshop. The existence of such a workshop in this area seems to be likely, since there is evidence that a local stone workshop also functioned in the same site.<sup>111</sup> However, there is no evidence for the probable location of this bronze

workshop. The figurine is dated by Evans to the LMIA period.

#### 8. Bronze Workshop in the Cave of Arkalochori<sup>112</sup>

Marinatos, in a paper dealing with the finds from the ritual cave of Arkalochori, suggested that a bronze workshop was located inside the cave. His hypothesis was based on the following observations.

a. One of the swords found in the cave is much shorter, thicker (1 cm. thick) and heavier, than the others. According to Marinatos the swords were originally cast in this form and attained their final length by hammering. Consequently, the thicker and heavier sword probably remained unfinished.

b. Among the finds were some peculiar flat-convex objects, which were probably standard types of raw material, such as ingots.

c. The finds constitute a unity as regards their forms and dating. Consequently, they could not easily be identified only as ritual offerings.

This aspect should be taken into consideration despite the fact that there was no trace of tools for bronze-working nor traces of burning. If we accept that bronze-working took place within the cave, then the following points should be separately emphasized.

a. The function of the above workshop was associated with religious needs, and not with ordinary ones. Probably in this cave a specific deity was adored, under the protection of whom the bronze industry would have lain.

b. The finds show that in this case also the two steps



of bronze-working took place in the same area (presence of the raw material together with unfinished objects which needed hammering).

There is no evidence for a safe dating of the above discussed material because pottery was not found in association with it. Probably, the material coming from the cave should be dated to the LMI period.

### Bronze Workshops Outside Crete

Though copper metallurgy was already practiced in the Aegean area from the last phase of the Neolithic period, the first major step in its development occurred during the second Early Bronze Age period.<sup>113</sup> Traces of bronze-working have been found on Cycladic sites (as Chalandriani in Syros and Avyssos in Paros)<sup>114</sup> from the Early Bronze Age. Also significant is the evidence from Kephala, Keos,<sup>115</sup> dated to the Final Neolithic period.

The evidence from the above sites consisted mainly of pieces of moulds for casting tools, fragments of clay crucibles and the presence of bronze slags, which were found scattered throughout the sites. Nevertheless, the precise location of bronze workshops or bronze-working areas is difficult to define. The discovery of a probable bronze-melting kiln in the EH settlement of Kolonna (Aegina) provided important evidence for the function of organized bronze workshops during the Early Bronze Age.<sup>116</sup> This small kiln in the form of an inverted basket had a kind of perforated floor, through which probably the melting metal ran in a channel; through this channel the metal ran down to

an area where casting in bar-line moulds was done. A part of another conduit which was in association with the kiln, probably served for air-circulation inside the kiln chamber.

#### 1. Bronze-working Areas of Rafina, Attica<sup>117</sup>

Close to the EH settlement of Rafina two large, ovoid cavities in the ground were investigated. The larger one (dim. 4,40 x 3,40 m.) had an almost regular shape with slightly sloping sides and almost horizontal bottom. There was no evidence for a surrounding wall, but on the north side a row of stones sunk to the soil forms a ledge to a height of 0,12-0,15 m. from the bottom of the cavity.

A great number of bronze slags, four clay funnels, a number of pieces belonging to crucibles, and fragments of some four-legged clay pots were found within this cavity. The same fill yielded a great amount of sherds belonging to the Early Helladic period and a number of pieces coming from a clay disk-shaped floor. Some of these pieces had holes and all bear traces of burning. It is likely that the pieces under discussion belonged to the perforated floor of a kiln.

Among the finds coming from the same area there were also some finished bronze objects.

At a distance of 15 m. to the south a second, similar cavity was investigated. On the west side at a height of 0,10 m. from the bottom, was a horizontal slot to the soil, which corresponded to the low stone ledge of the first cavity. The shape and width of this slot agree with the thickness and form of the perforated floor which was found

in pieces in the first cavity.

Theocharis considered that these cavities were used for smelting copper ore for the production of pure metal. His interpretation of the above evidence may be analyzed as follows.

a. The cavities were used as bronze-smelting kilns, since slags, crucibles and funnels were found within them as well as scattered throughout the surrounding area.

b. The low stone ledge and the slot were used for supporting a clay perforated floor. Pieces of such a floor with traces of burning and holes preserved were found in the larger cavity.

c. The crucibles and clay funnels were probably used for decanting the molten metal to the casting moulds. These moulds were probably from clay and consisted of two halves.<sup>118</sup>

d. The percentage of bronze remains in the slags is very low; this probably shows great experience among the bronzesmiths.

e. The discovery of more slags in the fill of the settlement indicates that the houses belonged to the bronzesmiths. Consequently, the residents of the whole settlement in Rafina seem to have been exclusively involved with bronze-working.

f. From the pottery found within the cavities, the Rafina installations are dated to the EHII period (about 2400 to 2300 B.C.).

On the basis of the above evidence, one may conclude the following.

a. Organized bronze workshops existed already from the



Early Bronze Age. We may perhaps infer specialized guilds of craftsmen.

b. The procedure for bronze manufacture in Rafina begins with the smelting, namely with the extraction of pure metal from the ore. This means that a suitable source of copper ore was easily accessible for this site.

c. The discovery of permanent installations which were intended for smelting together with bronze-working tools suggests that in cases in which only the tools have been found one should look for the precise location of the working areas.

## 2. Bronze Workshops at Malthi, Messenia (fig. 158)

On the citadel of Malthi in Messenia two areas provided evidence for metal-working.

### a. Area A43<sup>119</sup>

In a room located in the middle of the citadel (Room A43) some traces of metal-working were found. The east wall of the room ends in a square-like enclosure which was formed by vertically placed slabs; there, ashes and pieces of carbonized wood were found. This structure was probably used as a fireplace.

In the upper levels of the fill, level with the top of the fireplace, some iron blades were found. More or less scattered within the recess which was shaped by the walls of the fireplace, fragmentary, brownish, iron stones were found; these could provide a kind of iron ore. A group of bronze objects found in the adjoining room (Room A41) would be interpreted as scrap bronze for remelting. The iron blades

were probably the last objects which were produced in this workshop.

Evidence for other working activities comes also from the adjoining rooms (A41, 42, 46, 47). These rooms, together with Room A43, constitute a unit of some industrial character. The date of the unit has not been precisely defined. It should be roughly dated to the period from MH to LHIII B.

b. Room B109<sup>120</sup>

Central Room B109 yielded a conical, domed structure with thick clay walls, standing on a stone circular base (diam. 2 m.). The whole domed superstructure was found fallen inside or outside the base. The walls of the dome were 8-10 cm. thick and bore holes from 5-7 cm. in diameter. These holes (7 at least) were arranged in two horizontal rows. Their probable purpose was the creation of a strong air-draught, which would cause a high temperature, suitable for metal-smelting.

Numerous ironstones were found scattered in this area of the citadel. These stones, which contained lead, iron and a small amount of bronze, could be used as a raw material for smelting. The installation belongs to the last part of the MH period.

From the above brief presentation of the Malthi workshops one should notice two main points.

a. The process represented here is smelting.

b. The installations were located in central areas of the settlement.

### 3. Bronze Workshop in Room 100 at Pylos?<sup>121</sup> (fig. 159)

Room 100 lies at the SE end of the NE Building, which was named 'Workshop'.<sup>122</sup> Only the NW and NE walls of this room have been preserved. The floor has not been saved, but a layer of dissolved mud-bricks was found probably used as a substratum for the floor.

At the north corner of the room numerous ivory pieces, scattered in more than one group, were found. To the SW, in a burnt layer, a great number of bronze arrowheads of the barbed type was also found. Probably they were originally in a wooden box (not preserved).

The same layer yielded a large bronze nail found together with a clay sealing.<sup>123</sup>

Blegen and Rawson argued that this room was the specific part of the workshop devoted to the manufacture of small objects from various materials.

According to the Linear B tablets found in the Pylos palace, one of the workshops which one should expect to find in the NE Building is for bronze. Nevertheless, the evidence for such an identification is not strong, since apart from the finished products no other indication relevant to a bronze workshop have been found in this particular room. Consequently the location of such a workshop in Room 100 remains conjectural.

The 'Workshop' is dated to the LHIII B period.

### 4. Bronze-working at Nichoria, Area V<sup>124</sup>

Area V at Nichoria also provided evidence for the identification of a bronze workshop. The lower MHI layer



(L23, FGop, Ggr and probably Fqr) yielded some pieces of bronze slags and numerous pieces of charcoal, which suggest that this deposit comes from an area in which bronze-working took place.

The deposit dated to the end of MHI in L23, FGop, yielded a great amount of ashes and numerous pebbles, and it could be connected with bronze-working, since small bronze pieces, fragments of a crucible and small pieces of slags were found in the same context, on the top of the pit.

At Nichoria tuyeres and bellows were not found. These latter would probably have been made of leather or wood and they have not been preserved. Three stone horseshoe-shaped hearths could have been used as bowl furnaces. They were internally lined with yellow clay and they had an opening on the side from which the wind blows, for letting the natural draught. Such an arrangement provided a much higher temperature for a charcoal layer than an open heap of fuel.

The Nichoria structures belong to the MH period.

##### 5. Bronze Workshop at the Menelaion, Sparta, Mansion 2<sup>125</sup>

On the floor of the east corridor of Mansion 2 a small furnace was found, which without doubt was used by a bronze-smith to cast tools or fittings needed at the site. A heavily fire-blackened nozzle which was found in the leveling fill could well have been used in this furnace.

From the Menelaion also come a fragment of a clay mould, and a bronze band, probably used for strapping the two halves of a bivalve mould.<sup>126</sup>

The furnace is dated to the second half of the 15th century B.C.

A strange fact is that the furnace was located in a corridor and not in a more spacious room. There is not enough evidence for the identification of the precise location of the bronze workshop in this particular area or in an adjoining room.

6. Bronze Workshop in House A  
of A. Irini, Keos<sup>127</sup> (fig. 151)

Ground floor Room 21 of House A of A. Irini yielded a piece of a clay crucible. Other similar pieces were also found in Rooms 19, 20, 25-27. In addition, Room 19 provided a bronze ingot and a mould; a piece of slag came from Room 26.

The dispersal of the material indicates that it fell from a bronze workshop located on the upper floor, over the area of the rooms mentioned. The possibility that the ingot and the crucible were offerings in a shrine located in an adjoining upper floor room should not be excluded. The bronze workshop can be dated to Period VI of Keos (1550-1450 B.C.).

Two points should be noticed.

a. The bronze-working took place indoors on an upper floor room of the principal building of the site.

b. It is likely that bronze-working was connected with ritual purposes.

The discovery of clay tools used in bronze-working and bronze waste material confirm that a bronze industry existed at A. Irini from an earlier period (Period V). The

tools were crucibles and tuyeres.<sup>128</sup>

#### 7. Bronze-working in Phylakopi, Melos<sup>129</sup>

Despite the fact that there is some evidence for bronze-working in Phylakopi, a relevant workshop cannot be safely located in a particular room. The relevant evidence is the following.

a. A clay crucible with slags within it, and a piece of bronze stuck on its interior, coming from House J2.

b. Fragments of two bivalve stone moulds for casting bronze axes.

#### Bronze Workshops in Cyprus

It is well known that Cyprus played an important role in the production and trading of bronze. It is very likely that standard bronze types were imported from Cyprus to Crete and the Mainland, especially during the Late Bronze Age. The Gelidonya wreck provided additional evidence for the trade and for bronze-working in the East Mediterranean area.<sup>130</sup> The ship was probably on its way to Crete or the Greek Mainland. It was loaded with bronze ingots and tools, including an anvil, axes and hammers, adzes, tools for agriculture, a tripod cauldron and a mirror. A set of haematite weights was probably used for weighing the traded and raw materials. The ship may have belonged to an independent smith, who was itinerant and stopped to work where he wanted. Probably he traded the scrap metal also, as indicated by the state of preservation of some of the bronze objects.

The shipwreck is dated around 1200 B.C.



Since relationships between Crete and Cyprus existed, one may refer briefly to some known bronze workshops in Cyprus. Such a reference may be useful for the better understanding of equivalent installations in Crete.

1. Bronze Workshops of Kition, Cyprus<sup>131</sup> (fig. 160)

The industrial sector in the settlement of Kition lies to the west of Temenos A, between the north wall of Temple I and the town wall. There a unit of rooms can be associated with bronze-working. In the western of these rooms (Room 12), on Floor III (which should be dated at the end of the 13th century B.C.) were the remains of channels, as well as pieces of crucibles and tuyeres, thick layers of ashes, and bronze slags. Two cavities with fire-baked walls were probably used as furnaces. The floor of this room also yielded grinders for the grinding of ore. Room 12 was probably unroofed in order to permit the removal of poisonous gases created during the smelting procedure. The bronze workshops were located near the north end of the town for easier removal of the gases by the south winds, which usually blow in these sites.

On Floor III of Room 12 a circular cavity was found full of white ashes, mixed with pieces of bone. The ore in Cyprus is poor in silica; with the addition of bone ash as a fluid material, a larger quantity of metal could be extracted.

Room 12 communicated with some adjoining rooms (13, 14, 15). In Room 14 was a well, obviously used for the needs of the workshop. Quantities of slags have also been found on the floor of this room, as well as traces of furnaces.

On the floor of Room 16 a small furnace or hearth was also found.

Room 12 communicated directly with Temple I. From Temenos A one could enter Workshop 16 and by means of a narrow corridor Rooms 13, 14 and 15, and from there Room 12. It is obvious that there was a direct connection between the bronze industry and the deity, who probably protected the production.

The bronze workshops in Kition are dated around 1200 B.C.

From the above information one may conclude the following.

- a. The workshops were well organized and consisted of a unit of rooms located in a selected place in the settlement.
- b. The main process taking place was smelting.
- c. The bronze industry was directly connected with the religious authority.

## 2. Bronze Workshops at Enkomi, Cyprus<sup>132</sup> (figs. 160, 161)

The evidence from the settlement of Enkomi is much stronger. It comes especially from various layers in Rooms 101, 103, 105, 106 and 108 of the Fortress, from Room 19 in the South Wing and Rooms 77 and 54 in the West Wing of the Building in Level IIA, and finally from Rooms 1, 11, 49 and the whole west sector of the Building in Level IIB.

The evidence used for the identification of bronze workshops is based on the presence of the following features.

- a. Layers of ashes and hearths or fireplaces.
- b. Pits and cavities, sometimes lined, or dressed

with pieces of pottery.

c. A great number of slags usually found within these cavities.

d. Numerous pieces of tuyeres, which were used to create air-draughts for increasing the temperature during smelting.

e. Other auxiliary equipment, which includes grinders and mortars for grinding the ore before smelting.

f. In a few cases small furnaces.

g. Wells for water which was probably used for washing the ore.

h. Clay moulds.

i. Bronze tools related to bronze-working.

In the cases of the Fortress and the Building in Level IIB the workshops were located on the west sector of the buildings, probably for the easier removal of gases by means of the seawind. The bronze workshops seem to have been connected with independent buildings. It is likely that such other buildings would also be located in other parts of the same settlement.

Room I,<sup>133</sup> in the NE corner of the central sector in the Building of Level IIB, was probably a private bronze workshop of the owner of the building. It was important and well constructed, accessible through a narrow corridor on the south facade. The west sector of the building was exclusively devoted to bronze-working. It is likely that this house belonged to a Mycenaean prince or industrialist who established himself in an area where bronze workshops already existed.



Most of the bronze workshops in Enkomi are dated to the LHIIIIB period.

On the basis of the information given, two points should be separately emphasized:

1. The installations were very well organized and extensive, and were located in selected places within the settlement. The whole settlement appears to have an industrial character, mainly because of the bronze-working remains.

2. The installations are mainly connected with smelting.

#### Kilns with Channels in Crete

The kiln type with channels which was found in Zakros<sup>134</sup> is known also at other Minoan sites. At Knossos three kilns of this type have been identified: one was located just outside of the SE corner of the palace, and two more were recently excavated in the Stratigraphical Museum sector. Other kilns belonging to the same type are located at Phaistos (2), H. Triada, Vathypetro, and at Mitropolis near Gortys. A brief description of these kilns follows on the published information.

1. The kiln outside of the SE  
Corner of the Knossos Palace<sup>135</sup>

Almost on the SE corner of the Knossos palace, only a few meters north west of the South East House, a well preserved kiln was found during restoration and cleaning activities. The kiln had a fire pit and four clay-lined

channels rising from it. In the fill within the kiln chamber some lumps thought to be bronze slags were found, together with a lump of stone-like material with a thick whitish-green glaze over it.

The ends of the channels were backed by a small stone wall.

Hood considered that this kiln (dated to the LMII period) was used for faience-making, while N. Platon suggested that it was connected with bronze-working.<sup>136</sup>

## 2. The Kilns of the Stratigraphical Museum Sector at Knossos<sup>137</sup> (fig. 162)

Three more kilns were discovered by Warren during the recent excavations beside the Stratigraphical Museum at Knossos. Two of them belong to the type under discussion, the third one was simple, without channels, of horseshoe form. The kilns are located just to the south of the east-west paved road in this quarter.

West of a LMII house, there was a paving of greenish schist-stone slabs. Within this paving the eastern of the kilns was sunk. It consisted of a kiln chamber, constructed below the ground level, and a stone domed (originally) superstructure lined with mud-plaster on its interior. The stoke-hole was on the south. At the opposite side three channels led upwards from the chamber to a back wall. They were plastered and a part of the vertical baking plaster was preserved at the northern end of the eastern channel. There was not enough evidence to show if these channels were covered. The total length of the fuel chamber and channels is 1,80 m.

During LMI this kiln was replaced by a larger one, immediately to the west, of a similar construction but with five longer channels. The east wall of the chamber was built over a part of the chamber and channels of the previous kiln. The curving vault of the kiln was well preserved at the west side. The length of the fuel chamber and channels was 2,94 m.

The third kiln did not have channels and was contemporary with the second, lying to its SW.

Kilns 2 and 3 contained a layer of fine white powder found on the bottom of the chamber, in Kiln 2 mixed with and adhering to much coarse pottery. This white powder was analyzed and was shown to be  $\text{CaCO}_3$  calcite. Limestone blocks or pure  $\text{CaCO}_3$  calcite would be reduced to lime powder by burning. This powder under the influence of the air-moisture turns to  $\text{CaCO}_3$  calcite.

On the basis of this analysis Warren came to the conclusion that the Knossos kilns were used for the manufacture of fine white lime powder, which was the basic component of the Minoan white plaster of which the wall paintings were made. The presence of some pottery within the kiln chamber remains obscure. Probably, according to Warren, it fell in the chamber at the time of the destruction and the powder adhered to some pottery pieces in the hydration and recarbonization process.

The above interpretation, mainly based on the analysis of the material found within the chambers of the kilns, is persuasive enough. Nevertheless, one could express the following questions (apart from the presence of the pottery already mentioned).



a. Why they needed such complex structures for producing lime? The lime kilns till today appear to be simpler in form and function.

b. Was the analyzed material (which undoubtedly was calcite) a result of the process of manufacture itself or the result of accidental production from burnt limestones which probably fell within the kilns at the moment of their final destruction?

Anyway, the Knossos kilns constitute the best examples of this kiln type, and their final publication will offer important information for the study of the Minoan kilns.

From the above information, two important points should be noticed.

a. The kilns were in the middle of the settlement, beside residential quarters. It is probable that their operation troubled the residents.

b. The kilns constitute a clear industrial area at least during the second period (of kilns 2 and 3). This points to a well organized industry.

### 3. The Kiln of Court 90 in the Phaistos Palace<sup>138</sup> (fig. 163)

In Court 90 at Phaistos the remains of a kiln belonging to the same type were found. The kiln, constructed upon a layer of earth, was of horseshoe-shape. It preserves its mouth and part of its east walls, built from rough stones, lined by fired clay. The length of the kiln at the north side was 2,80 m. and at the east side 2 m. Its stoke-hole was on the north side. Channels, if they originally existed, have not been preserved and they probably were on the south

side of the kiln.

Pernier and Banti considered that the kiln was used for bronze-working and they referred to three successive layers of molten metal. The kiln is probably dated to the LMI period.

Only a few points can be noted. The kiln was almost completely ruined and its conjectural reconstruction cannot offer any new information. Moreover, the material found within the chamber was never analyzed and its identification with molten bronze is also hypothetical. Was this material similar to that coming from H. Triada's kiln?<sup>139</sup>

#### 4. The Kiln beside the West Ramp at Phaistos<sup>140</sup>

A small kiln discovered beside the ramp which led to the West Court of the Phaistos palace belongs to the type under discussion. It is horseshoe-shaped with an internal diameter of 2 m. and a length of 1,40 m. It had only three channels, separated by two, not absolutely straight, low partitions. The chamber was elliptical in form and its bottom lies on a level much lower than the channels' level. The whole structure was on strongly sloping ground with a difference of three meters between the bottom and top levels. The stoke-hole of the kiln has not been preserved. No trace of a perforated floor was found. The walls and the bottom of the kiln chamber were lined by at least two layers of fired clay.

The total length of the kiln is 5,5 m. and it is dated to the neopalatial period.

From the above information one point is significant

for understanding the method of operation of this kiln type: the strong slope of the structure excludes the possibility that a perforated floor could be located over the channels.

#### 5. The Hagia Triada Kiln<sup>141</sup> (fig. 163)

The Hagia Triada kiln is the largest of the known kilns belonging to the type under discussion. Its total length is 9 m. approximately, and if one adds a projection of the east wall of the chamber to the north, then it reaches 10,5 m. The orientation of the kiln is from north to south, with the chamber at the northern part and the channels at the south. Its form is semi-elliptical and from the south side of its chamber start five channels ascending up the slope, from north to south. The channels' ends are backed by an irregular wall, which was 5 m. long (only 3 m. have been preserved). The low partitions which separate the channels have different widths. The eastern channel was well preserved and 0,80 m. deep from the top of the external partition. All the channels were lined by successive layers of fired clay. The partition walls were based on a brick-made structure and were also constructed of mud-bricks.

The elliptical chamber consisted of two arched walls, separated by an opening in the middle of the north side. The eastern wall is well preserved to a height of 2 m. approximately. The whole structure was lined by a thick layer of fired clay.

Between the surrounding area and the east wall of the chamber there were three steps. It is likely that the kiln



was roofed by two different roofs on two levels, since a dome could not easily cover such a great structure without a central supporting beam.

The bottom and the walls of the channels were covered by a greenish material. The same material covered a part of the chamber walls, while numerous similar pieces were found in the fill of the area. The chemical analysis of this particular material showed that it was vitrified clay, which is usually produced under the influence of an especially high temperature.

At the northern end of the eastern channel, below the fallen mud-bricks, a zone of baked clay has been preserved. This zone was considered by the excavators as part of a perforated floor. Moreover, within the kiln chamber, in a compact whitish layer, numerous sherds were found, some of which were overfired or badly fired.<sup>142</sup>

Levi and Laviosa, who published the kiln, considered that it was used for making pottery. This aspect is based on the discovery of the overfired sherds and other pottery and on the presence of the vitrified clay which cover the walls and the channels of the kiln. According to this view, the vessels were situated upon a perforated floor located over the part with the channels, and the chamber was only used for fuel. The hot air produced would pass through the channels and would bake the pottery, located on the perforated floor. The opening on the south side of the chamber was probably used as a stoke-hole, while the steps to the east were probably used for repairs to the mud-brick dome.

With regard to the above interpretation one may make

the following points.

a. The pieces analyzed which showed vitrified clay were not part of the intended product. It is more likely that they are pieces of the lining which covered the interior surfaces of the kiln walls, and they have been vitrified during its functioning. It should be added here that in one part of the chamber's walls, between two layers of such vitrified material, there was an area of simply fired lining.

b. Overfired or badly fired sherds have not been published in detail and not illustrated despite the fact that they have been mentioned. Moreover, they were found, according to the excavators, within the kiln chamber and not in the area of the channels over which the firing chamber has been conjecturally located.

c. It has been mentioned that a whitish compact layer was found in the kiln chamber. Did this material have any similarity with the fine white powder found in the Knossos kilns?

Levi and Laviosa refer also to some evidence for the identification of another kiln in the same area, about 50 m. to the SW of the kiln described.<sup>143</sup>

## 6. The Kiln at Vathypetro<sup>144</sup>

The kiln at Vathypetro is located in a stone paved area slightly sloping towards the east, the dimensions of which are 15 x 30 m. It consisted of five stone parallel channels of square section which were lined with clay fired during the kiln's function. The width of the channels was 0,30 m., their depth reached 0,17 m., and their length 4,20 m. They

were spaced at 0,45 m. from each other. To the north of this area extends a large area like an elliptical room, where burnt earth and fragments of pots were found, some of which were burnt.

On the west side ran a well built stone channel which surrounds the kiln's structure. It has been preserved to a length of 8,50 m., is 0,50 m. wide and 0,35 m. deep, and was open on the top. The chamber of the kiln was completely ruined. The kiln is dated to the LMIA period.

Maninatos considered that the kiln was used for making pottery, since the same place yielded additional evidence for a potter's workshop.

The only new item in the case of the Vathypetro kiln is the long stone channel which surrounds the kiln. Marinatos considered that it had been used for the removal of fumes from the interior of the kiln chamber, though in the other cases described, this work was conjecturally done by the parallel channels.

#### 7. The Kiln at Mitropolis near Gortys<sup>145</sup>

During the excavation of a small shrine in the area of Mitropolis near Gortys the remains of a small kiln, probably belonging to the type under discussion, were identified by Alexiou. It has been mentioned that the kiln had plastered channels, similar to those of the Vathypetro and Knossos kilns. This particular kiln was not excavated further, but this brief reference classifies it in the type under discussion.



## Discussion of the Channelled Kilns

Of the nine specimens of kilns belonging to the channelled type, five have been described in detail giving a complete picture of their general form. On the other hand, different interpretations regarding their function have been given by scholars. These interpretations are the following, in brief.

1. N. Platon considered that the Zakros kiln was used for bronze-melting. This view is based on the discovery of some lumps considered by him as bronze slags, as well as on the existence of the channels, which would conjecturally serve the creation of draughts for increasing the temperature to the melting point of bronze.

2. Warren considered that the Knossos kilns were used for producing lime, which was the main component of the plaster used for wall-painting. His view is mainly based on the results of the chemical analysis of the contents of one kiln.

3. Levi and Laviosa believed that the Hagia Triada kiln was used for pottery making. This interpretation is based on the presence of overfired and badly fired pottery and on the chemical analysis of lumps found in this kiln, which confirmed that these were pieces of vitrified clay.

On the above interpretations one should note the following.

1. The first interpretation, that the kilns were used for melting metal, is not sufficiently persuasive. Tylecote<sup>146</sup> described types of metal kilns in the British Isles;

these types are completely different, as regards form and size, from the type under discussion. The main difficulty is the size of the kiln chamber, which appears to be very large for such a function. Moreover, the pieces considered 'slags' have not yet been analyzed, and whether they had any connection with bronze-working remains uncertain.

2. The second view, despite the fact that it is based on the results of chemical analysis, also has a weak point; why was such a good structure needed for producing lime, since it is well known that lime, even today, is produced in simpler installations?

3. The third interpretation is mainly based on the results of a chemical analysis of material which was not part of the intended product. Moreover, pottery kilns have been found in a number of Minoan sites, and their form appears to be different. The main principle of their operation is that the fire is usually located just under the firing chamber. In the case of H. Triada's kiln a perforated floor has been conjecturally located over the part with the channels, far from the firing chamber. Such an arrangement is unusual and not persuasive. In addition, one of the two Phaistos specimens excludes the possibility that a perforated floor was located over the channelled part of the kiln. On the other hand, it has been mentioned that overfired and badly fired pottery came from the fire-chamber of the H. Triada kiln. A more detailed publication of this particular material is needed to prove if it actually was waste material coming from the process of pottery manufacture.

On the basis of the above discussion, it seems likely

that the kiln type under discussion was mainly used for pottery making, especially during the LMI period. Nevertheless, it seems more likely that a perforated floor would probably have been located over the fire-chamber and not over the channelled part of the kiln. The channels were probably intended for the gradual increase of the temperature in the firing chamber, in order to avoid cracks on the surface of the vases. The possibility that the same kilns had been used for another kind of production should not be excluded, especially since there is the case of the Knossos kilns.

This type of kiln should be dated from the MMIII period (Zakros kiln) to LMIB and LMII periods (Knossos, sector of Stratigraphical Museum, SE palace corner). The simpler types of pottery kilns, without channels, are not easily datable. On the basis of the few safely dated specimens, this simpler type (without channels) was mainly developed during the LMIII period.<sup>147</sup>

#### General Discussion of Bronze Workshops

As has already been mentioned, only scattered evidence for bronze-working comes from Zakros. Nevertheless, the evidence from other Minoan and Mycenaean sites is also weak. Usually, the evidence used for the identification of bronze workshops includes the following finds:

- a. moulds for casting bronze objects,
- b. pieces of clay crucibles and tuyeres,
- c. bronze tools used for metal-working,
- d. finished products in quantities, and
- e. in a few cases, remains of small furnaces.



From the comparative study of the bronze workshops in and outside Crete one can draw the following conclusions.

1. In Crete the evidence is usually connected with bronze-melting and not smelting, which seems to have taken place in areas in which the ore was exploited, probably outside Crete (e.g., in Cyprus). It is well known that during the Late Bronze Age copper came to Crete in the form of standard ingot types (H. Triada, Zakros).

2. Usually, the first and second stages of the process of bronze-working, namely the melting and the hammering, took place in the same area (Unexplored Mansion, Arkalochori). For Zakros, it has been suggested that the bronze smithies were inside the place, but there is no evidence that the melting took place also in the same areas. There was no trace of crucibles and moulds within the palace.

3. The bronze workshops were well organized and usually located in central places in the settlements, probably in order to be more easily controlled by the authorities (Unexplored Mansion, Mallia, Pylos, House A of A. Irini, Enkomi). Probably, the situation was similar in Zakros, since bronze objects and raw materials were found concentrated within the palace.

4. In some cases, connections between religious authorities and bronze industries have been observed (House A of A. Irini, Nirou Khani, Arkalochori, Kition in Cyprus). Something similar could also be suggested for Zakros since the West Wing of the palace, from where most of the bronze material came, includes mainly religious apartments.

5. Only in a few cases (mainly in sites outside of

Crete) does the evidence point to independent bronzesmiths (Gelidonya wreck) or to guilds of craftsmen dealing with bronze-working (Rafina, Enkomi). Of the Minoan sites, only Gournia provided some evidence for independent bronzesmiths. However, in this case also, it is likely that the distribution of the raw material was made by the central authority.

### C. Ivory Workshops (Category A, Type 'd')

#### Crete

The evidence for the identification of ivory workshops in Minoan sites is very weak. The most probable ivory workshop was found at Knossos, while two more sites yielded scattered evidence for ivory-working.

#### 1. Ivory Workshop beside the Royal Road, Knossos<sup>148</sup>

On the north side of the Royal Road at Knossos, in a building badly ruined because of LMIII stone quarrying, a great number of ivory pieces mixed with a quantity of pottery was found, suggesting that an ivory workshop was located there. It is probable that the work area was on the upper floor, directly over the SE corner of the house and was much the same proportions as the corresponding room on the ground floor (about 5 m<sup>2</sup>).<sup>149</sup>

This material does not include large pieces of

unworked ivory. Most of the pieces are finished plaques of various shapes, and waste material: very small flakes and larger pieces which bear traces of unsuccessful trimming. The small pieces were probably at one stage in their working process. Perhaps some of the pieces came from finished objects, such as an ivory comb and a foot belonging to a large figurine. Among the other finds were nine small bronze gravers, fine-bladed chisels and scribes, which could be identified with an engraver's tool-kit.<sup>150</sup>

The workshop is dated to the LMIB period.

2. Ivory Workshop in Block X  
at Palaikastro(?)<sup>151</sup> (fig. 164)

A piece from the central part of an ivory tusk in association with ivory relief plaques found in adjoining rooms of the same block (Block X) at Palaikastro suggests that an ivory workshop was probably located in this area. The material probably fell from the upper floor, since it was found scattered in ground floor Rooms 10, 15, 16 and 17. These rooms were cellars, with the exception of Area 15, which was a staircase area, and belong to the first phase of the neopalatial building. Despite the fact that ivory working of some kind seems to have taken place on the upper floor of this block, a precise location of the workshop is not possible without additional evidence. The layer in which the ivories were found is dated to the LMIB period.

3. Ivory Workshop at Mallia?  
Room IV, 10 of the Palace<sup>152</sup>

In a small oblong area in Quarter IV of the Mallia



palace, some remains of masonry work were found. On the south wall of the room there were shelves and niches made of mud-bricks. Similar structures were formed on the east and west walls of the same room. The small size of the room and the shelves and niches indicate storage rather than working activities.

### Ivory Workshops Outside Crete

#### 1. Ivory Workshop in the 'Citadel House' of Mycenae<sup>153</sup>

The so-called 'Citadel House' is a building with religious significance lying in the lower town, inside the Citadel of Mycenae. In the fill of one room a fair number of partly worked ivory pieces were found together with an unworked piece in the form of a cube with smooth surfaces. The same fill yielded ivory plaques used probably as inlays, and a piece of a large ivory pyxis. Four vessels were found on the floor of the same room. Some more finished ivory products, probably made in the same workshop, were found scattered throughout the building.

The room in which the ivories were found was considered by the excavator as a shrine, since in one corner an idol standing on a base was found. Near this base a great number of glass-paste beads, probably belonging to a necklace, was also found. If the same room had been used as a shrine, as well as for housing an ivory workshop, then this suggests that there was a direct connection between ivory-working and religious activities.

The probable workshop is dated to the LHIIIB period.

2. Ivory Workshop in the East Wing  
of the Mycenae Palace<sup>154</sup> (fig. 154)

As has already been described, a workshop dealing with jewellery manufacture was located in one of the rooms of the East Wing of the Mycenae palace. In the fill of the same workshop numerous ivory flakes were also found, suggesting that this workshop also dealt with ivory-working. Probably the workshop was located in an upper floor room.

It is dated to the LHIIIIB period.

3. Ivory Workshop in the  
House of the Shields<sup>155</sup> (fig. 164)

The west and north rooms of the House of the Shields, which lies outside the Mycenae Citadel, yielded numerous small ivory objects, pieces and flakes, suggesting that an ivory workshop was located somewhere around these areas. In the same fill various relief works in wood, numerous stone vases and faience objects were also found.

All the finds were in a layer of soft black earth and carbonized and decayed matter which covered the north as well as the west room, suggesting that they had fallen from upstairs. Most of the ivories were found concentrated on the south side of the room.

Among the ivory pieces there were worked plaques representing columns. On some pieces, which had the form of eight-figured shields, are visible plain incisions which were probably intended to be carved. Other pieces bear irregular, almost rectangular hollows, for setting inlays. On some small disks the back face remained completely unworked. On plaques which have the form of ivy leaves,

the motive is represented by incised lines, while elsewhere the same motive is represented in low relief. The most characteristic pieces are some plaques in the form of helmets some of which seem to be finished while others are unfinished, as certain incisions used as guides for the carving show. Among the ivory pieces there are numerous flakes, waste products of the working process.

The workshop belongs to the LHIIIIB period.

#### 4. Ivory Workshop in the House of the Sphinxes<sup>156</sup> (fig. 164)

In ground floor Rooms 1, 2 and 4, in the northern part of the House of Sphinxes at Mycenae, numerous ivory pieces were found. Obviously, the material fell from an upper floor room and was scattered in different ground floor rooms.

The material consisted of worked and partly worked pieces. The backs of many circular plaques were completely unworked, while other rectangular plaques bear only incisions which were probably intended to be finally carved. On some small disks, the traces of some original incisions at the periphery are even now visible. One can follow the different steps of the working process in some inlays which had the form of papyrus-like flowers. Thin parallel incisions on pieces belonging to plaques, were probably used as guides for a decorative motive. Other rectangular plaques were completely unworked on all sides. On one piece belonging to a small plaque, the carving seems to be unfinished. Finally, most characteristic are the inlays representing columns with separate column capitals. The stem of the columns is roughly six-faceted, and some incisions probably



used as guides for the measurements have never been removed.

The workshop of the House of the Sphinxes is dated to the LHIII B period.

5. Ivory Workshop in Thebes  
(14 Oedipus Str. Area)<sup>157</sup> (fig. 154)

It is likely that in the Kadmeion at Thebes in the area excavated beside Oedipus Str., an ivory workshop functioned. The variety which is represented by the ivories coming from Thebes, as regards their sizes and forms, suggests that there was a local workshop, probably located in a place near the jewellery workshop, which has been described already.<sup>158</sup>

Despite the fact that there is no evidence for the precise location of this workshop, one could conjecturally locate it to the north or south of the jewellery workshop, since in this area the majority of the ivory pieces was found.

This hypothetical workshop is also dated to the LHIII B period.

6. Ivory Workshop in Room 100 at Pylos<sup>159</sup> (fig. 159)

We have already dealt with a probable bronze workshop located in Room 100 of the 'NE Workshop' in Pylos. In the north corner of the room, in a space of 1,30 x 1,15 m., numerous ivory pieces were found scattered in various groups. All the pieces were thin and burnt, some of them had incised motives, such as spirals and concentric circles, and some of them seem to have been coloured. The excavators believe that this room was also used for ivory-working.

Room 100 is dated to the LHIIIIB period.

### General Discussion of Ivory Workshops

Only one ivory workshop has been safely identified in Crete. This is the workshop beside the Royal Road at Knossos. The information given for the present is insufficient to give a good picture of its organization and function. Nevertheless, the case of the Royal Road workshop seems to be different from that of the workshop in Room XLIV at Zakros. In Knossos the material is much greater and is uniform, suggesting a workshop dealing exclusively with ivory-working. On the other hand, the Zakros workshop resembles more some Mainland workshops, such as the workshop on the East Wing of the Mycenae palace, or the workshop of Oedipus Str. in Thebes, where small artifacts and jewels from various materials were made in the same area.

The existence of two workshops in two different houses located outside the Mycenae Citadel proves that specialized, well organized, ivory workshops functioned outside of the Mycenaean palaces. However, were those workshops private? The rest of the contents from the same houses lead to the opposite conclusion. It is probable that these particular buildings were intended to house specialized workshops, which were probably controlled by the central authority.

Nevertheless, it should not be excluded that these houses belonged to certain specific officers of the palace, whose work was the supervision of, or the personal participation in, the ivory-working.

Only a few words can be added on the organization of

the ivory workshops. In most cases they were probably housed on the upper floor of the buildings, probably equipped with wooden furniture (tables, shelves, benches, etc.). Certainly, they should have been spacious and well lit. The evidence regarding the tools used is even weaker. Nine small gravers, fine-bladed chisels and scribers constituted the tool-kit in the Knossos workshop. Elsewhere, some obsidian blades found in association with the ivory pieces could have been used for carving. Of the finds coming from the workshops, only some obsidian blades could probably be used for ivory-carving. Nevertheless, in some cases, traces found on the surface of some finished products can indicate the type of tool used. On some pieces traces created by chisels and small saws are visible. In other cases traces of rubbing for polishing, probably created by pumice, are discernible. Some traces belong to tools used for measurements, such as compasses and rulers. Certainly some delicate tools for carving and others for perforating were also employed. The use of carpentry tools in ivory-working is conjectural and is mainly based on later written sources.

#### D. Faience Workshops (Category A, Type 'd')

Only a few words may be said on the location of faience workshops in the Minoan sites. In Knossos some unfinished pieces of unfired, premolded faience material were found together with finished products, in the fill of the Temple



Repositories. Probably a faience workshop was located on the upper floor in this area, but its precise location cannot be identified.<sup>160</sup> A steatite mould coming from the NW Treasury House in Knossos suggests that a faience workshop was probably located in this building, but once again the relevant information given is insufficient.<sup>161</sup> K. Foster compared this probable workshop with the other probable one from Zakros,<sup>162</sup> but the specific comparative features are secondary, while the reconstruction given seems to be completely speculative.<sup>163</sup> Two more areas at Knossos were considered as probable faience workshops: the north side of the Royal Road, and an area near the SE House<sup>164</sup> (fig. 165).

Evidence for the identification of faience workshops on the Mainland<sup>165</sup> is mainly based on the discovery of moulds probably used for faience-making or glass-paste jewellery manufacture. Some of the Theban workshops for the manufacture of jewellery described above,<sup>166</sup> probably dealt also with faience-making. Nevertheless, no workshop exclusively devoted to faience manufacture has been identified.

#### E. Glass-Paste Workshops (Category A, Type 'd')

The indications for the identification of glass-paste workshops in Crete as well as on the Mainland are only a few, and they could be summarized as follows.

1. Glass-Paste Workshop to the North  
of the Royal Road at Knossos<sup>167</sup>

In a LMIB deposit to the north of the Royal Road of Knossos, waste glass material and some lumps of blue frit were found together with finished products from the same material and faience objects. The material suggests local working; however, the precise location of a relevant workshop is not possible for the present before the final publication of the site.

2. Glass-Paste Workshop in  
Block S at Palaikastro<sup>168</sup>

In Room 5 of Block S at Palaikastro some objects found suggest the identification of a workshop which dealt with jewellery manufacture from various stones and glass-paste. The finds include half of a steatite mould, two beads, of which one was of glass-paste, a seal-cylinder, and a celt of breccia. The mould was probably used for the manufacture of glass-paste jewellery.

The layer which contained the material described is probably dated to the LMIB period.

3. Workshop in a House inside  
the Mycenae Citadel<sup>169</sup>

It has been suggested that a stone mould which was found in a house located to the left of the Lion Gate at Mycenae, comes from a workshop dealing especially with glass-paste. The existence of such a workshop at Mycenae seems to be certain, since four more stone moulds come from different spots of the same site.

## General Discussion of Faience and Glass-paste Workshops

The evidence for the identification of faience and glass-paste workshops in Crete and on the Mainland during the Late Bronze Age is not strong.

In most cases the evidence comes from areas where other workshops have been identified concerned with the manufacture of jewellery from various materials (Room XLIV at Zakros, Theban jewellery workshops, Block S at Palaikastro). In other cases the existence of such workshops has been indicated only by the discovery of moulds, probably used for the manufacture of jewellery from the materials under discussion (Workshop in the Mycenae Citadel and workshop in the 'NW Treasury House' of Knossos). Permanent installations for the manufacture of objects from these particular materials (such as faience or glass-paste kilns) have not yet been identified.

### F. Perfume Workshops (Category C, Type 'a')

#### Crete

Apart from Zakros, there is only scattered evidence for a perfume industry on Minoan sites. This evidence is almost exclusively based on the discovery of a number of fireboxes in a particular area. Some concentration of fireboxes has been observed at Mallia and Palaikastro.<sup>171</sup>



Nevertheless, the precise location of probable perfume workshops at the above sites cannot be made.

#### Outside Crete

The identification of perfume workshops on the Mainland has been extensively discussed by C. Shelmerdine, who dealt mainly with the Pylos industry.

#### 1. Perfume Workshop in the 'House of the Oil Merchant' at Mycenae<sup>172</sup> (fig. 164)

The 'House of the Oil Merchant' is one of the buildings excavated beside the modern road which leads to the Mycenae Citadel. It lies on the south of Grave Circle B. The basements of this house consisted of a corridor with several rooms opening off it. At the northern end of the corridor was a room (Room 1) in which eleven pithoi were found situated along the two long walls and the eastern wall. The jars were supported by low brick-walls. A tablet found in this room refers to production of a perfume workshop. In the middle of the floor was a depression, probably for trapping spilled oil. An installation for heating under one of the pithoi guided Palmer and Marinatos to identify the whole building as a perfume workshop.

Palmer considered<sup>173</sup> that this particular installation was a kind of 'bain-marie', the pithos being used as a container. According to Shelmerdine<sup>174</sup> this vase is completely unsuitable for the preparation of perfumes. In addition, an equivalent installation was not observed for any of the other ten pithoi. The space is very small, without good lighting and satisfactory ventilation and is uncomfortable

for use as a perfume workshop. Moreover, the tablet refers to a finished product and not to working activity.

For the above reasons, with Shelmerdine, an identification of a perfume workshop in this room seems to be improbable.

## 2. Perfume Workshop in Court 47 at Pylos<sup>175</sup> (fig. 159)

Court 42 and Court 47 were formed after the addition of some walls to the original NE facade of the Pylos palace, during the LHIII B period. Before the construction of these walls there was on this side a main entrance to the palace. During the final period of the palace, the addition of the walls cut off all access on this side. The succession of walls shows that the 'NE Workshop' was also a late addition on this side of the palace.

The NE wall of Courts 42 and 47 is continuous, while the cross-wall which separates the two courts was probably added at a subsequent time. Both of the courts had plastered walls and stucco paving.

Court 42 contained a great amount of pottery. The coarse ware includes small jars, a flat pan and a basin, as well as several tripod cooking pots. Among the finds of fine ware are some stirrup jars. The contents of this court suggest rather a kitchen.

Court 47 likewise contained a great deal of pottery. A large part of the total consisted of stirrup jars: twelve could be reconstructed and fragments of at least twenty-three more were also found. The pithoi are numerous and other coarse ware shapes include braziers, tripod vessels, scoops

and dippers, and basins. The pottery includes also a quantity of fine ware, mostly kylikes, cups and bowls. Two holes in the ground communicate with the drain, which continues on SE of Court 42, but there is no obvious source of water. A number of holes in the stucco floor suggests an fence or a shelter from the sun, though the excavators suggested a loom.

According to Shelmerdine it seems reasonable to identify Court 47 as a workshop, and the quantities of stirrup jars show a connection with oil. The clay vessels found could have been used for a perfume industry, while pieces of flint and obsidian, which were also found in the same fill, could have been used as tools. An enclosed court, open to the sky, would be a suitable place for building fires, while a probable shelter would serve for cold steeping. Other holes could be used for setting poles which probably supported racks for keeping perfume components and equipment.

Courts 42 and 47 are dated to the end of the LMIIIB period.

#### General Discussion of Perfume Workshops

Clearly, between the Zakros perfume workshop in Room XLVII and the probable perfume workshop in Court 47 of Pylos, there are only a few common features. The main differences could be summarized in the following points.

a. The identification of the Zakros workshop was based on the discovery of a number of specialized pots, for which use in perfume-making has been suggested. Equivalent pots



have not been found on the Mainland.

b. Room XLVII at Zakros lies in an area which was probably roofed, within the South Wing of the palace, while Court 47 was open to the sky, outside the facade of the Pylos one.

The reconstruction of the Pylos workshop is completely conjectural, as Shelmerdine observed,<sup>176</sup> and was based mainly on the information drawn from the palace tablets. On the other hand, in Zakros a workshop of some kind should be identified in Room XLVII, because otherwise the concentration of the peculiar 'fireboxes' in this particular area would remain without a satisfactory interpretation. One matter remains uncertain: whether these particular objects had actually been used for perfume-making.

Despite the above differences, two main points regarding the workshops' location should be noted.

a. Both of them were in a direct connection with the palace, and probably were directly controlled by the central authority.

b. Both of them adjoined other types of workshops.

#### G. Pottery Workshops (Category A, Type 'b')

If one excepts the kiln which, according to one interpretation, could have been used for pottery making during the MMIII period, traces of pottery workshops have not been found at Zakros. Here, we give a brief review of the

bibliography dealing with pottery workshops in Crete and on the Mainland during the Bronze Age.

There are many general descriptions of pottery manufacture, which can be useful for the identification and better understanding of the real pottery workshops. One may refer to the relevant chapter in the monumental work of Singer, Holmyard and Hall, A History of Technology.<sup>177</sup>

For Minoan pottery manufacture worthy of note is a specific study by E. Fiandra and P. Pelagatti,<sup>178</sup> which follows all the steps of the process of manufacture, and a relevant reference in Ph. Betancourt's recent book on the Minoan pottery.<sup>179</sup> For the traditional method of manufacturing pithoi in modern Crete, there are numerous studies among which one can refer to the work of R. Hampe and A. Winter.<sup>180</sup>

For organized pottery workshops there is not much evidence. For the EM period the evidence of a potter's workshop in Myrtos (Fournou Korifi)<sup>181</sup> is important, while for the LM period a pottery workshop has been located at Vathy-petro.<sup>182</sup> A site in which extensive pottery making took place has recently been investigated at Silamos, near Archanes.<sup>183</sup> On the Mainland a pottery workshop has been identified in House B at Zygouries.<sup>184</sup>

C. Davaras has published studies on pottery kilns,<sup>185</sup> as have D. Levi and C. Laviosa in their recent publication of the Hagia Triada kiln.<sup>186</sup>

To the list of the Cretan kilns included in these studies one could add three more kilns from Mallia,<sup>187</sup> and one at least from Silamos<sup>188</sup> near Archanes. To the Mainland kilns, one could add a kiln found at Agios Mamas near

Olynthos, dated to the EH period,<sup>189</sup> two MH kilns from Lerna,<sup>190</sup> and the MH kilns recently found on the Aetos hill near the Menelaion of Sparta.<sup>191</sup>

A specific study of potter's wheels comes from S. Xanthoudides, who published twelve specimens from the old excavations in Crete.<sup>192</sup> Finally, one may mention two more workshops dealing with clay, engaged in more specific production: the first one, near Houses A and B of Quarter Mu at Mallia,<sup>193</sup> dealt with relief decorated clay vessels, and the second is a possible workshop for terracottas,<sup>194</sup> identified in the EH settlement of Lithares, Boeotia.

#### H. Workshops for Pigments (Category A, Type 'g')

The evidence for the identification of workshops dealing with pigments in Crete is very weak. Apart from the conjectural working areas of Zakros, only Room 7 at Nirou Khani provided some evidence for the manufacture of pigments.<sup>195</sup> But the identification of a specific workshop in this area also remains conjectural. Some palettes and an object probably used as a colour-box from Gournia<sup>196</sup> suggest the existence of a specific working area in this site, though its location is uncertain.

Workshops dealing with wall-painting have not been identified in Crete, since painters would work, with their equipment in the rooms needing decoration. Nevertheless, in A. Irini on Keos<sup>197</sup> the eastern rooms of Area L, which



is located in the north central part of the settlement, provided some evidence for such an identification. This consisted of some small pieces of natural pigments, some murex shells broken into fragments, a number of bowls and basins, which contained a residue of white plaster, and some objects of stucco. The above evidence suggests a wall-painters' quarter or atelier.

#### I. Textile Workshops (Category A, Type 'e')

The identification of textile workshops in Minoan sites is mainly based on the discovery of loomweights in the destruction layers of the buildings. Loomweights of various types are usually found scattered throughout the whole settlement, indicating that weaving was mainly one of the household, small-scale activities. On the other hand, the concentration of a great number of loomweights in a particular area could indicate two different things.

a. The existence of one or more than one loom, probably used for weaving activities on a large scale.

b. The storage of loomweights probably in boxes or bags to be used in the future.

There follows a brief description of areas in which such a concentration has been found.

##### 1. The 'Loom-Weight Deposit' at Knossos<sup>198</sup> (fig. 166)

On the east slope of the Knossos hill, to the north

of the Domestic Quarter, was a group of deep basement rooms. In one of them, under its last floor and over the relics of the basement, was a deposit which yielded a great amount of pottery and over four-hundred loomweights. They were all pear-shaped and flattened more than those of the usual LM type. A. Evans considered that this area belonged to a women's apartment and noted that looms with suspended weights supply a sign in the Linear A system. The 'Loom-Weight Deposit' was dated by him to the MMII period.<sup>199</sup>

2. Loomweights in the Cult Room Basement in the Stratigraphical Museum Site at Knossos<sup>200</sup> (fig. 166)

The fill of the 'Cult Room Basement' of the North House yielded, together with a large quantity of fine pottery, a collection of seventy-nine vertical grooved, spherical loomweights. The majority come from the eastern part of the room, with a great concentration over a limestone block, the remainder spread south and west of it. Some of them were found at a high level of the fill, which showed that they had fallen from upstairs during the destruction of the building. They vary in weight from 100-670 gr. and do not seem to form a group, or separate groups, belonging to one or more looms. Seventy of them were between 100-280 gr. but this range seems very large for a single loom. Warren considered that their final use was perhaps for weaving a sacred robe or was otherwise connected with the ritual vessels found in the same fill. He believed that in the case of the 'Loom-weights Deposit' the numerous loomweights could also be associated with some ritual objects found in the same area.

The room under discussion belongs to the LMIB period.

3. Weaving Area in a House in the Knossos Area (in the Staphylakis Field)<sup>201</sup>

From an LMI house in the Knossos area (in Staphylakis field) comes a large collection of loomweights (over 50) found on the floor of a ground floor room. It is more likely that the loomweights were in storage than that they belonged to a loom on the spot.

4. Weaving Areas in Block E at Palaikastro<sup>202</sup>

The house which consisted of Rooms 36-43 in Block E, yielded two very large collections of loomweights: the first consisted of spherical perforated clay pieces and the second of seventy-one cuboid loomweights with four parallel suspension holes. Some of them had a circular sealing, representing an animal. Unfortunately, more detailed information for the precise find place of these two loomweight groups was not given.

The house is probably dated to the LMIB period.<sup>203</sup>

5. Weaving Area in House Fd at Gournia<sup>204</sup>

Room 18 of House Fd at Gournia provided evidence for the identification of at least one loom. Along the south wall of the room a horizontal black stain on the earth 0,35 m. above the floor, indicated the existence of a wooden structure. Just over it, fourteen loomweights (13 of clay and 1 of stone) were found, placed in order. Outside the west door of the room, under the floor, a group of bronze carpentry



tools was found.

Boyd considered that the loomweights were in storage on a shelf, since they were found placed in order on the same level, over a wooden structure, but it is also probable that they fell from a loom in that spot.

House Fd is one of the earlier houses of the site and is probably dated to the LMIA period.

#### 6. Weaving Area of Vathypetro<sup>205</sup>

In the same room in which the wine-press was located,<sup>206</sup> in the SE part of the room, a large number of spherical loomweights was found. If this particular material had not fallen from upstairs (since one of the loomweights was found within the wine-press), then in the same room there was probably a loom also.

Marinatos offered the hypothesis that a carved stone slab associated with a drainage system<sup>207</sup> was probably used for dyeing wool.

The wine-press room is dated to the LMIA period.

#### 7. Weaving Area in Building 4 at the Cemetery of Archanes, (Fourni)<sup>208</sup> (fig. 171)

Forty-seven loomweights in total were found in the fill of different ground floor rooms on the eastern part of Building 4 at Fourni, Archanes. The largest number of weights comes from Room 2, where the wine-press was also installed.<sup>209</sup>

The loomweights were found in different levels of the same fill, scattered throughout all the eastern rooms, a fact which shows that they had fallen from upstairs. The

loomweights were spherical or flattened spherical, and some of them bear grooves in various directions.

Building 4 is probably dated to the LMI period.

J. and E. Sakellarakis suggested<sup>210</sup> that textile manufacture in Building 4 was directly related to religious offerings to the dead.

8. Looms can be identified in Crete during the LMIII period, too. For instance, Room A<sub>1</sub> of the postpalatial settlement in Khondros Viannos, yielded a great number of loomweights.<sup>211</sup>

Weaving areas have also been identified in other contemporary sites in the Aegean area. Here it is enough to mention looms identified at A. Irini, Keos,<sup>212</sup> in Kastri, Kythera,<sup>213</sup> and in Akrotiri, Thera.<sup>214</sup>

### General Discussion

#### of Weaving Areas

From the above description of some areas in which weaving activities probably took place one may observe the following.

a. Loomweights are found either isolated, scattered throughout the site, or in groups in large numbers. This shows that weaving was one of the household activities; however, it sometimes appears to be better organized in specific areas.

b. The discovery of large collections of loomweights inside the palaces (Zakros, Knossos) indicates large-scale weaving, probably directly controlled by the central authorities.

c. In some cases weaving seems to be related to religious activities (Knossos, Stratigraphical Museum site, Archanes, Building 4). Probably, in cases of palace looms also, a religious character cannot be excluded.

d. In most cases looms were located on the upper floor. In other instances weaving probably took place in areas in which other working activities also occurred (e.g. Vathy-petro).

e. The possibility of storage of loomweights for using in the future should not be excluded. In these cases a loom could be conjecturally located in an adjoining area (House Fd of Gournia and many of the areas in which loomweights have been found in Zakros).

## J. Workshops for Basic Food Production

### Wine-Presses (Category B, Type 'a')

As has already been discussed,<sup>215</sup> six installations considered as wine-presses have been found in Zakros. Five of them consist mainly of a wide-spouted tub, which drained into clay receptacles situated lower, with their rims level with the spout of the tub. Such installations have been found on Crete, however, have sometimes been interpreted differently. The catalogue which follows includes all similar installations before they are considered as a whole. Some equivalent installations, which present some differences from the standard type, but based on the same principles of



function, will also be included in the same list.

1. Knossos, to the south of the Royal Road<sup>216</sup>

An installation which belongs to the EMII period was found at Knossos in a house lying to the south of the Royal Road. Upon an uneven but distinct level of bright red gravel, near the north wall, were the remains of a large, spouted, clay tub. The layer in which this pot was found, belonging to the second phase of occupation, provided traces of burning. The tub had two conical-like projections over the spout and two symmetrically located vertical handles on its walls. Its rim slopes slightly outwards.

Warren considered that the tub was used as an oil-separator and dated it to the EMII period.

2. Area 8 at Myrtos (Fournou Korifi)<sup>217</sup> (fig. 167)

Area 8 was not a room, but simply a space between the North Building and the complex to the south, of which the northern room is Room 16. In Area 8, beside the north wall of Room 16, a large spouted tub was found. It was supported on a raised base, the surface of which consisted of two slabs. The broken-off spout of the tub was found in a cavity cut in the natural rock. From this cavity started a channel, also cut in the rock, which continued to the south and then to the west, along the north wall of Room 16. Beside the tub and to the north of it, in an area enclosed by a poorly preserved wall, was a burnt place, which was probably used for heating water or food. East of the tub was an area paved with flat slabs, which also was probably used as a

working area. The dimensions of the tub are the following: ht. 29,2 cm., diam. 64,7 cm., width of the hole from the body into spout 5,7 cm.

Warren in a discussion on the possible uses of this particular installation came to the conclusion that it is more likely to have been used as an oil-separator or as a washing tub.<sup>218</sup> Area 8 is dated to the EMII period.

### 3. Room 17 of Myrtos (Fournou Korifi)<sup>219</sup> (fig. 167)

Beside the south wall of Room 17 was found a small pithos, which must originally have stood in the SE corner of the room below a ledge of the natural rock. This ledge formed the east side of the room below the east wall, and was probably used as a working surface since large flat slabs were found placed on its top. Below this ledge and beside the pithos were the remains of a large tub in situ, with two stones inserted underneath to support it on the sloping ground. Only the bottom of the pot was preserved, but it seems to belong to a tub resembling that of Area 8. The spout was not preserved. According to Warren,<sup>220</sup> Room 17 was probably a workshop dealing with liquids (wine, oil, or water). The room is dated to the EMII period.

### 4. SE Tub-room, Myrtos (Fournou Korifi)<sup>221</sup> (fig. 168)

This room lies west of Room 58 and was entered from the southeast, from Room 60. The principal find of the room was a large clay spouted tub like that of Area 8, found on the ground, placed on three large flat slabs. Immediately to the north was an oblong quernstone. The spout of the

tub was turned to the east. The liquid could be easily removed, since the soft natural rock slopes slightly to the south. Near the tub were pieces of three baking dishes and two cooking bowls. The chromatographical analysis of the lipids, which had soaked into the bottom of the tub, yielded animal substances and not vegetable ones.

Warren considered that the tub was used for washing textiles. Room 58, immediately to the east of the room under discussion, yielded some loomweights, which suggest that this room was probably used for weaving. The large shallow baking plates could be used for drying the wool.

The dimensions of the tub are: ht. 27,4 cm.; diam. 59,2 cm.; diam. of the hole from the body to spout 5,7 cm. The room is dated to the EMII period.

#### 5. Room 90 in Myrtos<sup>222</sup> (fig. 169)

Room 90 lies to the north of 89 and was accessible from the west, from Room 91. It is a small rectangular chamber. Beside the north wall was a low bench consisting of flat stones placed on a hard layer of earth. Beside it, on the NW corner, was a large stone pot stand. In the center of the room a large spouted tub was found. Its original location was probably on the ledge described. In the same fill one-third of a pithos was also found. On the stand of the NW corner was a spouted bowl, within which remains of grapes were found. The same room yielded a jug, two spouted jars, a lamp, a stone weight, a spindle whorl and a grinder. A large quernstone was found in the doorway.

Warren suggested that the installation discussed was



used for wine-making; this production could be associated with the function of an adjoining shrine. It is likely that in Room 90 wine was prepared, to be used for offerings to the shrine.

The dimensions of the tub are: ht. 28 cm.; diam. 54 cm.; width of the hole from the body to spout 4,3 cm. The installation is dated to the EMII period.

6. Room 19 of Quartier Γ in Mallia<sup>223</sup>

Room 19 of Quartier Γ in Mallia yielded a spouted tub of the type under discussion; in front of this tub, sunk into the ground, was a pithos-receptacle. Remains of a clay drain were also found associated with this installation. Dimensions of the tub: ht. 30 cm.; diam. 62 cm. The installation has been interpreted as an oil-separator.

7. Room XXVIII, 1, in the North Quarter of the Mallia Palace<sup>224</sup>

A similar installation was found in Room XXVIII, 1, close to magazines of the Mallia palace. The tub is of the standard form with two conical-like projections over the spout. Dimensions: ht. 32 cm.; diam. 55 cm.; width of spout 7 cm. The installation has been interpreted as an oil-separator and is dated to the LMI period.

8. Block E (Room 29) at Palaikastro<sup>225</sup>

In the SE corner of Room 29 in Block E at Palaikastro a similar installation consisting of a spouted tub and a receptacle was found. The tub was under the corner of a later house and was supported from two sides by means of

walls of the room, as well as from a third side by another wall built exclusively for the purpose. On the fourth side, it slopes down over a pithos, which was built within a hard plastered bed, to its lip. Between the tub and the wall over it, two or three clay lamps were found. The date of the installation is probably the LMIB period. (This date is based on the dating of the lamps.)

9. House B at Palaikastro<sup>226</sup>

In Room 37 of Block B, on a stone platform, a spouted tub was found. The spout of the tub stood over a pithos, probably used as a receptacle. Quantities of carbonized material were found on the floor of the room.

10. Room 14 of Block N at Palaikastro<sup>227</sup>

Room 14 of Block N of the same site yielded an installation, probably used as a wine-press. In the NW corner of the room was a platform upon which the bottom of a jar was found (probably belonging to a spouted tub). In the same room three more jars with vents were also found.

11. Room 9 of Block N at Palaikastro<sup>228</sup>

Room 9 of the same block yielded an installation which consisted of a tub with a vent on its lower part and a small trough in close connection with it. This room was mainly used as a storeroom, but the installation under discussion was interpreted as an oil-separator.

12. Room I of Building 2 at Palaikastro<sup>229</sup>

In Room I of Building 2, which was partly excavated during the recent Palaikastro excavations, a large spouted vat was found sitting on the floor. It has been interpreted by the excavators as an oil-separator. This hypothesis was supported by the fact that the area where the vat was discovered produced a thick oil-slick on the surface after it had filled with rain water one night.<sup>230</sup> The installation should be dated to the LMIA period.<sup>231</sup>

13. House Ac at Gournia<sup>232</sup>

In Room 21, lying immediately after the paved anteroom of House Ac and beside the south facade of the house, a very similar installation was found. The clay tub was placed on a stone bench and had two arched handles in a slightly oblique position, over the spout. Ht. 36 cm.; diam. 36 cm. House Ac is one of the earlier houses of the site. It should probably be dated to the LMIA period.<sup>233</sup>

14. House Dd at Gournia<sup>234</sup>

In Room 30 of House Dd at the same site a similar installation was found. On a stone bench stood the clay spouted tub with the spout turned over a hole in the pavement of the room, where a receptacle was probably placed originally. The tub had two vertical handles, just over the spout. Two troughs were found near the tub. Boyd considered that the installation was used as an oil-separator and she referred to a similar Hellenistic installation at Praisos. House Dd was also one of the earlier houses of



the site. The installation should probably be dated to the LMIA period.

15. Vathypetro<sup>235</sup> (Pl. 64)

In the NE room of the south quarter at Vathypetro a well preserved installation of the type under discussion was found. The room had a luxurious character and seems to have been originally used for other purposes. Its walls were constructed of ashlar poros blocks and its floor was well paved.

In the NE corner a large clay spouted vat with two horizontal handles was found. The vessel stood in situ on a base made of small stones and clay. Its spout was level with the rim of a pithos-receptacle, which was sunk within the pavement to half its depth. A second pithos was also fixed beside the tub, in the NW corner of the room. In front of the receptacle was a semi-circular stone slab in which a shallow cavity was carved, sunk also into the floor. There is an opening at the edge of this slab, from where a stone drain started and, passing under the foundation of the east wall, ran to the south corridor. This particular slab was probably used to drain the water which would have been used for cleaning the area after the end of work.

The same room yielded two stone lamps, a great number of loomweights and over twenty clay vases of medium and small sizes.

Marinatos interpreted the installation as a wine-press, considering that the spouted vat was used as a press-bed,

and the pithos in front of it as a receptacle for the juice. The installation is dated to the LMIA or IB period.

16. Epano Zakros<sup>236</sup> (Pl. 64)

Room A, in the south sector of the villa, yielded an important double installation of a wine-press. The room had a plastered floor and walls. 4,70 m. from its north corner was a plastered bench at right angles to the north wall of the room. At a lower level stood a broader platform, where two clay tubs were built, the one beside the other. The northern tub was very well preserved, while the southern was badly damaged. Both of the tubs were spouted; the two spouts converged to the same point, to drain the liquid into the receptacle. This latter was partly placed in a cavity shaped on the side of the built platform. Adjacent was a pithos, also fixed in the ground. A second auxiliary spouted pot was placed in a plastered cavity and its contents drained into a drain lying to the SW of it. Between the northern spouted tub and the back wall was a rectangular recess, the function of which remains unclear. A second depression was found to the SE of it, just below a modern water drain.

The installation was interpreted by N. Platon<sup>237</sup> as a wine-press and is probably dated to the LMIA period.

17. Room Γ of the Villa at Epano Zakros<sup>238</sup>

Room Γ is a small rectangular room in the NW part of the same house. The fill of this room yielded the bottom of a tub and a spout probably belonging to the same vessel,

which was probably of the type under discussion. The same room yielded a piece of a long clay pipe, the end of which was roughly shaped in the form of an animal's head. This room can also be dated to the LMIA period.

18. Room Γ of the Villa at Profitis Ilias, Tourtouli (A. Georgios)<sup>239</sup> (fig. 170)

Room Γ lies in the NE part of the part of the villa at Profitis Ilias, near Praisos. It is almost square and was accessible from the north. Along the west wall of the room was an oblique ledge on which a large spouted tub with two handles just over the spout had been placed. Near the west wall was a deep vessel, probably used as a receptacle. A jar with an almost globular body and cylindrical neck and a cooking pot were found in the same area. The layer in which the tub belonged is dated to the LMIA period.<sup>240</sup>

19. Room Ψ of the Villa at Profitis Ilias, Tourtouli (A. Georgios)<sup>241</sup> (fig. 170)

Spacious, rectangular Room Ψ lies in the SW part of the villa and seems to have been used for various working activities. Beside the north wall of the room was a bench and close to it a piece of a stone disk-shaped table with oblique grooves at the periphery was found (potter's wheel?). In front of the bench a clay spouted tub was found on the floor. Near the tub was a flat slab, probably used as a quernstone, since a rubber was found on it. Three pithoi stood along the north wall of the room. The same fill also yielded a parallel-sided rubber, two stone weights, a piece of a potter's wheel and a triton shell. This room is



probably to be dated to the LMIA period.<sup>242</sup>

20. Room B' of the Villa at Profitis Ilias<sup>243</sup> (fig. 170)

Rectangular Room B' was accessible through a door with two descending steps from a spacious ante-room (Room A'). The room had one more entrance from open area Σα, lying to the east of it. A bench was built beside the west wall of the room and consisted of two different parts, on two levels. Near the north wall a clay spouted tub of the well known type was found. Three pithoi stood near the south wall, and a fourth beside the bench. The same room yielded a basin-like pot, a saddlequern, a rubber, and a stone weight. Room B' is probably to be dated to the LMIA period.

21. Building 4 of the Archanes Cemetery (Fourni)<sup>244</sup> (fig. 171)

Basement Room 2 of Building 4 at the Archanes cemetery provided another installation of this type. The natural rock had been cut into two different levels of which the western is the higher. On this level, beside the south wall, was a small structure which consisted of five large stones forming a raised flat surface. It is likely that the spouted tub which was found fallen in the east part of the room, was originally placed on this structure. The clay tub is almost cylindrical, with slightly sloping walls. A vertical handle starts from the top of the spout, ending at the rim. There are also two smaller handles one each side of the spout. Three more horizontal handles are fixed just below the rim, at a standard distance from each other. On the

bottom of the vase there are some blackened places, probably the traces of juice.

In the eastern part of the room an elliptical tank was cut into the natural rock. The eastern limit of this tank was a low curved wall built of small stones. In the northern part of the tank there were two semi-globular depressions cut into the natural rock (diam. 0,25 m. and depth 0,05-0.06 m.). It is probable that these depressions were used for trapping the spilled juice. A triangular stone, found on the north side of the room, was probably used as a pot-stand.

The same room yielded eleven clay vessels, some of which seem to have fallen from above. The remainder were probably used as auxiliary equipment for the wine-press.

J. and E. Sakellarakis considered that this installation was intended for production which would be used for offering to the dead during relevant ceremonies in the cemetery.<sup>245</sup> Building 4 should be dated, from the pottery, to the LMI period.

22. Room 5 of the 'House of the Wine-Press in Kommos'<sup>246</sup> (fig. 172)

Room 5 of the 'House of the Wine-Press' is almost square and paved. In its SW corner was a rounded platform upon which a carved slab was placed. Its top is around 0,86 m. above the floor. The slab varies from 0,15-0,20 m. in thickness and is carved with a shallow circular cavity, 0,10 m. deep. It had a long projecting spout (0,25 m. long) and sloped slightly to the south to permit the flowing of the liquid through the spout.

J. Shaw suggested that this particular installation was probably used for wine-making. It is very thin to have been used for crushing olives. The grapes would probably have been placed on the slab. During the pressing, juice would flow out through the interstices of the basket and would drain through the spout. On the floor, to the east of it, pieces of a pithos were found, probably belonging to a receptacle for the juice.

The installation should probably be dated to the LMIII period.<sup>247</sup>

23. Area 21 in the House of the Central Hillside at Kommos<sup>248</sup> (fig. 172)

Area 21 was lined with slabs set on edge and seems to have been used as a wine-press room. In the NE corner was a stone platform and in front of it had fallen a spouted stone press, carved from a triangular slab. In front of the platform was the bottom of a storage vessel, which was probably used as a receptacle. The same yielded the remains of a tall jar, cooking and other household pots and numerous carbonized olive pits. The installation is dated to the LMIII period.

#### General discussion of Wine-presses

Clearly, if one excepts the Kommos specimens, all the installations described, as well as the Zakros ones, have as a common feature the clay spouted tub. This type of tub, and consequently the installations as a whole, have been interpreted up to now in three different ways.



a. As oil-separators (in 9 cases). Before oil-pressing takes place, heated water is added, which should later be removed from the final product. The mixture of oil and water would be placed within tubs, which were equipped with a spout on the lower part of their walls. The oil, being lighter, would come on top of the mixture, while the water would subside to the bottom. Then, the spout, which until that moment would remain closed, would be opened and the water first would drain out. At the appropriate moment the spout would be closed again to keep the oil in. This interpretation is given first by Bosanquet, who published an oil-making installation in Hellenistic Praisos.<sup>249</sup>

b. As wine-presses (in 16 cases). The grapes would be placed within the tub, where they would be pressed by a bare footed workman. The juice would be drained through the spout into a receptacle located in front of the tub. Marinatos was the first to give this interpretation on the occasion of his description of the Vathypetro installation.<sup>250</sup>

c. As washing tubs. Warren suggested<sup>251</sup> that these tubs would occasionally be used for washing cloths or foods. This aspect is mainly based on the results of a chromatographic analysis which was done on one of the tubs found at Myrtos. This analysis gave animal and not vegetable substances.

It has become clear that more evidence regarding the location and construction of the installations under discussion is needed here. This evidence can be summarized in the following points.

a. In thirteen cases, the clay tubs were found placed

on raised structures, platforms and benches, while in four more cases it seems probable that they were originally on such structures found in the same area. Only in three cases were they found actually on the floor, while in five cases the information regarding their precise location is lacking.

b. In two cases the tubs were sunk up to their rim into specific structures, and consequently were not transportable or movable (House I on the NW hill of Zakros, Room A of the villa in Epano Zakros).

c. In ten cases receptacles have been found in direct association with the tubs, in five of which they were fixed or sunk up to their rim in the ground; consequently they could not be easily moved.

d. In five cases auxiliary pots found in the same area were in direct association with the installations under discussion.

e. In eleven cases the installations appear to be permanent: they are built structures, sometimes having supporting walls, or equipped with permanent receptacles.

f. In seven cases a drainage system was in direct association with the installations.

On the basis of the above points, it becomes clear that the installations in most cases were permanent and specifically organized for a specific purpose. Consequently it is difficult to consider that they have been used for more than one function, or that each case was completely different from the others. This is against Warren's view, who considered that these tubs could have been used in various working activities, during the different seasons of a year. 252

Moreover, it is well known that Minoan pottery is characterized by a great variety in forms which were connected with each specific, required function. It is unlikely that the large spouted tubs were used for two or more completely different functions.

In the light of this, the hypothesis that such installations have also been used for washing should be put aside. Nevertheless, two different interpretations remain. The question is: oil-separators or wine-presses?

The first of the two views is mainly based (as has already been mentioned) on the evidence of a Hellenistic oil-making installation. This point of view does not seem very strong because:

a. The form of the tubs under discussion is not very suitable for such a function. The spout is wide and would result in a rapid flow of the liquid; this fact would create problems for a good separation of the two liquids, oil and water. In addition, the hole of the spout could be closed only with difficulty since it lies at the back of the spout, on the walls of the tub. On the other hand, pots with a small vent in the lower part of their walls have been found quite often in Minoan sites;<sup>253</sup> such pots would be much more suitable for such a function.

b. In none of the above cases was an oil-press-bed found in association with such an installation. A hearth, which could probably be used for heating water,<sup>254</sup> cannot be connected with the installation since water is added before pressing and not before the separation.<sup>255</sup>

c. In cases in which the receptacles or the tubs were



fixed as well as in the cases of built structures, a use as an oil-separator is not probable, since there would be problems with the removal of the water, which would drain first through the spout.

For all the above reasons the identification of these tubs with wine-presses seems to be stronger. A recent specimen of such a tub, made of stone, confirms that these objects were used for pressing grapes.<sup>256</sup> The drains usually found in association with these installations, were probably used for cleaning the area with water after the end of work.

The two cases of stone presses in Kommos constitute another type of wine-press. Nevertheless, this type is also based on the same principles: a stone raised platform above which a curved spouted slab was placed. The spout of the slab drains into clay receptacles situated at the lower level in front of them. The use of baskets made of perishable materials for the pressing seems to be very probable, perhaps the only possible solution. Probably this type was developed during the LMIII period, since none of the clay specimens comes down further than the LMIB period. The earlier specimens from Knossos and Myrtos are dated to the EMII period.

The case of House A on the SW hill in Zakros is the single case in which the press-bed was built. Once again the installation suggests permanency, since the huge receptacle was placed at a much lower level, within an area cut into the ground for the purpose.

If one returns now to the distribution of the wine-

press installations throughout the sites in which they were located, one may classify them into three categories.

1. Those which were located inside the palaces. In a single case the installation was located in a palace area (in Room XXVIII, 1, at Mallia).

2. Those which were located throughout the towns. The wine-presses were not located in all the houses but were scattered in different quarters of the town. Only in Zakros can one notice a fair concentration of wine-presses in a particular quarter of the town (SW quarter).

3. Those which were located in isolated villas. There was usually more than one in each case.

On the basis of the above evidence one may conclude the following.

a. The palaces did not have such installations, on their own. The palace magazines were probably filled from the production of the town. Probably the palace arranged for the wine-making to be done by specific people or groups of people working in the town.

b. The distribution of the wine-presses throughout the whole town shows that they produced wine for wide social groups and not only for the residents of the particular houses which housed the installation.

c. The extent of the wine-press installation in villas shows that their owners exploited the surrounding agricultural zone.

## Oil-presses (Category B, Type 'b')

No trace of oil-presses was found in Zakros. It is likely that oil-making was done by means of simple stone tools, as quernstones, rubbers and grinders.

The installations dealing with oil manufacture in Crete may be classified in three categories.

1. Oil-presses resembling the later installations belonging to the Classical and Graeco-Roman period. These consisted of a stone press-bed equipped with a circular grooved channel, which drains the oil through a spout into clay receptacles. Only two slabs belonging to this type of press-bed are known from Minoan Crete, from Palaikastro<sup>257</sup> and Knossos.<sup>258</sup>

2. Permanent built structures for oil-making of different types. Two such structures, probably forerunners of the type with the channel, were identified at Palaikastro.<sup>259</sup> A peculiar stone installation found at Phaistos was probably also used for oil-making.<sup>260</sup>

3. Simple stone equipment, usually stone blocks carved with shallow cavities, were probably also used for oil-making. Such simple equipment has been found at Zou,<sup>261</sup> Vathypetro<sup>262</sup> and Nirou Khani.<sup>263</sup>

The evidence connected with oil-separation has been discussed already under the interpretation of the clay spouted tubs.<sup>264</sup>

On the basis of the information given related to oil manufacture in Minoan Crete, one can conclude the following.

a. In most cases the relevant installations were simple and oil manufacture was probably one of the household activities.

b. There is no evidence for installations dealing with



oil manufacture inside the palaces.<sup>265</sup> The palace magazines were probably filled from the town production.

#### Grinding Areas (Category B, Type 'c')

##### Crete

No trace of a permanent, well organized, mill-house was found at Zakros. It seems that grinding constituted one of the household activities, the production of which was destined to be consumed by the residents of the particular house. Permanent grinding areas were also not found in the palace. Once again, it seems that the magazines of the palace were filled from the town production.

Only a few permanent or independent grinding installations have been identified in other Minoan sites. Two of them, located within the palaces, suggest a centrally controlled production. The permanent grinding installations identified in Crete are the following.

##### 1. Room V of the Old Palace at Phaistos<sup>266</sup>

Room V, located close to the Theatrical Area at Phaistos, belongs to the old palace. It was equipped with a bench along its south wall (dim. 1 x 0,55 m.; ht. 0,60 m.). Above this bench was found an elliptical saddlequern and a stone rubber together with a stone trough, probably a container for the flour.

Pernier suggested that this installation was destined to produce sacral bread, which would be offered in the adjoining shrine. The adjoining room (VI) was probably used

for kneading.

2. The 'Room of the Plaster Table' at Knossos<sup>267</sup> (fig. 173)

A. Evans suggested that a room located in the Throne Room area was used for kneading. Beside the wall lying opposite the room's door was a low seat (ht. 13 cm.; width 35 cm.; depth 46 cm.). In front of it, on the same level, was a low plaster table with a rounded end, fixed in the ground. On the end which was closer to the seat there was a bowl-shaped cavity. Another shallow oblong depression was set at the opposite end of the table. It is likely that this structure was used as a working table, but the fact that it was plastered excludes its use as a grinding or pounding table. Along the internal wall of the room was a two-stepped, plastered bench. The lower step was probably used for sitting. At the centre of the second step was a cavity, similar to that of the table.

Evans considered that this room had been used as a kitchen. It probably belongs to the LMII period (or LMIII-A<sub>1</sub>?).

3. The 'Baker's Room' at H. Triada<sup>268</sup>

This room lies to the east of the 'House of the Cauldron', and probably belonged to a building of which other traces have not been preserved. It yielded a large stone basin, a large clay vessel, and two quernstones of a local stone. On the ground were two small rectangular depressions surrounded by stones. The evidence suggests that this room was probably used for grinding.

4. Room 18 in Block E at Palaikastro<sup>269</sup>

Room 18 belongs to a small house located to the south of the large northern house of Block E. It was the largest room of the house and was paved. Two saddlequerns were found above projecting masses of masonry. An open-mouthed pithos was found standing below each of them. The installation is probably dated to the LMI period.

5. Room 1 of House A on the Hill at Palaikastro<sup>270</sup>

Room 1 was a spacious room on the ground floor of House A, without entrance from the outside. In the middle of the room was a roughly built bench and in the SE corner two stone troughs made from coarse grit. Among the other finds were a number of saddlequerns and stone rubbers, a perforated 'firebox', and a quantity of common pottery. House A is dated to the LMIB period.

6. Mill-house in the Area of Amnisos<sup>271</sup>

North of a building which belonged to the LMIII period at Amnisos, an independent permanent mill installation was found in a small room. The installation consisted mainly of a saddlequern 0,76 m. long and 0,38 m. high and a stone rubber found on it (length 0,40 m.). At one end of the saddlequern was located a small vessel, probably used as a receptacle for the product. In the same room a pithos was found, which probably contained the material ready to hand for grinding.

This room probably belonged to a house extending to



the south, which was not excavated. The date is probably the LMIA period.

7. Grinding Place in Space 3 at Kommos<sup>272</sup>

In the SE corner of this space, above a raised earth surface, was the lower part of a large pot. North of it, on the ground, two circular fist-sized hammer-stones were found. J. Shaw considered that this room was used to crush material such as grain and the products would be placed in the vase which was to the right of the workman. The date of the installation remains uncertain.

8. Room 14, b, in the West House  
of the Top Hill at Kommos<sup>273</sup>

Room 14 of the west house on the Top Hill at Kommos provided some evidence that during the LMIII period it housed grinding activities. On the ground were a burnt area (a hearth?), a saddlequern, and a number of stone grinders or rubbers.

### Permanent Grinding Installations

#### Outside Crete

Three important, permanent grinding installations were identified in the settlement of Akrotiri at Thera.

1. Room A<sub>1</sub> in Quarter 1<sup>274</sup>

Quarter 1 lies west of Quarter A and Marinatos considered that it was used as a mill-house. It was equipped with a door and windows opening to the central road of the settlement. Before the mill-room there is a small ante-room

equipped with a bench. The mill-room was irregular in form. Near its east wall was a quernstone of trachyte, fixed on a stone base. In front of it was a slab, clearly intended to receive the flour. The fill of the same room yielded several more quernstones. In the SE corner a semi-circular cavity was made which was covered by small stones. In the SW corner was a clay basin containing pumice, and in the NW corner a basket from osiers with sea urchins. Two circular depressions found at a depth of 2 m. below the floor level probably belonged to a similar installation of the EC period.

Marinatos considered that this particular mill-house was used for production which was destined to be offerings in religious ceremonies.

The installation belongs to the LMIA period.

## 2. Mill Installation in Room $\Delta_{15}$ at Akrotiri, Thera<sup>275</sup> (fig. 173)

Room  $\Delta_{15}$  was oblong and had a door and a window opening to the central road of the settlement. An internal staircase led to the upper floor. Beside the north wall was a stone slab 1 m. long, which probably served as a bench for the workers. On the floor was a quernstone and a second similar one was found underneath the bottom of a clay vessel. This latter was on a bench constructed of stones. Within the vase, which was a bucket-jar, one more quern and five small pots, which were probably used as measures, were found.

The date of the room is the LMIA period.

## 3. Mill Installation near Room $\Delta_8$ at Akrotiri, Thera<sup>276</sup> (fig. 173)

Near Room  $\Delta_8$  at Akrotiri, just to the east of it, a narrow chamber was discovered in which was a quernstone with the relevant installation. The same room yielded a great amount of pottery, a bronze dagger, and a bronze sickle. The installation is dated to the LMIA period.

### General Discussion of Grinding Areas

On the basis of the information given above one may conclude the following.

a. In most cases grinding was a household activity, the products of which were destined to be consumed by small social groups. For such grinding activities taking place everywhere, simple stone tools were used, rubbers, troughs and mortars, and quernstones. This equipment is easily transportable and does not necessarily indicate a permanent working area. This method of grinding with simple tools represents the most common type for producing flour. This way is even today common to primitive societies.<sup>277</sup>

b. As for the palaces, two cases of more permanent grinding installations have been identified, but these particular installations appear to be associated with a specific purpose: in Room V at Phaistos with religious offerings, while the 'Room of the Plaster Table' of Knossos, being in a close connection with the Throne Room, probably also had a specific function. Consequently, the palace magazines would have been filled from the town production.

c. More permanent grinding installations are rarer: at Palaikastro, Amnisos, H. Triada and Akrotiri in Thera. The fact that such installations produced quantities of



the relevant product for wider social groups does not exclude the possibility that grinding was also one of the household activities.

CHAPTER V  
GENERAL FEATURES OF THE MINOAN WORKING AREAS  
AND SOCIO-ECONOMIC STATUS OF CRAFTSMEN  
FINAL CONCLUSIONS

Introduction

In Chapters III, 1 and 2, we have given a detailed presentation of the evidence for the identification of places in which working activities took place in the Zakros palace and town. Such a presentation, as has been determined already,<sup>1</sup> aimed to give, as far as possible, a complete picture of this type of activity in one of the most important Minoan centres. The simultaneous presentation of the palatial and urban working activities can be helpful for a more general study of Minoan crafts during the Late Bronze Age.

Zakros yielded evidence for stone-working, mainly for the manufacture of stone small artifacts and jewels, bronze and ivory-working, perfume manufacture (probably), weaving activities, dyeing of cloths (probably), and wine, oil and flour-making.

Below, we give a summary of the general features of the Zakros work places which can be used as a basis for a further discussion regarding craft specialization and the socio-economic status of craftsmen in Minoan Crete.

A. General Features of the Zakros Work Places

1. Location and Type of Production

Almost all the places which seem to have been used

for the working of rare and precious materials have been identified inside the palace, or in quarters directly dependent on it.<sup>2</sup> Eight areas yielded evidence for stone-working and five areas have been considered as places for some kind of operations with bronze. On the other hand, the town houses provided only scattered evidence for the manufacture of common stone vessels and small objects, and very few indications of bronze-working. It is very probable that ivory and faience-working was also confined inside the palace, or in buildings directly dependent on it.<sup>3</sup> Also from the palace comes the evidence for the identification of a perfume workshop, large looms and probable places for dyeing. On the other hand, installations for basic food production (wine and oil-presses, grinding tools) have been almost exclusively identified in houses of the town. Only a few stone tools for grinding came from the palace, but they are not enough to define the use of the areas in which they were found.

There is a large concentration of working places in the West and South Wings of the palace, as well as in a quarter lying just outside its NE entrance. Probably this latter quarter was constructed especially to include the kiln, of which the installation inside the palace would have presented practical difficulties.<sup>4</sup>

Most of the evidence for stone and bronze-working comes from the upper floor of the West Wing. Large quantities of unworked serpentine-steatites and bronze tools of various types were found scattered in different ground floor rooms, suggesting working places on the upper floor.



Precious raw materials, such as copper ingots and elephant tusks, being in storage, were found in the same contexts. It seems likely that other working activities, such as weaving and working with pigments, took place also in the same areas. This has been indicated by the discovery of collections of loomweights and rubbers with traces of pigments on their surface in the basements of the west magazines. Some evidence supports the view that some kind of bronze-working took place also on the upper floor of the West Wing. This sounds strange, since places for bronze-working should rather be located on the ground floor because of the need for a fireplace or a furnace.

All the above mentioned places yielded also a great quantity of fine pottery, luxurious wooden boxes inlaid with ivory and faience, and elegant stone vessels. The total gives the impression that some of the upper floor rooms had been used also for the storage of luxurious goods, some of which had a ceremonial use, belonging certainly to the palace. The almost direct communication between these apartments and the shrine's apartments on the ground floor by means of a staircase,<sup>5</sup> makes it possible that some of these objects were actually used in religious ceremonies which took place downstairs in the Hall of Ceremonies (XXVIII), or in the small shrine (XXIII).

One of the ground floor rooms of the West Wing of the palace, lying just beside the Treasury of the Shrine, yielded some evidence for stone-working (Room XXVI). This room was simultaneously a kind of ante-room to the Treasury and was approached from the Hall of Ceremonies only, by means of

a corridor which had doors at both ends. If this room was actually used for stone-working, its dependence on the Shrine seems certain.

An installation with successive built troughs, in the SW quarter of the palace, was more independent, since it was approached directly from the open area south of the palace by means of a short corridor. The whole arrangement points to a self-sufficient place, despite the fact that the finds coming from the adjoining rooms do not offer much evidence for their use.

A large concentration of working places is also obvious in the South Wing of the palace, on both floors. Two of the ground floor rooms were used for stone-working activities (of which one was probably for ivory-working also), one was probably a perfume workshop, another yielded some evidence for grinding activities, and in another bronze-working activities probably took place. All these rooms communicated with each other by means of doors. The NE room of the wing<sup>6</sup> was a kind of storeroom, while in the NW sector there was a staircase leading to the upper floor apartments. For one of the southern rooms the use is uncertain.<sup>7</sup>

All the above mentioned rooms also yielded a fair number of beautiful stone and bronze vessels and fine ware, which suggests places used as storerooms for objects related or unrelated to the workshops.

The upper floor of the South Wing housed at least one loom, as the collections of loomweights found in the fill of the southern rooms indicate. Moreover, there is



some evidence for bronze-working activities, also taking place on the upper floor of this wing. From the upper floor rooms come also bronze and stone objects and some fine vases which were found in the fill of the ground floor.

Just outside the NE gate-entrance of the palace were some enclosed working places open to the sky, with doors which opened directly onto the Harbour Road. Among these areas were the kiln, the use of which is uncertain, and another place, where stone-working took place. The relationship of this particular quarter to the palace seems direct, although it preserves some architectural independence. The material used could have been transported, either directly from the palace (where it was probably stored), or from the port (or the country), along the Harbour Road.

The installations for wine-making were located in different houses of the town. A relatively high concentration has been noticed for the SW quarter,<sup>8</sup> but the remaining installations were found scattered in different quarters of the town. The wine-presses were located either in large rooms, where other working activities also took place, or in specific rooms devoted exclusively to this activity. In all the cases the rooms were located near the entrances or just inside the facades of the buildings, for the easier transportation of raw materials and products. There is no obvious connection between the places where the installations were located and storerooms or magazines in the same houses.

The installations for grinding were found scattered throughout the houses, presumably located in large rooms or in small basements. The same is true of the collections of



loomweights.

From the above information one may deduce the following main points.

a. Areas in which stone, bronze, ivory and faience-working took place, as well as perfume and textile workshops were mostly identified inside the palace, where also raw materials and tools were in storage; a large concentration of such places has been observed for the upper floor of the West Wing and the ground floor of the South Wing.

b. Places for working activities were also identified on the ground floor of the West Wing: one of them especially, used for stone-working, was in direct connection with the Shrine rooms.

c. A kiln and other places in which working activities took place were in a free-standing quarter, but located close to the palace.

d. The installations for food production were situated in their entirety in the town. A relatively high concentration of wine-presses has been observed for the SW quarter.

e. Production within the palace was related to internal palatial activities.<sup>9</sup> Production in the town was related to the external environment and supplied the palace.

## 2. Architectural Form and Construction

The working areas which have been identified on the ground floor of the West and South Wing of the palace, were small-sized, usually enclosing an area not more than 15 square metres. Only Rooms XLIII and XLVII of the South Wing were spacious and they will have been used for activities which needed more space, or for several workmen operating

in the same place.<sup>10</sup> Probably the upper floor rooms used for working activities were spacious, especially if the conjectural reconstructions given in Chapter III, 2, are approximately right.<sup>11</sup> The areas open to the sky near the kiln were also spacious. The wine-presses were usually located in large rooms, or in specific areas where there was also enough room for working.

The lighting of the working areas sometimes appears to be deficient. For instance, the small room beside the Treasury, considered as a stone workshop, would have been indirectly lit, or by means of lamps. The working places of the South Wing could have been directly lit although traces of windows have not been preserved. Certainly the upper floor working places could have been well lit. A special interest in direct lighting is obvious in the case of wine-presses, which were located just inside the facade of the houses.

The rooms of the palace in which working activities took place do not present specific and common architectural features. It is not easy to distinguish them from other rooms of the palace; they usually had plastered walls or floor, and doors of the usual width. Room XLIII of the South Wing, which was used for the sawing of a marble block, presents some fine architectural fittings: plastered floor decorated with two carpet-like squares of tiles laid on either side of a central column, and plastered benches along its walls. On the other hand, Workshop Ø, close to the kiln, was nothing more than an area open to the sky with floor made of trodden earth. The wine-press areas were carefully

constructed with paved floors or plastered, built tanks and specific areas for the receptacles and the other requisite vessels. The proposed dyers' installations were also carefully constructed: they consisted of small built troughs laid in association with a drainage system.

Of the presumed wooden furniture of the working places only a few traces have been preserved. In Room XXVI three rows of irregular stone slabs were probably used to support a low wooden platform.

From the above information one may deduce the following.

a. The areas in which working activities took place were mostly small- or medium-sized. Probably working places on the upper floor would have been more spacious.

b. Their lighting, in some cases, appears to have been deficient.

c. They had no common and distinctive architectural features. In some cases they had been carefully arranged, in others not.

d. Only a few traces of their furniture have been preserved.

### 3. Contents

The material directly related to the working activities which took place in the particular areas mainly consists of unworked materials and tools. Only in a few cases were unfinished or partly worked objects found, while in no case was waste material securely identified.

The identification of the areas in which some kind of stone-working took place was principally based on the discovery of large or smaller quantities of unworked materials.



All the stone-working areas in the West Wing of the palace, which mainly yielded large quantities of unworked steatite-serpentine (but in addition some other types of stone material<sup>12</sup>), did not provide evidence for waste material, or unfinished and finished products. It is likely that the raw material was in storage in these particular areas; however, the finding of a large collection of bronze tools coming probably from adjoining areas suggests that the working was done in the same place. The same was probably the case with the jewellery workshop in Room XLIV of the South Wing, where a small quantity of unworked material was found together with finished products from the same material. A truly partly-worked stone piece was the half-sawn block of veined marble, found on the floor of Room XLIII of the South Wing. In addition, Workshop  $\Phi$  outside the NE gate-entrance of the palace yielded unworked and partly worked pieces of steatite, together with small prismatic objects of the same material, which can probably be identified as finished products.

Only a few bronze tools were found in close association with the above mentioned unworked materials, and they were not very specialized in form: they include chisels, double axes and punches. In addition, some of the bronze tools which fell from the upper floor of the West Wing of the palace, such as drills and knives, could have been used in the workshops identified in adjoining rooms. Two pairs of small bronze tweezers found in Workshop  $\Phi$  could have been used in a stage of the manufacture of the small prismatic objects which were produced there.

The areas considered as housing some kind of bronze-working yielded only a small amount of relevant material, namely some amorphous bronze sheets for which one cannot say if they were scrap metal for remelting, partly worked material, or simply pieces of finished products in a bad state of preservation. In addition, there were some pieces of bronze objects for which it is also uncertain if they were intended to be joined, or were pieces broken away from finished products. Some of the bronze tools which were found fallen from the upper floor in Rooms XXIV and XXVIII of the West Wing, such as a stake-head, could be related to bronze workshops housed in adjoining rooms.

The ivory-working areas also provided very few indications: some tools probably used for carving, and finished products of the same material. The room considered to have housed a perfume workshop yielded a fair number of specialized pots, which were probably used for perfume manufacture or in another industry, together with a great deal of ordinary pottery. The identification of looms was exclusively based on the discovery of large collections of loomweights, and that of workshops for basic food production and probable dyeing on the presence of distinctive permanent installations.

A very important point should be noted here: the areas which provided the evidence for working activities also yielded a great number of objects unrelated to them. For instance, in Room XLIV, which housed a jewellery workshop, over thirty clay, stone and bronze vessels were found, in an area of about ten square metres only! Room XXVI yielded ten indistinct clay vessels and four loomweights. The upper



floor rooms of the West Wing, in which stone-working took place, yielded a great number of clay decorated vessels of various forms and sizes, some of which probably had a ceremonial use, as well as a fair number of stone and faience objects. Room XLIII of the South Wing, where the half-sawn block was found, was almost empty apart from a bronze cauldron which was found in situ placed on one of the plastered benches. Workshop  $\Phi$  near the Harbour Road yielded ten conical cups, four fragments of stone vases and two loomweights.

The upper floor rooms of the West Wing, considered to have housed some kind of bronze-working activities, yielded large quantities of decorated pottery, as well as some fragments of coloured plaster, probably belonging to wall paintings. From the room above Room XLIII of the South Wing came a pendant of rock crystal, a figurine, some obsidian and steatite pieces and a great deal of pottery. Room XLVa, apart from the bronze objects, yielded a number of clay vessels, some pieces of stone vases, a clay figurine, and pieces of pumice. The room which housed the perfume workshop provided a great deal of pottery which consists of small and medium-sized vases, loomweights, obsidian, and pieces of pumice.

The independent rooms which housed wine-presses yielded material relevant to them only. On the other hand, the large rooms which contained such installations, yielded a great number of other objects, of which a large part is related to other household activities.

From the above information one may deduce the



following points.

a. The material which was directly related to the working activities taking place in the particular areas consists usually of unworked materials and tools only. Unfinished objects have rarely been found in them, while waste material has in no case been identified.

b. The variety of the unworked materials and tools used is not very large.

c. The areas which provided evidence for working activities in most cases yielded a great deal of pottery and other material unrelated to them.

## B. General Features of Minoan Workshops:

### A Basis for a Discussion of Questions on their Organization and the Socio-economic Status of the Craftsmen

#### 1. Location and Type of Production

As has been mentioned already, there is in Zakros a noticeable concentration of the workshops dealing with precious and rare materials inside the palace or in buildings directly dependent on it. In Knossos, three of the stone workshops dealing with the manufacture of vessels and small artifacts were inside the palace and one other in a house just outside its south facade. Only one stone vase workshop appears to be far away from the Knossos palace,<sup>13</sup> and its relationship to it, or to any other authority, remains uncertain. Close to it an ivory workshop also appears to be free-standing. A channelled kiln lies just outside the SE corner of the palace, and its connection with it seems

certain. Three other similar kilns were found in a quarter of the town some 350 metres from the palace. Some evidence for faience-working comes from the area of the palace.

Finally, a LMII bronze workshop has been identified in the Unexplored Mansion, a large building the precise function of which is uncertain.

At Mallia, the two identified stone workshops were located in the area of the palace.<sup>14</sup> One of them also housed a bronze workshop. A specialized pottery and a seal-making workshop belonging to the protopalatial period, were found in the town and it seems probable that they had been connected with another authority.<sup>15</sup>

Phaistos has provided even less evidence. Nevertheless, a kiln of an uncertain use stood in the NE court of the palace and a similar one was located beside the road which led to its West Court. A stone workshop was also identified in rooms of the West Wing of the old palace.

From the above brief presentation it is clear that the craftsmen dealing with precious materials worked mainly inside the palaces. This was probably due to an attempt at control of the craftsmen's work as well as of the transportation and consumption of the raw materials. Besides, a large part of the trade in precious materials seems to be in the hands of the palatial authorities, as argued first by Keramopoullos for the later Mycenaean palace of Thebes.<sup>16</sup> The Pylos and Knossos tablets (though they are later than the Minoan workshops) point to absolute bureaucratic control of raw materials and production, although in this case the palaces appear to provide precious materials for craftsmen



working outside them as well.<sup>17</sup>

On the other hand, it is not clear whether the craftsmen who worked inside the palaces also lived in them. This seems likely, if one thinks that the palaces probably housed a great number of people, among which could well have been their better craftsmen. Here one could mention the myth of Daedalos, whom Minos kept inside the palace against his will.

For the residence of craftsmen, Zakros offers some important evidence: if the South Wing of the palace was actually intended exclusively to house various working activities,<sup>18</sup> then it could also have been the residence of the craftsmen. One at least of its rooms was a storeroom (Room XLII), in another one (Room XLIII) a tripod cauldron used for cooking was found in situ, and a third (Room XLV) yielded some grinding tools. At least one loom was on the upper floor, but it is not clear if it was used for the needs of the craftsmen, or to produce textiles under palatial orders.

The concentration of different types of workshop in particular quarters of the palaces, as in the NE quarter of Knossos and the West Wing of Zakros, could mean either an attempt at a close control of production, as Branigan believes,<sup>19</sup> or that the authorities granted a quarter to the craftsmen class, as residence. On the other hand, cases of isolated workshops are not rare (Workshop to the north of Polythyron III, 7, and Workshop in Room XVII, 2, at Mallia, Gypsum Vase Workshop at Knossos and Workshop of the Shrine in Zakros).

The Stone Lamps Workshops in the House of the Fallen Blocks at Knossos constitutes an exception. The craftsman



worked in his house, but probably under palatial control since his production was specialized and his house very close to the palace.

As has been mentioned, the materials were kept in safety. At Zakros the Workshop of the Shrine, which lies in a room just beside the Treasury, was approached with difficulty by means of a short corridor at both ends of which were doors <sup>20</sup> and it had no window directly opening to the outside. Upper floor rooms used as working places (Zakros, Knossos) were easily controlled because of the small number of staircases.

Apart from the workshops which have been identified inside the palaces or in direct dependence on them, some concentrations of working places have been observed outside, at a distance from them. Both of the areas at Knossos in which a concentration of working activities has been noticed were at some distance from each other as well as from the palace, though they were easily approached by means of paved roads. Their precise internal arrangements and any connection with the palace remain uncertain. The ivory workshop and probably the stone workshop as well to the north of the Royal Road may have been subsidized from the palace according to what has been argued above for Zakros. However, it is not clear if the palace received all the finished products, as probably happened in the case of Pylos on the Mainland,<sup>21</sup> or whether it permitted some independence to the craftsmen to trade a part of their work for themselves. In any case we are not dealing with fully independent craftsmen, since it is unlikely either that the palace sold the raw materials

(which were not abundant) or that the craftsmen could import ivory for themselves.

The channelled kilns in the area of the Stratigraphical Museum, at Knossos, lying 350 metres to the west of the palace, indicate group rather than individual activity. In this case one might think of a guild, which probably lived in this particular quarter of the town, though its connections with the palace appear to be uncertain. Either the kilns were used for the production of lime or pottery, or there was no need for close control of the raw material by the palace (since these particular materials are not rare).

There was also a category of craftsmen who, while they did not live inside the palace, worked mainly for it. The Pylos and Knossos tablets agree on this point at least for the Mycenaean period. However, why did these craftsmen not work inside the palace as other craftsmen did? The installation of kilns in areas outside the palaces was probably for practical reasons though the presence of similar kilns very close to the palaces or in the palace courts themselves<sup>22</sup> shows that external locations were not exclusive. In addition, kilns were usually located in places where there was an abundance of raw material, and this was probably the reason for the selection of the area for the installation of the Knossos kilns.<sup>23</sup> Unfortunately, for the ivory and stone workshops beside the Royal Road the evidence is still lacking and consequently a full understanding of the status of their craftsmen is for the present impossible.

On the other hand, for the protopalatial workshops of Quartier Mu in Mallia a satisfactory interpretation for



their location has been given already.<sup>24</sup> These workshops were not directly related to a palace (if a palace existed during this period), but rather to buildings which have been considered as probable religious centres. This latter seems very likely, since their products were very specialized and had presumably a ceremonial use.

The case of Mallia suggests that some craftsmen were dependent (at least during the protopalatial period) on a different type of authority, the religious one. Such a view agrees with the relevant information drawn from the Pylos tablets<sup>25</sup> although they document Mycenaean practice. In some cases names of craftsmen directly dependent on the Shrine have been mentioned,<sup>26</sup> as well as types of materials directly related to the Shrine.<sup>27</sup>

In Crete, some workshops appear to be exclusively devoted to production with religious significance. At the sacral cave of Arkalochori there was a bronze workshop for the manufacture of objects which were used as offerings to the deity. It has been suggested that the products of a wine-press and a loom in Building 4 of the cemetery at Archanes (Fourni) were exclusively used for offering in sepulchral ceremonies. The wine-press of Room 90 in the EM settlement of Myrtos was probably intended to produce wine for offerings in an adjoining shrine.

On the other hand, it is difficult for anyone to distinguish the administrative from the religious authority in the Late Bronze Age palaces. Consequently, in this case the craftsman should be considered as dependent on a single central authority, which probably included religion. For



instance, the Workshop of the Shrine in Room XXVI at Zakros produced objects for the Treasury of the palace, which objects were certainly used for religious purposes. The Gypsum Vase Workshop in the Knossos palace was located in an area which was originally considered as a "Sanctuary Hall".<sup>28</sup> The craftsmen who worked there were certainly directly dependent on the central authority although production of the workshop for religious purposes should not be excluded. Working places for shrine production have also been identified in the old palace of Phaistos.

In addition, the existence of a class of craftsmen exclusively devoted to religious purposes is well known from other, more or less contemporary Aegean sites. At Kition in Cyprus extensive installations for bronze-working were absolutely controlled by the religious authorities. The NE Workshop at Pylos was a free-standing building, which also contained a significant shrine.<sup>29</sup> At Mycenae three probable workshops were located near a religious centre.<sup>30</sup> At Akrotiri on Thera, in the House of the Ladies, a workshop for stone vases was identified in a room adjoining a probable shrine. Finally, in House A of A. Irini on Keos, some bronze activities appear to have a direct connection with some religious offerings.<sup>31</sup>

In any case, the craftsmen who were dependent on the central authorities, religious or administrative, appear to have been full-time specialists subsidized exclusively by them. It is very unlikely that they were also occupied with other activities, such as farming operations, especially since most of them probably lived inside the palaces (or

other centres).

In contrast to the places in which the working of precious or rare materials took place, the areas for food production appear to have been almost exclusively concentrated in town houses. Only one installation, in Mallia,<sup>32</sup> was located in a room of the palace, while all the Zakros wine-presses were identified in the town. In Knossos, no similar installation has been found, apart from one which is dated to the prepalatial period, while the old palace at Phaistos yielded a built structure, probably used as an oil-press. The absence of such installations in the palaces makes it almost certain that the magazines of the latter were filled from the town production. The Pylos and the Knossos tablets refer to some distributions of land from the palace to employed cultivators.<sup>33</sup> The cultivation and the agricultural production appear to have been absolutely controlled by the central authority. If the palaces actually managed a large part of the cultivated land, then, in this case also, they controlled production and the jobs of the workmen. Consequently, this class of cultivators who lived in various quarters of the town, was economically dependent on the central authority. The concentration of a number of wine-presses in the SW quarter of the town of Zakros probably aimed at greater control and mass production. On the other hand, it is not clear if the producers were partly independent with freedom to trade a part of their production or to keep a part for personal consumption. Nevertheless, in none of the houses have large magazines been identified in close association with the wine- or oil-press installations



to store large quantities sufficient for trading.

It has already been argued that the palaces housed their own full-time craftsmen, who dealt with precious and rare materials; the palaces also subsidized with land some cultivators, requiring a large percentage (or the total) of their agricultural production. Who then, made the goods which have been found in the town houses? Were there, finally, independent (or partly independent) craftsmen? If yes, where did they live?

The discovery of widely distributed evidence for stone-working in the Zakros town and the identification of a stone workshop to the north of the Royal Road at Knossos indicate that there was a class of craftsmen who lived outside the palaces practising their crafts for themselves. The case of the Knossos workshop has been discussed above and remains obscure, but at Zakros, apart from the isolated evidence, two probable stone-working places have been identified: Room A of the Building of the Pottery Deposits, and Room A of Building Z on the SW hill. In the first case, the stone-worker dealt with various activities, since stone grinding tools were also found in his workshop. Room A of Building Z yielded a heap of unworked steatites similar to those coming from the West Wing of the palace. In both cases it is likely that we have to do with part-time craftsmen who, simultaneously with their other occupations, dealt with stone-working. They probably traded their production which consisted of stone vessels, in the town. Their equipment would probably have been simple and their capability limited, as regards both the quantity and the quality of the products. Some



stone vessels of high quality which have been found in the town houses probably came from palatial craftsmen, or were gifts given by the palace authority to the owners of the particular houses.

An ivory workshop and a probable workshop for the manufacture of glass-paste jewellery have been identified north of the Royal Road at Knossos, but it is not very likely that the craftsmen traded their products in the town. Such objects have not usually been found in private houses and it is very likely that they were mainly intended for significant persons.

It seems that among the residents of the town there were some part-time bronze workers, since sometimes bronze tools have been found in private houses. Thus, we must accept the existence of a class of part-time bronze craftsmen, which could have been partly dependent on the palace for their raw material. Nevertheless, it is probable that these craftsmen were partly independent, trading part of their production. As regards the Mycenaean palaces, the Pylos tablets point to an absolute, bureaucratic control, even for the above cases.<sup>34</sup>

It is likely that among the residents of the town there were potters. These could have been full-time craftsmen earning their livelihood by practising their craft and trading their products among the residents of the town (or in neighbouring towns). The concentration of a large part of the fine ware inside the palaces suggests that they had their own craftsmen. If the channelled kilns were used for the manufacture of pottery, as Levi and Laviosa believe,<sup>35</sup>

then it is likely that a category of potters lived inside the palaces and were supported directly by them. It is not very probable that the huge quantities of pottery found in the palaces and in the large settlements were made by itinerants.

It has already been mentioned that the installations for food production, even though located in the town, produced chiefly for the palaces. The grinding and oil-pressing installations were scattered in almost every house of the town. Thus one could argue that part of the production remained for the owners of the houses for personal consumption, while the rest went to the palatial magazines. However, in the case of the wine-presses the number of the installations is much smaller than the number of the houses. Consequently, either the total production went to the palace from where a redistribution was made, or a part only went to the palace and the rest was traded by the producers directly in the town.

Clearly, the economic system described above was the basis for a strong state with a bureaucratic structure which in the case of Minoan Crete is represented by the palaces. However, what happened in the towns for which there is no evidence of a strong authority?

Areas in which stone-working took place have been identified in Kommos, Palaikastro, Mochlos and Trypeti, the harbour of Knossos. Areas for bronze-working were identified at Gournia, Kommos and Trypeti; in addition, there is some evidence for an ivory and a glass-paste workshop at Palaikastro.



All the above areas yielded heterogeneous finds, together with objects obviously unrelated to the particular working activities. For instance, the 'Stone Workshop' in Kommos yielded two bronze chisels, one long bronze tool, one whetstone, a seal and a fish-hook. The workshop in Block S at Palaikastro yielded a piece of lead, two beads, a partly worked piece of Giali obsidian, a cylinder seal, and a mould for the manufacture of glass-paste jewellery. In two of the houses in the town of Gournia moulds for casting bronze tools were found, but there was no other evidence for bronze-working. In a third house at the same site some bronze tools were found together with a folded bronze sheet, while in an adjoining room a stone table for working pigments was also found. The probable ivory workshop in Block X at Palaikastro, apart from some finished ivory pieces and part of an elephant tusk, yielded also a sickle and a double axe.

We are dealing, as Branigan argued,<sup>36</sup> with a class of part-time craftsmen who, simultaneously with their farming activities, made some objects from various materials to cover part of the needs of the community. Such people, capable in various crafts, exist still today in the small Cretan villages ("μύστορες"). These craftsmen practise their crafts at home, or in some cases in small independent rooms, according to various orders placed by people living in the village, or in other adjoining villages. Simultaneously they deal with their farming activities, since the profit coming from their crafts is not large enough to provide their total livelihood.



Even part-time craftsmen appear to have been concentrated in some areas. This has been observed for Palaikastro (Blocks F and E, Block N), but is more obvious in Gournia, where a large concentration in the northern part of the town is easily noticeable. Nevertheless, it remains uncertain if this latter formed any kind of guild (since we have to do with part-time specialists), or whether their location served some practical needs, such as the use in common of some of the tools, or finally, was simply an attempt to concentrate the inconvenience coming from the noise in a single quarter of the town.

It seems that permanent, full-time craftsmen may not have existed in these settlements. Probably, some of the needs of the residents were serviced by itinerant craftsmen though the latter are difficult to identify.

Nevertheless, the presence of independent craftsmen, even if they were part-time, in places where there is no evidence for a strong economic and administrative authority suggests the existence of independent merchants, who would provide them with the necessary raw materials. It is not very likely that the merchants and the craftsmen were the same persons, because the craftsmen would not have the required time, since they were compelled to deal also with farming or other activities. Consequently, the economic system in these societies appears to be somewhat different from that which has been described for the societies at the palatial sites where a large part or the total of the trade was in hands of the palace authority. On the other hand, the distribution of the installations for food production

throughout these settlements appears to be similar to that of the palatial towns. In Palaikastro five wine-presses were found, in Kommos two, and in Gournia two also. Consequently, their owners could dispose of their production directly to the town, without any intervention.<sup>37</sup>

The economic system of the above settlements seems to have been based mainly on free commercial exchanges. Consequently, the identification of 'shops' in Street Γ-E at Palaikastro, and probably along the East Ascent at Gournia, need not occasion surprise.<sup>38</sup>

Only a few traces of specialized crafts have been found in isolated farmhouses or 'villas'. Nirou Khani and Myrtos Pyrgos yielded some traces of bronze-working. Two channelled kilns have been identified at Vathypetro and Metropolis at Gortyna, and two pottery workshops at Vathypetro and Zou.

It seems likely that it would have been difficult for the residents of these buildings to get precious raw materials. In no case have stone, ivory, faience, or seal-making places been identified. Some limited bronze-working activities and the need for pottery manufacture lead to part-time craftsmen, not necessarily very specialized, who certainly were members of the social groups in these buildings. It is very probable that some of the needs of the residents were covered by itinerant craftsmen, or through commercial exchanges with neighbouring settlements.

Installations for food production have been identified in most of these houses: wine-presses at Vathypetro, Epáno Zakros, Profitis Ilias (Tourtouli), and oil-presses at



Vathypetro and Zou. These installations do not appear to be so extensive as to justify production intended to be consumed by social groups wider than those which were housed in the particular buildings. It is reasonable to suppose that the owners of most of these buildings exploited a surrounding agricultural zone as large as they could cultivate by themselves.

## 2, 3. Architectural Form and Contents

As has been described, the working places in Zakros were usually small or medium-sized, not in every case well lit, without standard architectural features. Those at Knossos and Mallia were similar. The stone workshop in Room XVII, 2, at Mallia is a small-sized basement, such as the room containing the raw Spartan basalts at Knossos.<sup>39</sup> For the architectural form of the Gypsum Vase Workshop at Knossos and the workshop to the north of the Polythyron III, 7 in Mallia we have insufficient evidence. The Stone Lamps Workshop in the House of the Fallen Blocks at Knossos was spacious enough and well lit; however it was approached only from upstairs by means of ladders, since it had no other entrance. The Lapidary's Workshop at Knossos, the workshop to the north of the Royal Road at the same site and the workshops in Trypeti and Mochlos have not been architecturally identified. The seal-making workshop at Mallia was located on the upper floor of a relatively small-sized house.

The probable bronze workshops present the same variety of form, construction and size. The location of the bronze-working places in Gournia has not been precisely identified. Nevertheless, in House Ea a big, multi-faceted mould was



found in a large, paved, ground floor room. The precise location and architectural form of the bronze workshop in the Unexplored Mansion is uncertain, while for the bronze workshop to the north of the Polythyron III, 7 in Mallia, housed in the same area as a stone workshop, we do not have a complete picture, because the new palace was constructed above it. Also, there is not enough evidence for the architectural form and the precise location of the ivory workshops.

Similarities in construction are only shown by the specific types of industrial installations, of which the form was directly related to the function. These include the channelled kilns, the pottery kilns, the looms (identified only in the similarities of the loomweights found) and the wine-presses. However, in these cases, we are rather dealing with permanent equipment of the particular workshops than with common architectural features.

Another important point drawn from the study of the Zakros working places is that the material used for their identification includes almost exclusively raw materials and tools. The same can be observed for working places at other sites, as for the workshop to the north of Polythyron III, 7 at Mallia, the room with the raw 'Spartan basalt' blocks at Knossos,<sup>40</sup> the stone workshop in Kommos, the probable ivory workshop at Palaikastro and the bronze-working places at Gournia. Nevertheless, some working places also yielded unfinished objects and waste material, such as the Gypsum Vase Workshop at Knossos, the seal-making workshop at Mallia, and the bronze workshop in the Unexplored Mansion, Knossos.

If one puts aside these latter workshops, the remaining working areas yielded limited quantities of waste material and unfinished products. At Zakros, the only real partly worked stone material was a half-sawn marble block. Only two unfinished stone vases of serpentine and limestone were found in the workshop of Room XVII, 2, at Mallia, and two unfinished amphorae were the only finds in the Sculptor's Workshop at Knossos. One unfinished lamp found together with seven similar finished pieces is the only evidence for the Stone Lamps Workshop at Knossos, while the Lapidary's Workshop at the same site yielded only a few partly worked pieces of material.

On the other hand, large quantities of raw materials in storage have been found in some cases, for example, in the room with the raw Spartan basalts at Knossos and the workshops of steatite-serpentine on the upper floor of the West Wing at the palace of Zakros. It should also be noted here that the variety of the unworked and partly worked material is not great. Gypsum was almost exclusively used in the Sculptor's Workshop and the Gypsum Vase Workshop at Knossos. Lapis lacedaemonius (Spartan basalt) was the only material in store in the basement of the Sculptor's Workshop at the same site. Steatite-serpentine was the type of material which was mostly used in the workshops of the West Wing of the Zakros palace. Steatite was almost exclusively used as well in Workshop Ø of Zakros and in the seal-making workshop at Mallia.

It has already been mentioned that at Zakros most of the areas in which working activities took place also yielded



large quantities of pottery and some other objects unrelated to them. Unfortunately, the information on the places in which working activities took place in other Minoan sites in most cases refers exclusively to the evidence related to those activities. We have no information on the remaining contents in the Sculptor's Workshop, the Lapidary's Workshop, the Stone Lamps Workshop at Knossos, or for the contents of the bronze-working places at Gournia. Also, we have not enough information about the context in which the material of the Gypsum Vase Workshop was found nor for any remaining contents in the seal-making workshops at Mallia and the ivory workshop beside the Royal Road at Knossos. Nevertheless, the two stone workshops in Mallia and the probable bronze workshop in Kommos present a picture similar to that of the Zakros working places: apart from the few objects related to the working activities, a great deal of pottery and objects unrelated to them were also found in the same contexts.

Finally, one more important point should be separately noted: the coexistence of two or more types of workshops in the same area. Thus, at Zakros a probable ivory workshop was located in the same area as a jewellery workshop. At the same site some weaving activities and working of pigments took place in an upper floor room in which a stone workshop has also been identified.<sup>41</sup> At Mallia, one stone and one bronze workshop were housed in the same area. In the Unexplored Mansion at Knossos a potter's wheel was found in an area adjoining a bronze workshop. In Nirou Khani a workshop for the manufacture of pigments was identified in one room, in which some kind of bronze-working activities may also



have taken place. At Vathypetro a loom was identified in the room of the wine-press.

A similar situation can also be observed for the Mycenaean working areas on the Mainland. For instance, a bronze and an ivory workshop were housed in the same room (Room 100) in the NE Workshop at Pylos.

On the basis of the above discussion one might conclude the following.

a. The dimensions of the areas in which working activities took place and the limited quantities of working material exclude the possibility of working groups with large numbers of people. Even in cases where the material was sufficient for this and there was actually sufficient space for working, careful study of the material itself showed that the craftsmen did not number more than two.<sup>42</sup> Moreover, it is likely that there was a single, specialized craftsman, who worked with the help of a second person, probably an apprentice. The seal-making workshop at Mallia and the Stone Lamps Workshop at Knossos point rather to work which was confined to members of the same family. The bronze workshop in the Unexplored Mansion yielded evidence for a more extensive activity which probably required a wider group of craftsmen.

Some groups probably worked in the country, but we do not know how many of them were specialized craftsmen and how many were simple workmen. Such large mixed groups, consisting of specialized craftsmen and workmen, probably dealt with some specific jobs requiring a large amount of work. Such jobs were probably the building activities,

the mining of raw materials, as well as some of the agricultural activities.

b. The working places were not especially built or fitted to be used as workshops. If traces of the working activities which took place in them had not been preserved one could not distinguish these particular rooms from others which were used for completely different purposes, such as storage or for living. They did not provide evidence for fittings (which would probably be made of wood), and there is no obvious planning for satisfactory lighting or ventilation, or for an easy way of approaching the area.<sup>43</sup> The working material in most cases was easily transportable and was found together with a large number of unrelated objects. Most of this latter material was probably in storage, on shelves or on the floor along the walls of the rooms.

In this situation one cannot easily speak of 'workshops', meaning permanent working places, especially arranged to house working activities. It seems likely that a number of places were occasionally used by the craftsmen to house some of their work for a relatively short time.

c. The unworked materials and the unfinished objects found in the working places are not at all equivalent to the volume and variety of the finished products found in the Minoan sites. Nevertheless, there are some cases in which raw materials were found in storage; their final working would certainly provide a great number of objects. The three elephant tusks and the six bronze ingots in Zakros, the raw Spartan basalts in Knossos, and the heaps of unworked steatites-serpentines found in the West Wing of the Zakros



palace, give an idea of the quantities of the raw materials intended to be worked by the palatial craftsmen. On the other hand, the variety of these particular materials is not as great as in the finished products. One can conclude that the material found in the working places (and that which was in storage as well) was simply that which was available at the specific moment of the destructions. For instance, in Knossos just before the final destruction there were available mostly lapis lacedaemonius and gypsum (Sculptor's Workshop, Gypsum Vase Workshop). At Zakros a large block of veined marble, a lump of rock crystal, large quantities of steatite-serpentine, ivory and bronze; at Mallia, before the ruin of the protopalatial buildings, there were steatite, serpentine, obsidian of two types and a large piece of red quartzite.

In cases where the quantity of unworked material is limited, we are probably dealing with what remained from a larger amount, part of which had probably been already worked out. The unworked rock crystal from Zakros is what remained of a larger quantity of the material which had been used for some objects found in palatial contexts (rhyton from the Treasury, pin-heads from the workshop itself).

From the above it has become clear that the raw materials were not imported all together but at different times, and were not renewed until completely spent. Besides, some of them were precious or rare and the quantities in which they were imported were not large. If one takes into consideration that the manufacture of a stone vessel required full-time work of one month at least, the quantities of the raw materials found appear to be enough for full-time



occupation for ten specialist craftsmen for one month. Consequently there is no need to look for workshops necessarily located outside the palaces (which have not yet been identified), especially since sufficient raw materials were concentrated in these latter.<sup>44</sup> Certainly, some of the goods were probably imported to the palaces as already finished products, by commercial exchanges, while a class of itinerant specialized craftsmen should not be excluded, even if for the present there is no archaeological evidence for their identification.<sup>45</sup>

d. The fact that the same small-sized (10-15 m<sup>2</sup>) rooms in most cases housed various working activities leads to the following conclusion: probably the same craftsman dealt with more than one craft, as happened with the part-time craftsmen already referred to above. The picture of a palatial craftsman who deals with every type of craft is represented in the tradition of Daedalos, the mythical craftsman of Minos. It has been argued elsewhere<sup>46</sup> that potters and bronzesmiths were the same persons, and the stone workers appear to have dealt with bronze activities as well. The motives and the craftsmanship of the small relief ivory plaques from the East Building at Zakros are very similar to those on the relief stone rhyton with the scene of the Peak Sanctuary found in the Treasury of the palace, and so may well have been carved by the same craftsman.<sup>47</sup> It seems likely also that the craftsman who dealt with jewellery and small stone artifacts also worked in ivory and seal-making, as is suggested by the evidence from Room XLIV of Zakros and the Lapidary's Workshop at Knossos.

### C. Final Conclusions

1. Various places in the Minoan palaces and settlements have been classified as workshops since some working activities obviously took place there for an unspecified length of time. However, these places do not suggest a permanent function and did not have standard architectural features.
2. During the neopalatial period the working of precious materials seems to have been concentrated inside the palaces or other big administrative centres. The raw materials were stored in their magazines.
3. In the same period there was a category of specialized craftsmen, who could be termed 'palatial'. These were full-time specialists, probably selected from among the town craftsmen, who may have lived inside the palaces and directly controlled by them. They practised their crafts in various places inside the palaces and probably dealt with more than one type of craft. They worked by themselves, with the help of some, not necessarily specialized, persons and rarely formed working groups. They were probably economically dependent on the central authority.
4. Another category of specialized full-time craftsmen appears in some cases to have been dependent on a different type of administration, the religious one, at least in the Middle Minoan period, Mallia, Quartier Mu. The craftsmen in this category usually worked near or inside the religious centres.

5. Jobs requiring a large volume of work were probably done by large, mixed working groups of specialized craftsmen and ordinary workmen, probably under the supervision of the central authority.
6. Installations for food production were usually located in the towns and provided foodstuffs for the palatial magazines, as well as for other private houses. Palatial control and intervention of the central authority in redistribution of the products seem probable, at least in the neopalatial period.
7. There appears to have been a class of part-time craftsmen who worked in the towns. They may have been able to exchange a proportion of their products independently. Nevertheless, in cases in which the raw materials used came from the palace, a palatial administrative control of the production should not be excluded.
8. A similar class of part-time craftsmen appears to have worked in towns with no obvious central administration. The economic system in this case was more or less based on free commercial exchanges.
9. The existence of independent or semi-independent craftsmen suggests a class of independent or semi-independent merchants who would trade a part of the imported raw materials.
10. In isolated houses, farmhouses and villas, full- or part-time specialists in crafts requiring precious raw materials probably did not exist. Some of the residents of these houses probably dealt with some simple crafts for the



manufacture of necessary goods. The rarer, luxurious objects came to the owners of these houses through commercial exchanges or were made by itinerant craftsmen.

11. A class of itinerant craftsmen has not yet been identified. Nevertheless it seems likely that such did exist, mainly to provide isolated houses with goods, or small settlements where there were no part-time or full-time specialist craftsmen.

12. The evidence from the identified prepalatial and proto-palatial workshops is not sufficient to produce a complete picture for their modes of organization and function. Nevertheless, the technology appears to have been closely similar to that described for the neopalatial workshops, and the socio-economic status of the craftsmen within the palatial period does not present distinctive differences. One may only notice the special relationship of some protopalatial workshops to a type of religious authority, which probably stood independent of the administrative one (Mallia, Quartier Mu). Prepalatial socio-economic status of the craftsmen was probably different from the palatial, though the evidence related to the workshops is not enough for a safe definition of it.

13. The workshops belonging to the Mycenaean period (LMII-III) were also very similar to the preceding neopalatial ones with respect to technology, organization, and function.

## NOTES TO CHAPTER I

1. R.D.G. Evely recently discussed the question of a more precise definition of the term 'workshop'. Evely 1988, 398-401
2. Evely 1988, 398.
3. As in the work of R.D.G. Evely on the subject of Minoan tools. Evely 1979.
4. The final publication of the material from Zakros has not yet begun since the excavation is still in progress.
5. It should be noted that the general diary for each excavation day is written by Prof. N. Platon himself, so any differences between the diaries are uniform.
6. New financial support for the excavation and the restoration of the material was given by the Greek Ministry of Culture from 1984 for the following five years.
7. The material from Zakros from 1961 to 1980, was transported to Heraklion Museum since Siteia Museum was not opened until 1980. In 1984 a great deal of the restored material was transported from Heraklion to Siteia, with the exception of the material which had already been put on exhibition in Heraklion.
8. Platon N. 1961-1970, 1971a, 1972-1973, 1975-1980, 1981a, 1982-1983.
9. Platon N. 1971b, and Platon N. 1974.
10. I would like to thank Prof. N. Platon for permission to use his diaries and his notes.
11. The research on the material in the storerooms of the Heraklion Museum was very difficult because of the heaping up of huge wooden boxes without external labels. It is probable that the material discussed exists, although it was impossible to identify it.
12. Until 1973 which was the year of the discovery of the kiln, they were described as 'volcanic masses' because some of these appear to contain sulfur.
13. Some of this research, done at the same period as the palace excavation and confined to the 'Gorge of the Dead', was intended to investigate the caves which contained burials of the prepalatial period.
14. Hogarth 1901.
15. Tournavitou I. 1988, 455-459.



NOTES TO CHAPTER II

1. Platon N. 1963, 175.
2. Platon N. 1963, 186, and Platon N. 1964, 149.
3. Platon N. 1974, 130.
4. Platon N. 1974, 196.
5. Platon N. 1966, 150-152.
6. Platon N. 1963, 187, and Platon N. 1964, 145-146.
7. It has been suggested that the East Wing of the palace of Knossos had four or five storeys. Evans 1921, III, 341 s.s. In the palace of Zakros which is built on level ground, only two floors have been proven.
8. As in the case of Room XIII of the Zakros palace.
9. Platon N. 1974, 114.
10. As in the case of saws in the Hall of Ceremonies (Room XXVIII) at Zakros.
11. See Chapter V.
12. The date of the Knossos tablets has been extensively discussed. Nevertheless, the earliest date considered does not lie earlier than the Mycenaean period of the palace.
13. Blegen, Rawson 1966, 299-325.
14. Evans 1921-1935.
15. For instance, for the 'Sculptor's Workshop' in the East Wing of the palace of Knossos, a detailed description of the two unfinished amphorae has been given, but the remaining contents (if there were any), have been omitted. Evans 1921-35, 896-900.
16. Nevertheless, sometimes the interpretations given in the annual reports in BSA have been interpreted differently in The Palace of Minos. For instance, an installation in the NE quarter of the palace was interpreted in the annual reports as an oil-press, Evans 1901, 82-83, while in The Palace of Minos it was described as a system for draining water, Evans 1921-35, 378.
17. Pernier 1935, and Pernier, Banti 1951. The oil-press in Area XX was described in detail, but a description of the remaining contents and the stratigraphy of the area were not given. Pernier 1935, 215-217.



18. Levi 1981. A kiln discovered beside the ramp leading to the West Court of the palace is described in detail. After the description follows the date and some parallels. The disadvantage is that the interpretation has been given first, while exact measurements and the stratigraphical description are omitted. Vol. I, 327-328, figs. 510, 511.
19. Halbherr, Stefani, Banti 1977. Here, as well, a good stratigraphical study is omitted, and it is difficult for the student to gain a good picture of each separate area.
20. Fouilles exécutées a Mallia, Etude Crétoises 1-26. These comprise reports from 1922 until today. The objects are separately presented, isolated from the architecture of the area. Consequently, it is not easy to have a general picture of each area nor is there a systematic stratigraphical description. Nevertheless, the descriptions of the objects are brief and essential. Interpretations of their use are usually given, as in the case of an oil-separator from the palace area. Chapouthier, Demargne 1942, 47-48.
21. Pelon 1980. For instance, there is only brief information on the use of Room XVII, 2, considered by the excavators as a stone workshop. 210-213.
22. Effenterre H. 1980. A good example is the description of the obsidian workshop. Vol. I, 85-86.
23. See Chapter I, n. 8.
24. Platon N. 1974.
25. For instance, Room XLV has been considered as a workshop, a consideration based exclusively on the discovery of some millstones and grinders; raw materials, tools, unfinished objects and waste material were not found in this room. There were, on the other hand, some fine stone vases, objects obviously unrelated to the workshop.
26. Excavations at Palaikastro I-V, BSA 8-12 (1902-1906).
27. Bosanquet, Dawkins 1923.
28. For instance, for the ivory plaques from Block X we know only the rooms in which they were found. For an unworked piece of an elephant tusk the information given is even more incomplete. Dawkins 1905, 284-285.
29. Boyd 1908. House Ac was described very briefly, while the exact position of the finds was not given. The 'oil-vat' in Room 21 is described separately, together with the household objects (p. 28). For a similar object from House Dd (Room 30), the method of use was given in detail (p. 27).

30. Hazzidakis 1934.
31. Xanthoudides 1922.
32. Marinatos 1941.
33. For example, Room 7 of the villa at Nirou, where the four big ceremonial axes were found, was considered as a bronze workshop though the evidence given is not satisfactory. Only a possible hearth and two heaps of schist-stone material which could possibly have been used for colour production, may be considered as evidence for the identification of the area.
34. Marinatos 1932. The absence of various finds in the villa's area was noted; however, the few clay vessels which were found were not described at all. No room was identified as a workshop area.
35. Marinatos 1949-1953, and Marinatos 1955, 1956.
36. Platon N. 1955, and Platon N. 1956.
37. Platon N. 1959a.
38. Platon N. 1960a.
39. Platon N. 1952, Platon N. 1953, and Platon N. 1954.
40. For instance, a kiln considered as a pottery kiln in the villa of Zou Siteia led the excavator to the view that a trough in a neighbouring room was used for the preparation of the clay; an open-air area close to the kiln was connected with the pottery manufacture and was thought to have been used for drying the vases after firing.
41. In Archaeological Reports (AR) there are short reports for most of the excavations which have been conducted in the area of Greece. Similar short excavation reports are given in Bulletin de Correspondance Hellénique (BCH).
42. For the 'Unexplored Mansion' at Knossos see Popham, Sackett 1973. (For the final publication see n. 52.) For Pyrgos, see Cadogan 1978. For the Stratigraphical Museum excavations see Warren 1981b, 1983, and 1985. These reports are also preliminary and the information given cannot be examined in detail. For instance, there is information on crucibles found in the villa of Pyrgos (in two spots), but we do not have their exact find position and there is no other information for the context of the rooms in which the crucibles have been found. Cadogan 1978, 76.
43. Tzedakis 1971, 1972a, 1973, 1974, Papapostolou 1975, Tzedakis 1976a, 1977a, 1978, 1979. In this case the architectural and stratigraphical relationships are



clearly described. However, the absence of interpretation of the function of the areas and their contents prevents easy understanding of the description. The successive architectural phases are not easily comprehensible, as well. For the excavations during recent years at the same site, see also Tzedakis, Hallager 1978, Tzedakis 1976b, 1977b, 1980-1982.

44. Sakellarakis J.A. 1966, 1967, 1971-1983.
45. Karetsou 1974-1981.
46. Lembesi 1972-1977, 1981, 1983.
47. Zois 1972 and 1974-1982. An extensive critical discussion of the preliminary excavation reports of Seager, who first excavated the site, as well as of a study of the architecture of the houses by Sinos (Sinos ST., Eine Untersuchung der Sogenannten "Palastanlage" von Vasiliki, AA 85, 1970, 1-24), is given in the first volume of the final publication of the site, Zois 1976b. Simultaneously a new publication of the old data is attempted, especially useful as introduction of the publication of the new excavations. The analysis of all the evidence is very good, while architectural, chronological and stratigraphical problems are extensively discussed. The publication of the movable finds of Seager's excavation is not included in the first volume, but has been announced for Vol. II.
48. As in the case of the description of a wine-press found in Building 4 at Phourni Archanes. After a detailed description of the area and of the installation itself, an interpretation is suggested based on the evidence given in the same text. Sakellarakis J. and E. 1977, 475-476.
49. Shaw 1977-82, 1984, 1986. Here, there are detailed descriptions of the areas, though the interpretations are not extensive. For instance, for a wine-press in Room 5 of the 'House of the Wine-press' interpretation has been given briefly. Shaw 1978, 119, pl. 35a, b.
50. Warren 1972a.
51. For instance, Room 90 (South West Tub Room) was considered to have been used for the preparation of wine offerings for the neighbouring shrine (Room 92). Warren 1972a, 83-84.
52. Popham 1984.
53. For instance, there is a good chapter on the bronze objects: The bronzes and metal-working equipment, by H.W. and E. Catling. Popham, 1984, 203-221. Here there is a typological classification of all the objects and general discussions of their use and date. Even the



problem of the identification of a bronze smith's workshop is separately discussed. Popham 1984, 205-206.

54. Branigan 1983.
55. Effenterre M. 1983.
56. Poursat 1983.
57. Evely 1988.
58. Tournavitou 1988.
59. Warren 1967.
60. Evely 1980.
61. Younger 1979.
62. Warren 1969a.
63. Warren 1979.
64. Warren 1978.
65. Evely 1979.
66. Deshayes 1960.
67. Shaw 1973.
68. Effenterre H. 1980.
69. Fiandra, Pelagatti 1962.
70. Betancourt 1985.
71. Hazzidakis 1934.
72. Hampe, Winter 1962, and Hampe 1962.
73. Singer, Holmyard, Hall 1954.
74. Davaras 1973, Davaras 1980.
75. Levi, Laviosa 1985.
76. Xanthoudides 1927.
77. Maryon 1949, Maryon 1959.
78. Forbes 1950.
79. Tylecote 1962.
80. Muhly 1973.

81. Renfrew 1972.
82. Catling 1964.
83. Branigan 1974. See also Branigan 1968.
84. Matthäus 1980.
85. Buchholz 1959.
86. Sandars 1955.
87. Platon N. 1981b.
88. Poursat 1977a, 1977b.
89. Sakellarakis J. 1979.
90. Krzyszkowska 1982.
91. Foster 1979.
92. Haevernick 1960, 1963.
93. Higgins 1980.
94. Keramopoulos 1930.
95. Symeonoglou 1973.
96. Demakopoulou 1974.
97. Papaefthymiou 1973.
98. Tsountas 1897.
99. Effenterre H. 1979.
100. Sapouna-Sakellaraki 1971.
101. Paton, Myres 1898.
102. McDonald, Rapp 1972.
103. Bosanquet 1902b.
104. Marinatos 1951.
105. Kopaka 1984.
106. Warren 1972a.
107. Nevertheless, it should be noted that, in some cases, the excavators because of their intention to identify an area, did not use the whole evidence but a selection from it. So, not rarely, from a group of finds only a few have been selected for the identification of an

area. For instance, a group of bronze tools has often been distinguished in order to be used for the identification of a workshop although many other unrelated objects have been found in the same area.

108. As the thesis of Kopaka for movable equipment of houses. Kopaka 1984.
109. For example, the study of Evely on the published material coming from Magazine XIII of Knossos. Evely 1980.
110. Platon N. 1964, 149.
111. See Chapter III 2, p. 118-133.
112. Popham 1984, 203-221.
113. Over Rooms XI, XII, XIII, XIV and XV. Among the vases fallen from the upper floor where the workshop has been identified, were two dozen large decorated pithamphorae, fruit-stands and pots for ceremonial use. Platon N. 1974, 99-104.
114. Effenterre H. 1980, 477.
115. Effenterre H. 1980, 551.
116. Evans 1929-35, IV, 896-900.
117. Effenterre H. 1980, 478-479.
118. Branigan 1983.
119. McGillivray 1987a, 277-278.
120. Platon N. 1974, 114.
121. Between Areas  $\Phi$  and T of House D. Platon N. 1962, 144.
122. Platon N. 1974, 106.
123. Blegen, Rawson 1966, 323-325.
124. Effenterre H. 1980, 478.
125. In the case of House A on the SW hill, spacious Room A was used for wine production, while simultaneously other household activities were taking place in the same area. Platon N. 1962, 144.
126. Evans 1921-35, IV, 898.
127. Platon N. 1974, 202-205.
128. Platon N. 1974, 100. As regards the ingots, it is certain that the area used for their working was elsewhere, since a kiln for melting the bronze could not have been located in the West Wing of the palace.



129. Platon N. 1974, 106.
130. Blegen, Rawson 1966, 311, 316.
131. Keramopoulos 1930, 35.
132. Such as the material coming from the 'Unexplored Mansion'. Popham 1984, 240-244.
133. Popham 1984, 218-219. Material lost in the workshops (droplets or spills), and that which was detached during the process of finishing (jets, web, risers, runners).
134. Levi, Laviosa 1986, 43-46.
135. McGillivray 1987a, 276.
136. Levi, Laviosa 1986, 18.
137. Popham 1984, 206.
138. As the analysis of the organic remains found in a tub at Myrtos. Warren 1972a, 54.
139. As in the 'Sculptor's Workshop' at Knossos. Evans 1921, IV, 896-900.
140. As the bronze tweezers found in Workshop  $\Phi$  of Zakros. Platon N. 1969, 203.
141. As in the case of Room A41 on the acropolis of Malthi. Valmin 1938, 104.
142. See below, p. 25.
143. See Evely 1979.
144. As Room  $\Gamma$  of the Building of the NW quarter in Zakros. Platon N. 1967, 185.
145. McGillivray 1987a, 277-278.
146. As in residential quarters.
147. Evans 1921-35, IV, 926-927. In a room used for kneading there was a two-stepped bench along the wall. It was thought that the workman sat on the first step, working on the second.
148. Platon N. 1974, 115.
149. Warren 1969a, 160.
150. In Room XXVI of the palace of Zakros apart from the raw materials some clay vases were also found, considered by the excavator as auxiliary equipment of the workshop. Platon N. 1963, 178.

151. This probably happened in the jewellery workshop at the 'House of Kadmos' in Thebes. Keramopoulos 1930, 35.
152. As in the case of a room discovered near Makrytikhos at Knossos, identified as a kitchen. Hood, DeJong 1959.
153. Room XLIII of the palace of Zakros was probably used only for the sawing of a large block of veined marble, the next stage of manufacture may have been carried out in another area.

### NOTES TO CHAPTER III 1

1. It is well known that the obsidian coming from Yali, near Nisyros, was mainly used for the manufacture of stone vases or objects, as for one of the sacred communion chalices found in the 'Treasury' of the palace. Platon N. 1971b, 143, 144.
2. This has already been described by Leakey. Singer, Holmyard, Hall 1954, 137-319.
3. Singer, Holmyard, Hall 1954, 134-135.
4. Bosanquet 1904, 222-223.
5. Singer, Holmyard, Hall 1954, 134.
6. Singer, Holmyard, Hall 1954, 137.
7. For steatite, ivory and bronze see below p. 54, 69.
8. See Chapter III 2, pp. 103-145.
9. Becker 1975, 244, 247, 248, 249, 250, and Warren 1969a, 140.
10. See Chapter III 2, pp. 103-145.
11. See Chapter III 2, pp. 166-177.
12. See Chapter III 2, pp. 168-169.
13. See Chapter III 2, pp. 103-145.
14. Platon N. 1974, 58. Since the particular material was not extensively used for seal-making in neopalatial times, the unfinished seal could hypothetically be dated to the postpalatial period. This would be possible, since the seal was found in one area where postpalatial occupation for a limited time has already been proved.
15. See Chapter III 2, pp. 144, 172.
16. Singer, Holmyard, Hall 1954, 137-139.
17. The pieces of veined marble found in Room XXVI to which the excavator refers have not been identified and studied by the writer. Platon N. 1974, 115.
18. For one of these two pieces see Platon N. 1977, 426.
19. Warren 1969a, 159.
20. See Chapter III 2, pp. 158, 179.



21. Warren 1969a, 159-160.
22. Serpentine, which is the most usual material for the manufacture of stone vases, was the material of most of the bore cores.
23. See Chapter III 2, pp. 154-166.
24. Marinatos 1931, 158.
25. Platon N. 1974, 122, fig. 71.
26. Under the term 'lapis lazuli' is meant here only the semi-precious stone and not its substitute, namely a blue glass-paste.
27. Despite the fact that there is strong evidence for local sources of the particular material. Marinatos 1931, 159.
28. See Chapter III 2, pp. 154-166.
29. <sup>Polinger-</sup>~~Foster~~ 1987, 291.
30. Platon N. 1977, 432, pl. 228.
31. Platon N. 1977, 428-433.
32. For Knossos see Evans 1921-35, I, 486.
33. Platon N. 1974, 199.
34. Platon N. 1977, 423.
35. See Chapter III 2, pp. 199-204.
36. Platon N. 1974, 115, 130.
37. Platon N. 1974, 100.
38. For the various colour-ranges which ivory takes under the influence of fire, see Poursat 1977a, 256.
39. Platon N. 1977, 433.
40. Platon N. 1977, 423.
41. Rubbers and grinders are studied on the basis of the information coming from the excavation diaries.
42. Such as, e.g., in the case of the East Building's workshop or the workshop in Room Γ of the Building of the NW quarter.
43. Such a view has been supported for dress manufacture on the basis of the information drawn from the Linear B tablets. Killen 1984, 49.

44. The information for most of the material is mainly based on the excavation diaries.
45. As, e.g., Room XVII of House B on the NW hill. Platon N. 1979, 315, fig. 4.
46. The information comes from the excavation diaries.
47. For these particular pits see Hogarth 1901, 123-129.
48. See Chapter V, p. 427.
49. Evely 1979.
50. Evely 1979, 49-65. Evely mentions that there are eleven saws from Zakros. He refers twice to the saw which was found fallen in the staircase leading to Room XXIV and he describes it, first as a wood-saw (p. 56), and secondly as a stone-saw (p. 59). From the study of the material itself (in addition to the information given in the preliminary excavation reports), one can identify a single saw, untoothed, which was rather used for stone-working. An additional confusion is due to the fact that the saw is preserved today in two pieces which are separately described in Evely's catalogue (p. 59-60). The study of these particular pieces by the writer proved that they belong to the same saw which, as mentioned, was probably used for stone-working.
51. Evely is right that the number of saws found in the sotto-scala of Area X was three, instead of two mentioned by N. Platon. Evely 1979, 56.
52. Evely does not understand why the saws were found folded in Zakros and puts forward the suggestion that they were probably votives of some fashion. Evely 1979, 66.
53. Evely incorrectly mentions two. Evely 1979, 54.
54. Type 3 includes the longest toothed saw operated by two persons. Evely 1979, 55.
55. In type 5 untoothed saws are included. Evely 1979, 59.
56. Evely considers that initially the saws had a single handle and later the second was added; he thinks that, because of the difficulties he had in the interpretation of their tapering blade or the rounded tip in this type. The necessity of a second handle for better operation was made obvious by experience. Evely 1979, 65.
57. Evely believes that the many holes prove the replacement of the saw's handle more than once. Evely 1979, 56 (no. 28).



58. This number does not agree with that given by Evely. Evely 1979, 23 (nos. 139-146). This happens because the chisels belonging to Evely's type '4' are not included here since they are separately described (see Drills, pp. 93-94). On the other hand, the chisels belonging to the writer's type '2' are considered 'flat adzes' by Evely and they are described by him as a separate category of tools. Evely 1979, 126. Although there is not enough evidence for such a function we cannot exclude this last.
59. Evely refers to three Zakros specimens belonging to this type and he classifies them as 'flat adzes', but there are actually five. This particular type of flat adze could be classified as variation 'c' of Evely. Evely 1979, 128.
60. Evely also faces the same problem. He suggests that most heavy-duty chisels of types '2' and '3' (our '1' and '3') should have been used for metal-working. Evely 1979, 29, 34.
61. Evely suggests a use only on soft stones, or for removing earth in agricultural work. Evely 1979, 129.
62. Evely distinguishes two types of knives, the flanged type and the type without flange. These types roughly correspond to our types '1' and '2'. Evely 1979, 44-46.
63. Type '1' of Evely. Evely 1979, 105.
64. Evely describes it as 'badly cast, unfinished, lumpy, full of gas-holes' and he classifies it in type '1'. Evely 1979, 101.
65. Evely consisers it a 'flat adze'. Evely 1979, 126.
66. Evely 1979, 105-106.
67. Evely 1979, 105-106.
68. See n. 64.
69. See n. 65.
70. N. Platon incorrectly calls this tool 'anvil'. Platon N. 1963, 183. To this fact is due the slip made by Evely, who refers to two separate tools, one 'stake-head' and one 'anvil'. Actually we are dealing with a single tool, a stake-head. This last is wrongly located by Evely in Room XXV. It was found, fallen from upstairs, on the descending steps of Room XXIV. Evely 1979, 196.
71. Evely 1979, 196.
72. According to the description given in the catalogues of Heraklion Museum.



73. Evely takes into account the possibility that these particular tools were used as drills, but finally he rejects it. However, he does not give his own interpretation. Evely 1979, 159.
74. Evely 1979, 133, 147.
75. Evely prefers to distinguish two different categories of tools and not two different variations (types). Evely 1979, 133, 147.
76. At least one more 'razor' was among the bronze objects which Hogarth found in Building C, as appears in a photograph published in the preliminary report of 1901. Hogarth 1901, fig. 46.
77. S. Marinatos was the first who expressed this view, in the publication of a house of the site 'Kousse'. Marinatos 1925, 71.
78. Evely 1979, 155.
79. Papaefthymiou 1979, 254.
80. Evely classifies these delicate tools in the category of saws creating one more type (type '6'). He believes that they were used for cutting soft stone, ivory, bone and wood. Evely 1979, 69.
81. They were found stuck together in pairs. Evely 1979, 69.
82. Evely distinguishes two types: a) Type 1: pointed. b) Type 2: blunt. The subdivisions of the above mentioned types are related to the presence or absence of the handle. Evely 1979, 166.

NOTES TO CHAPTER III 2

1. See Chapter II, p. 39.
2. It is located between other areas considered as rooms which served the Shrine, such as the Archive Room (XVI), the Deposit Room of the Shrine (XXII), the Central Shrine (XXIII), and the Lustral Basin (XXIV).
3. Warren 1969a, 107, 109, and Platon N. 1974, 123.
4. The Marsjeilles ewer found in Egypt has also been considered to have been made in Zakros by the same craftsman who made the Zakros one. Platon N. 1974, 92.
5. In Πρακτικά 1963 (Platon 1963), letter Ψ is given to the room. From Πρακτικά 1964 (Platon N. 1964) it has been numbered XXVI.
6. Platon N. 1963, 178.
7. Platon N. 1974, 115.
8. Platon N. 1963, 178.
9. Platon N. 1974, 115.
10. Excavation diary of 1963.
11. Excavation diary of 1963.
12. The existence of a door which could be closed is proved from slabs flattened at the two ends of the doorway, probably used for fixing a vertical bolt.
13. See Vol. III, Plan.
14. Traces of windows have been observed by J. Shaw on the east wall of the Hall of Ceremonies (XXVIII) (Excavation diary of 1964). The Banquet Hall (XXIX) could have been lit by similar windows, traces of which have not been preserved.
15. The Lustral Basin (XXIV) should have been roofed because of its use. In addition, the famous amphora with the S-shaped handles found in the fill of this room certainly fell from above. It is also improbable that there were windows in the Treasury (XXV), since precious objects which demanded security were kept there.
16. Platon N. 1963, 178.
17. Platon N. 1963, 178, and Platon N. 1974, 115.

18. Platon N. 1963, 178.
19. Warren 1969a, 140.
20. In a personal discussion which I had with N. Platon, he supported that there is no similarity between 'stalactite' and 'banded tufa', which is a kind of poros stone. However, he supported also that many stone vases from Mochlos were made from this material. Thus, it seems that the term 'polychrome stalactite' of Platon corresponds to the 'banded tufa' of Warren who writes: "Banded tufa was especially popular at Mochlos," Warren 1969a, 126.
21. This view was expressed by P. Warren who saw a fragment of this material.
22. Platon N. 1974, 115.
23. Platon N. 1963, 178. Many vases from the Treasury were made from various kinds of marble-like stones, but not from a red-coloured variety. Rosso antico is the only reddish stone from which some vases of the Treasury were made.
24. Platon N. 1963, 178.
25. Platon N. 1974, 150.
26. Drawing based on a draft drawing of N. Platon in the excavation diary.
27. See below, p. 141.
28. See below, pp. 118-141.
29. From the excavation diary we know that the small jar at the NE corner of the south part was found on 16-9-63 and the stalactites are mentioned on 17-9-63.
30. Information drawn from the excavation diary, 1963.
31. Above the corridor beside the Lustral Basin (XXIV) and the SW part of the Hall of Ceremonies (XXVIII).
32. Steatite was principally used for seal-making in pre-palatial times.
33. Warren 1969a, 165, 175, and Evely 1980, 129-133.
34. A wall-painting from Egypt, (Thebes, XVIIIth dynasty), depicts the functioning of a similar stone-vase workshop. Warren 1969a, 639.
35. Platon N. 1974, 166.
36. The finding of a handle and a leg of a bronze cauldron together with unshaped bronze sheets is evidence for the identification of a bronze workshop which we will discuss



below, pp. 188-191.

37. Platon N. 1963, 174. It was suggested that the material belonged to the contents of a room in which working activities took place, located on the upper floor.
38. If fragments of the same pot or similar material are found on both sides of a ground floor wall, it should be considered that the material had fallen from the upper floor.
39. The hypothetical restoration of the upper floor makes it possible that the areas above Rooms XI and XV comprised a single room.
40. For the arrangement of the upper floor rooms in Minoan buildings we have indirect evidence from the town of Akrotiri on Santorini (Thera). Moreover, some walls at Knossos were preserved to the level of the upper floor, mainly on the East Wing of the palace.
41. There is no evidence for a third floor at Zakros, although the excavator N. Platon does not exclude this possibility. Platon N. 1974, 70.
42. Typical examples of such an arrangement are the West Wings of the palaces at Knossos and Phaistos, as well as the houses in the town at Zakros. Nevertheless, large halls were found on the ground floor of the West Wing of the palace at Zakros.
43. In the excavation diary it is mentioned that the swords were found in situ, the one upon the other, at the SW corner of the room.
44. Platon N. 1974, 106.
45. Platon N. 1963, 174.
46. Blocks from the superstructure of the west facade of the palace were found fallen to the west of it. Platon N. 1964, 146.
47. Platon N. 1974, 99.
48. In the Banquet Hall (XXIX) there were two central beam systems, each consisting of three beams. Platon N. 1974, 159-160.
49. Perhaps the door opened a little further to the west, if there was a door opposite to it, which led to the room above the magazines.
50. For the window on the ground floor, see Shaw 1973, 102.

51. Platon N. 1962, 160-161. It is mentioned that a great number of mud-bricks had fallen from above. Also, Platon N. 1963, 176-177.
52. Platon N. 1963, 174. It is mentioned that coloured plasters had fallen from the upper floor. Most of these were found in the fill along the east wall of XIII, which was also the west wall of Room XIV. Information from the excavation diary.
53. In the catalogue of Heraklion Museum discernible incised signs in the form of  $\Lambda$  are mentioned in two cases. My study did not confirm this information and N. Platon states that incised signs are not visible. Platon N. 1974, 100.
54. For bronze workshops see below, pp. 180-198.
55. Information drawn from the excavation diary. Study did not confirm it. The 'silver band' is probably the bronze plate itself, which turns inwards to attach the wooden handle.
56. On the other hand, if these fragments were the top ends of two similar tools, the teeth should be used for the attachment of the wooden handle. That does not seem very probable, since there are no examples for such back ends, which were usually simpler.
57. See above, pp. 122-123.
58. These pots were described as vessels used in ceremonies. Platon N. 1974, 100.
59. Platon N. 1974, 106.
60. At least 0,30 m. above the floor. Information from the excavation diary.
61. Platon N. 1974, 99.
62. The latter do not belong safely to the same context.
63. In this case the problem of their dispersal in different levels in the fill remains.
64. Probably in a small storeroom or in wooden cases.
65. They were found in the NW part of Room XVI. Information from the excavation diary.
66. Apart from two or three fragments with polished surfaces.
67. See below, pp. 188-191.
68. Marinatos 1925, 71-73.



69. Two small chisels which could be used as ends of solid drills were found fallen from the upper floor in neighbouring areas. The first was in the north part of the corridor beside the Lustral Basin (XXIV), and the second immediately to the south of the lightwell of the Hall of Ceremonies (XXVIII). It should also be noted that, in most of the cases, reeds might have been used as tubular drills. Warren 1969a, 158.
70. Platon N. 1962, 156, and Platon N. 1963, 172.
71. It has been suggested that this group was built in blocking the doorway between Rooms VI and V.
72. The bronze axe which was found on the steps of Area II was of ceremonial type and its use as a tool may be excluded.
73. It is very probable that looms existed on the upper floor of the West Wing, since a great number of loomweights were found fallen from above in the area of the magazines. Platon N. 1974, 95.
74. One more piece of evidence which proves that the upper floor room was arranged differently is the presence of fragments of wall-paintings in the fill, which would probably have decorated a single wall corresponding to the east wall of the Corridor of the Bays. Platon N. 1961, 224.
75. In the case of Magazines III and IV, the separating of the contents fallen from above from the ground floor ones is extremely difficult. It should also be noted that most of such pots were found in Magazine III (θ). Platon N. 1962, 159.
76. Platon N. 1962, 159. This material has not been identified in the museum.
77. Platon N. 1962, 157.
78. Platon N. 1962, 156.
79. Platon N. 1962, 156.
80. Platon N. 1961, 223.
81. Information from the excavation diary.
82. Date based on the pottery.
83. Rooms III and IV.
84. Above Room IV.
85. Of the solid type, such as those of Br. S. Dr. cat. nos. 4 and 5.



86. Platon N. 1974, 130.
87. Based on information drawn from the excavation diary.
88. For the steatites the information is drawn from the excavation diary and the external label with which the material was labelled in the museum.
89. Nevertheless, N. Platon mentioned in the annual report that the stratum contained sherds earlier than the vases found on the floor. Platon N. 1963, 166.
90. In the same stratum a number of loomweights of various types and flakes of ivory and bone were also found. Probably, the area was used for various, different working activities. Platon N. 1963, 166.
91. Platon N. 1974, 196.
92. Platon N. 1965, 198-199.
93. Because of its weight this material has not been transported to Heraklion Museum, but was stored in a temporary storeroom in Zakros.
94. It seems that work was interrupted by the unexpected destruction of the palace. However, this could not be proved since a saw was not found in association with the block. At Knossos, similar half-sawn blocks of Spartan basalt were stored. Evans 1921-35, II, 268-271.
95. It is not certain that there was a north door facing the Central Court since the north wall was not well preserved at this point.
96. Information drawn from the excavation diary. Since the floor was plastered it is reasonable to suppose that the walls were plaster too.
97. This earlier use could belong to the same period (LMIB).
98. Room XLIII is the most spacious room on the ground floor. Such spacious ground floor rooms in the town houses of Zakros were usually used for working activities.
99. Platon N. 1974, 196.
100. Platon N. 1971a, 234, pl. 329a.
101. Platon N. 1971a, 234.
102. Platon N. 1966, 151.
103. Platon N. 1974, 203.
104. Platon N. 1974, 205.

105. If there was a similar arrangement on the upper floor.
106. The south and east walls of the room were parts of the facades of the South Wing.
107. Platon N. 1966, 148.
108. Platon N. 1966, 151.
109. On the external label is written: 'SE corner of the palace' (?).
110. The last stratum was not completely excavated since the water-table was high and prevented work.
111. The two drawings which are given on figs. 16, 17 are only sketches copied from the excavation diary.
112. Date based on pottery.
113. Platon N. 1974, 205.
114. The exact find place of this vase has not been identified.
115. Warren 1969a, 159.
116. Some bone tools, such as punches, could also be connected. Platon N. 1966, 152.
117. For ivory and faience-working see below, pp. 199-206.
118. Similar pin-heads were made of ivory and steatite.
119. Platon N. 1965, 188.
120. Platon N. 1964, 249.
121. Beads were also made of glass-paste and faience.
122. Letter Ø has been given to this area in a paper for the neighbouring kiln. Platon N. 1981b, 443.
123. Platon N. 1969, 202.
124. Platon N. 1981b.
125. For the date see below, pp. 170-171.
126. This small area was described by N. Platon as a washing area. Platon N. 1981b, 443.
127. Nevertheless, there was probably a temporary wooden roof.
128. If the two parts were attached to a wooden haft, the tool would not be very effective.
129. Platon N. 1969, 203.

130. Platon N. 1969, 203.
131. Platon N. 1981b, 444.
132. Warren suggested that these stones were used to keep the reed at the desired point during cutting out of cores from the interior of stone vases. Warren 1969a, 159.
133. It is possible that it was used to produce a white cream for the make-up of Minoan women. Also, steatite (talc) was used to make the white paint used on vases, and probably for medicinal purposes.
134. L. Pomerance suggested that saws which were found in the Hall of Ceremonies (XXVIII) were used for repairing the wooden floor which might have been damaged during earthquakes before the final destruction.
135. See above, pp. 118-133.
136. See Chapter II, p. 39.
137. See Chapter III 1, pp. 82-100.
138. We may mention the bronze cauldrons from Rooms XLII and XLIII of the South Wing of the palace. Platon N. 1964, 157, pl. 153a, and Platon N. 1965, 198.
139. As the jug from Room V of the Building of the Niches, or a bowl from Room XXVIII of the palace. Platon N. 1975, 360, pl. 279a, and Platon N. 1963, 186.
140. As the one from Room XXVIII. Platon N. 1964, 149.
141. Platon N. 1966, 148-149, and Platon N. 1974, 201-202, fig. 116.
142. Platon N. 1963, 182-183, fig. 2, and Platon N. 1974, 127-128, figs. 86, 87.
143. Platon N. 1963, 183, and Platon N. 1974, 130, fig. 89.
144. Platon N. 1963, 175, and Platon N. 1974, 108, fig. 90.
145. Platon N. 1976, 430. The sherds, from the description, seem to belong to the protopalatial period.
146. Platon N. 1981b.
147. Platon N. 1964, 153.
148. The material has not been restored. Some of this studied by the writer cannot safely be identified with finished or unfinished objects.
149. Platon N. 1981b.



150. See Chapter IV, pp. 333-344.
151. Platon N. 1973, 151.
152. Platon N. 1981b, 444.
153. Platon N. 1981b, 444.
154. Levi, Laviosa 1985.
155. Chapter IV, pp. 333-344.
156. See above, pp. 121-122.
157. Platon N. 1963, 174.
158. See above, pp. 118-133.
159. D. Evely's 'flat adzes'. See Chapter III 1, p. 89.
160. See above, p. 178.
161. Evely 1979, 196.
162. See Chapter III 1, p. 85.
163. Platon N. 1974, 195.
164. See above, pp. 147-148.
165. See above, p. 147.
166. Platon N. 1965, 199.
167. Platon N. 1965, 199.
168. Platon N. 1965, 199.
169. Platon N. 1965, 199.
170. See above, pp. 154-166.
171. Platon N. 1974, 201.
172. Platon N. 1974, 201.
173. Platon N. 1966, 148.
174. Platon N. 1966. 148. It has been mentioned that the ground floor's vessels had subsided from their original level.
175. Platon N. 1966, 149-150.
176. See above, p. 163.
177. Platon N. 1981b.

178. Platon N. 1963, 178, 183.
179. Platon N. 1974, 130, fig. 102.
180. Platon N. 1974, 130.
181. Platon N. 1966, 151, and Platon N. 1974, 202.
182. Platon N. 1977, 429.
183. See above, pp. 155-166.
184. See above, pp. 159-161.
185. See above, pp. 154-166.
186. Platon N. 1977, 429.
187. Platon N. 1977, 433.
188. Platon N. 1977, 423.
189. Platon N. 1977, 428.
190. Platon N. 1977, 432.
191. Platon N. 1977, 429-433.
192. As N. Platon argued. Platon N. 1977, 433.
193. Platon N. 1974, 130.
194. Platon N. 1974, 202-203.
195. See above, pp. 154-166.
196. Platon N. 1966, 144, and Platon N. 1974, 196-197.
197. Among others are R.M. Dawkins, F. Chapouthier, and P. Warren. Bosanquet 1903, 37-38, Chapouthier 1941, Warren 1972a, 122-123.
198. Georgiou 1980. See also Georgiou 1986, 7-11.
199. Shelmerdine 1985.
200. See above, pp. 145-153.
201. Platon N. 1974, 199, 200.
202. Platon N. 1966, 145.
203. Georgiou 1980, 140-141, 152-153.
204. Georgiou 1980, 129-133, 151.
205. Platon N. 1965, 200.

206. Platon N. 1966, 144, 145.
207. Georgiou 1980, 169.
208. Orlandos 1966, 122-125.
209. Georgiou 1980, 174.
210. Georgiou 1980, 173.
211. Georgiou 1980, 170.
212. Shelmerdine 1985, 57-58.
213. Platon N. 1964, 146.
214. Platon N. 1974, 90.
215. Platon N. 1974, 88.
216. Platon N. 1964, 146.
217. Platon N. 1974, 90, and Platon N. 1964, 146.
218. Platon N. 1964, 146.
219. Platon N. 1964, 146.
220. Hogarth 1901, 141, pl. V, 4, fig. c.
221. Despite the fact that in the case of Room XX a direct connection of this system with the installation under discussion has not been confirmed.
222. Platon N. 1975, 367.
223. Platon N. 1962, 159.
224. See above, pp. 133-141.
225. Platon N. 1962, 156, 157, and Platon N. 1974, 95.
226. See above, pp. 133-141.
227. For instance, a loom was identified by S. Marinatos in the room of the wine-press at Vathypetro. Marinatos 1951, 269.
228. Platon N. 1966, 150, and Platon N. 1974, 205.
229. See above, pp. 154-166.
230. Platon N. 1971a, 237.
231. Platon N. 1974, 225.
232. A precise number has not been given.



233. Platon N. 1971a, 237.
234. Platon N. 1978, 273-274.
235. Platon N. 1978, 293-296, and Platon N. 1979, 313.
236. Platon N. 1978, 296. Two cups coming from the lower level of the fill belonged to the MMIII period.
237. Hogarth 1901, 130, fig. B (above), pl. IV.
238. Platon N. 1974, 18.
239. Mylonas 1984, 96.
240. Hogarth 1901, 130.
241. Hogarth 1902, 333, pl. XII. The marine-style rhyton was found in the destruction layers of House A.
242. Hogarth 1901, 140, fig. C.
243. Hogarth 1901, 130, fig. B (below).
244. Hogarth 1901, 135.
245. Houses E-D constitute a sector of the 'Oblique Building' excavated again by N. Platon. Platon N. 1974, 212-213.
246. The 'Building of the NW Quarter'.
247. Platon N. 1974, 213.
248. Platon N. 1974, 212.
249. Originally, this room was named with the capital letter 'N'. Platon N. 1961, 221, fig. 2.
250. Platon N. 1961, 221, fig. 2, pl. 174b, and Platon N. 1962, 148-149, pl. B'.
251. Platon N. 1962, 151.
252. Platon N. 1963, 164-165, pl. 142a, and Platon N. 1974, 29, fig. 17.
253. However, the precise find place for each of them has not been given.
254. Platon N. 1962, 144, and Platon N. 1974, 58.
255. Platon N. 1962, 144.
256. Moreover, in Room A it seems that there was a period of reoccupation during the LMIII period: one upper floor was found 0,40 m. higher than the floor which corresponds to the installation under discussion. Platon 1962, 144.

any

257. Platon N. 1966, 147, and Platon N. 1974, 200.
258. Platon N. 1966, pl. 128b.
259. Platon N. 1974, 200.
260. Platon N. 1966, 148.
261. See above, pp. 194-198.
262. Platon N. 1962, 144.
263. See above, pp. 236-239.
264. Platon N. 1963, 168.
265. Platon N. 1962, 146.
266. Platon N. 1962, 147.
267. Platon N. 1962, 153, 154.
268. Despite the fact that one more period of use has been confirmed; this last phase probably belongs to the LMIII period. Platon N. 1974, 53-54.
269. Platon N. 1967, 183, 184, and Platon N. 1974, 212.
270. Platon N. 1967, 182, and Platon N. 1974, 211-212.
271. Platon N. 1967, 184-186.
272. Platon N. 1969, 227, and Platon N. 1974, 213.
273. Platon N. 1969, 220.
274. Platon N. 1971a, 253, 254, pl. 340b.
275. Platon N. 1971a, 262, 263.
276. Platon N. 1970, 218.
277. Platon N. 1970, 219.
278. Platon N. 1972, 181, 182.
279. Platon N. 1972, 181, and Platon N. 1969, 206.
280. Platon N. 1969, 206.
281. Platon N. 1962, 208, and Platon N. 1970, 211.
282. Platon N. 1970, 211.
283. Platon N. 1977, 404.
284. Platon N. 1979, 297.

285. Platon N. 1979, 305.
286. Platon N. 1979, 298-299.
287. The same fill yielded pottery which belongs to earlier periods. Platon N. 1979, 298.
288. Platon N. 1979, 302-303.
289. Platon N. 1979, 305.
290. Platon N. 1978, 293, and Platon N. 1979, 312.
291. Date based on the pottery. Platon N. 1979, 313.
292. Platon N. 1979, 314-317.
293. Platon N. 1979, 316.
294. Platon N. 1980, 320-323.
295. Platon N. 1980, 320.
296. Platon N. 1980, 325.
297. Platon N. 1980, 325.
298. Platon N. 1981a, 356.
299. Platon N. 1981a, 356.
300. Platon N. 1982, 346.
301. Platon N. 1982, 347.
302. With the exception of the 'East Building', where precise architectural location of the room is difficult.



#### NOTES TO CHAPTER IV

1. See Chapter II, p. 39.
2. Evans 1921-35, IV, 896-900.
3. Evans 1921-35, IV, figs. 875a, b, 876.
4. Information given by P. Warren in a personal discussion.
5. Evans 1921-35, III, 268-271.
6. See below, p. 309.
7. Warren 1967, Evely 1980.
8. Warren 1967.
9. Warren 1967, 196.
10. Evely 1980, 127.
11. Evely 1988, 409.
12. Abrading powders can be made from quartz sand, powdered quartz and emery. Red ochre is included among the polishing agents. Warren 1969a, 160.
13. Evely 1980, 137.
14. Evans 1921-35, II, 296-300.
15. Evans 1921-35, fig. 173.
16. Warren 1969a, 157, 159-160.
17. Warren 1969a, 138.
18. Chapouthier, Demargne 1942, 53-66, and Effenterre H. 1980, 476-481.
19. Warren 1969a, P. 627.
20. Warren 1969a, 157.
21. Chapouthier, Demargne 1962, 8, 56-57, and Effenterre H. 1980, 477.
22. Warren believes that the type of stone was serpentine. Warren 1969a, 103.
23. Warren 1969a, Type 13.
24. Pelon 1980, 8, 211-213, 219, 221.

25. See below, pp. 275-276.
26. Evans 1921-35, II, 235-238.
27. Warren 1978, 555.
28. Warren 1978, 561.
29. Shaw 1982, 166.
30. Branigan 1983, 26.
31. Levi 1976, 105, 96, pls. 230, 232, 239, 241, 242, 243.
32. Cadogan 1978, 83, Evans 1921-35, I, 170, and Platon 1957a, 143.
33. Blegen, Rawson 1966, 222-225.
34. Willson Cummer, Schofield <sup>1984</sup> 37-39.
35. Davis 1986, 97.
36. Warren 1978, Warren 1979, 103-104, and Marinatos 1974, 8.
37. Warren 1969a, Type 14.
38. Warren 1978, 557-561.
39. See Chapter III 2, p. 165.
40. See Chapter III 2, pp. 151-152.
41. See Chapter III 2, p. 146.
42. See Chapter III 1, pp. 60-61.
43. See Catalogue (Vol. II), Oth. St. cat. no. 18.
44. Platon 1969, 214, πν. 261β.
45. Warren 1969a, 160.
46. Reeds were probably used for this operation.
47. See Chapter III 2, p. 155.
48. See Chapters III 1, 2.
49. Dawkins 1904, 215-216.
50. Bosanquet 1902a, 316.
51. See above, pp. 267-269.
52. Evans 1921-35, IV, 594-595, and Evans 1901, 20-21.

53. See below, pp. 297-298.
54. Younger 1979, 258.
55. Warren 1979, 104.
56. Keramopoulos 1930, 35-36, and Keramopoulos 1911, 146-147.
57. Keramopoulos 1930, 36-58.
58. Since the material already described above was found in the adjoining room (O-E), it is very probable that there was a single workshop (instead of the two described), which should be located over Rooms E, O, and  $\Phi$ .
59. Symeonoglou 1973, 63-71.
60. Demakopoulou 1974.
61. Consequently, we can as well speak of a seal-making workshop housed in the same area.
62. Mylonas 1966b, 425-426, and Mylonas 1966a, 72-73.
63. See Chapter III. 2, pp. 173-177.
64. Effenterre H. 1980, 551-561.
65. Poursat 1983, 278.
66. Poursat 1983, 278-280.
67. See above, pp. 267-269.
68. Evans 1921-35, IV, 594-595, Evans 1901, 20-21, and Younger 1979.
69. Younger 1979, 260.
70. See above, pp. 282-283.
71. Betts 1976.
72. Forsdyke 1927, 252-254.
73. See Chapter III. 1, p. 55, n. 14.
74. Platon N. 1962, 147.
75. Poursat 1983, 280.
76. Torrence 1982, 193.
77. Effenterre H. 1980, 85-86.
78. Warren 1972b, 393, and Warren 1981, 630.



79. Torrence 1986, 152.
80. Tzedakis, Hallager 1983, 7.
81. Bosanquet 1904, 218-224, Torrence 1986, 147-150.
82. Torrence 1978, 79.
83. Torrence 1986, 149.
84. Torrence 1986, 154.
85. Torrence 1978, 77-84.
86. See Chapter III- 1, pp. 48-49.
87. Shaw 1973, 30-75.
88. See above, pp. 261-263.
89. See Chapter III- 2, p. 149.
90. Platon N. 1971, 234, πλν. 329a.
91. Boyd 1908, 32, pl. III, 57, 58.
92. Boyd 1908, 32, pl. III, 53, 54, 55, 62, 63.
93. Boyd 1908, 32, pl. III, 67.
94. Boyd 1908, 24.
95. Chapouthier, Demargne 1942, 53-66, and Effenterre H. 1980, 477-481.
96. See above, pp. 267-269.
97. Chapouthier, Demargne 1942, 56-66, figs. 37-40, pls. LII, LIII, XVI.
98. Pelon 1987, 271.
99. Pelon 1987, 271.
100. Effenterre H. 1980, 387-388, n. 57.
101. Effenterre H. 1980, 280-281.
102. Pelon 1987, 269.
103. Popham 1984, 203-222.
104. Popham 1984, 205-206.
105. Evely 1988, 407.
106. Shaw 1982, 183.

107. Shaw 1979, 162.
108. Xanthoudides 1922, 12-13.
109. Cadogan 1978, 74, 76.
110. Evans 1921-35, II, 235.
111. See above, p. 271.
112. Marinatos 1962, 87-94.
113. Renfrew 1972, 308-319.
114. Tsountas 1899, 124-126.
115. Coleman 1977, 3-4.
116. Walter 1983, 58-63.
117. Theoharis 1951, 80-81, and Theoharis 1952, 130-135.
118. Theoharis 1952, 131.
119. Valmin 1938, 103-105.
120. Valmin 1938, 156-158, fig. 27.
121. Blegen, Rawson 1966, 323-325.
122. Blegen, Rawson 1966, 299.
123. Tegyey 1984, 67.
124. Rapp, Aschenbrenner 1978, 123, 210-211.
125. Catling 1977, 31.
126. Platon N. 1981b, 442.
127. Willson Cummer, Schofield 1984, 37-39.
128. Davis 1986, 89.
129. Atkinson, Bosanquet 1904, 190-191.
130. Vermeule 1964, 229-230.
131. Karageorghis 1976, 56, 72-76.
132. Dikaios 1969.
133. Dikaios 1969, 65.
134. See Chapter III 2, pp. 182-187.
135. Hood 1957, 388, and Platon N. 1957b, 388.

136. Platon N. 1981b, 437.
137. Warren 1981b, 75-79, figs. 6-9.
138. Pernier, Banti 1951, 215-217.
139. See below, p. 340.
140. Levi 1976, 318, 327, figs. 494, 509, 510-511, 784, and  
Levi, Laviosa 1986, 37-38.
141. Levi, Laviosa 1986, 7-47.
142. Levi, Laviosa 1986, 7, 18-19.
143. Levi, Laviosa 1986, 21.
144. Marinatos 1951, 271, 1953, 298, 1955, 310 (πλν. 115γ),  
1956, 223.
145. Orlandos 1957, 92.
146. Tylecote 1962, 29-39.
147. See e.g., Davaras 1973, 75.
148. Hood 1960, 26, Hood 1961, 27, and Krzyszkowska 1982,  
138.
149. Evely 1988, 407.
150. Branigan 1983, 27.
151. Dawkins 1905, 283-284.
152. Pelon 1980, I, 106-107, 156, 179, 180.
153. Taylour 1969, 94, and Sakellarakis J.A. 1979, 19.
154. Mylonas 1966b, 425, pl. 96a, and Sakellarakis, J.A.  
1979, 17, 18; ελκ. 12, 13.
155. Sakellarakis J.A. 1979, 21-31, Wace 1954, 235-237,  
and Wace 1955, 180-184.
156. Sakellarakis J.A. 1979, 30-39, Wace 1954, 238-241,  
and Wace 1955, 185-189.
157. Symeonoglou 1973, 44, 61-62.
158. See above, pp. 286-287.
159. Blegen, Rawson 1966, 323-325.
160. Evans 1903, 64, fig. 20 , f, g, h, i, k.
161. Evans 1921-35, I, 488-489, fig. 349a, b, c.



162. Foster 1987, 291.
163. Foster 1987, 291.
164. Foster 1987, 290.
165. Foster 1979, 120.
166. See above, pp. 286-289.
167. Cadogan 1976, 18.
168. Dawkins 1904, 215-216.
169. Haevernick 1960, 41.
170. Tsountas 1897, 97-104.
171. Georgiou 1980, 174.
172. Shelmerdine 1985, 57-58.
173. Palmer 1969, 276.
174. Shelmerdine 1985, 54.
175. Shelmerdine 1985, 58-62.
176. Shelmerdine 1985, 62.
177. Singer, Holmyard, Hall 1954, 376-412.
178. Fiandra, Pelagatti 1962.
179. Betancourt 1985, 5, 23, 35, 47, 77-79, 117.
180. Hampe, Winter 1962, and Hampe 1962.
181. Warren 1969b, and Warren 1972a, 18.
182. Marinatos 1955, 310.
183. McGillivray 1987a, 276.
184. Blegen 1928, 30-38.
185. Davaras 1973, and Davaras 1980.
186. Levi, Laviosa 1986, 32-42.
187. Effenterre H. and M. 1976, 31-45, Chapouthier, Demargne 1942, 16, and Chapouthier, Joly 1936, 22-23.
188. McGillivray 1987a, 276.
189. Heurtley 1939, 5-7.

190. Caskey 1956, 158-159, pl. 41a.
191. Catling 1981, 16, figs. 23, 24.
192. Xanthoudides 1927.
193. Poursat 1983, 278-279.
194. Tzavella-Evjen 1972, 467, and Tzavella-Evjen 1984, 94-95.
195. See above, p. 318.
196. Boyd 1908, 32, nos. 42, 43, 56.
197. Caskey 1964, 322-323.
198. Evans 1921-35, I, 248-253.
199. Evans 1921-35, I, 249.
200. Warren 1981b, 84, fig. 42.
201. Catling 1977a, 7.
202. Dawkins 1904, 207.
203. Dawkins 1904, 205. The pottery from this house resembles the pottery from the house of the NW hill of Zakros. Hogarth 1902.
204. Boyd 1908, 22-23.
205. Marinatos 1951, 269.
206. See below, pp. 375-376.
207. See below, p. 375.
208. Sakellarakis J. and E. 1977, 474.
209. See below, pp. 378-379.
210. Sakellarakis J. and E. 1977, 480-481.
211. Platon N. 1957a, 141.
212. Willson Cummer, Schoefield 1984, 37-39.
213. Coldstream, Huxley 1972, 58.
214. Marinatos 1968, 21, 24, figs, 22, 27.
215. See Chapter III. 2, pp. 225-242.
216. Warren 1972b, 394, and Warren 1981a, 630, fig. 202a-b.

217. Warren 1972a, 25-27, figs. 15, 16, 75, pl. 8B.
218. Warren 1972a, 27.
219. Warren 1972a, 32-33, pl. 11B.
220. Warren 1972a, 33.
221. Warren 1972a, 53-55, figs. 21, 75, pl. 56B.
222. Warren 1972a, 83-84, 139, fig. 28.
223. Demangne 1953, 28, n. 1.
224. Chapouthier, Demargne 1942, 47-48.
225. Bosanquet 1903, 295.
226. Bosanquet 1903, 288.
227. Sackett, Popham 1970, 264.
228. Sackett, Popham 1970, 260.
229. McGillivray 1987b, 151, pl. 24f.
230. McGillivray 1987b, n. 38.
231. McGillivray 1987b, 151.
232. Boyd 1908, 22, 28, pl. I, 14.
233. Boyd 1908, 28.
234. Boyd 1908, 27, fig. 11.
235. Marinatos 1951, 266-269, εικ. 7-9, and Marinatos 1952, 594-596, εικ. 5-6.
236. Platon N. 1964, 165-166, εικ. 1, πιν. 156, and Platon N. 1965, 218-219.
237. Platon 1964, 166.
238. Platon N. 1965, 220.
239. Platon N. 1960a, 295, πιν. 239.
240. Platon N. 1960a, πιν. 239.
241. Platon N. 1960a, 300, πιν. 239.
242. Platon N. 1960a, πιν. 239.
243. Platon N. 1960a, 300.
244. Sakellarakis J. and E. 1977, 475-476, πιν. 242.



245. Sakellarakis J. and E. 1977, 480-481.
246. Shaw 1978, 119, pl. 35, a, b.
247. Shaw 1982, 170.
248. Shaw 1982, 170, pl. 51, e, f.
249. Bosanquet 1902b, 264-268, figs. 31-36.
250. Marinatos 1951, 266-268.
251. Warren 1972a, 138-139.
252. Warren 1972a, 138-139.
253. Demargne 1953, 90, pls. XLI, 8, XLI, 7, Deshayes, Dessenne 1959, 42, pl. IX, 3, Platon N. 1965, 219, Platon N. 1963, 169, and Shaw 1977, 208, pl. 49B.
254. Warren 1972a, 25-27.
255. Paton, Myres 1898, 209.
256. From the settlement of Petras (Siteia). This recent find is unpublished. It has been briefly presented in a paper by Dr. M. Tsipopoulou to the 6th International Cretological Congress, Khania 1986.
257. Dawkins 1905, 276, fig. 8.
258. Warren 1983, 73.
259. Bosanquet 1903, 334, fig. 1, and Bosanquet 1902a, 308.
260. Pernier 1935, 277, fig. 158.
261. Platon N. 1955, 291.
262. Marinatos 1949, 103, ελκ. 3.
263. Xanthoudides 1922, 14.
264. See above, pp. 380-385.
265. The Phaistos installation is protopalatial. Pernier 1935, 275-277. Another installation found in Knossos, originally named 'oil-press' by A. Evans, was finally proved to be a water drainage system. Evans 1901, 82, and Evans 1921-35, I, 378-380, fig. 275.
266. Pernier 1935, 205-206, fig. 89.
267. Evans 1901, 34, fig. 11.
268. Halbherr, Stefani, Banti 1977, 271-272, ελκ. 180.

269. Bosanquet 1903, 294.
270. Bosanquet 1902a, 305.
271. Alexiou 1964, 439, πιν. 520a.
272. Shaw 1977, 210.
273. Shaw 1978, 117, fig. 3.
274. Marinatos 1970, 13-15, pls. 10, 11, 12.
275. Marinatos 1972, 22-24, pls. 40-42.
276. Marinatos 1971, 26.
277. Forbes 1964-1972, III, 146-148.

## NOTES TO CHAPTER V

1. See Chapter I, pp. 1-2.
2. See below, p. 399. The kiln and Workshop  $\Phi$  were located in a free-standing quarter just outside the main NE gate-entrance of the palace.
3. East Building which housed a probable ivory workshop does not seem to have been a private house. A direct connection with the palace is likely.
4. Nevertheless, one of the Phaistos kilns was located in the NE court of the palace (Court 90); see Chapter IV, pp. 336-337.
5. Staircase X.
6. Room XLII.
7. Room XLVIII.
8. See Chapter III. 2, p. 241.
9. Rooms which housed working activities on rare and precious materials were located in the innermost parts of the building and were not easily approached from without.
10. One example is the sawing of the marble-stone block in Room XLIII.
11. See Chapter III. 2, pp. 119-124, 134-135.
12. Examples are unworked stalactites and reddish limestones identified in Room XXVI.
13. The workshop to the north of the Royal Road, west of Arsenal.
14. However, it should be noted here that one of them certainly belonged to the protopalatial period.
15. See below, pp. 409-410.
16. Keramopoulos 1930, 33-41.
17. Branigan 1983, 30.
18. As N. Platon argued. Platon N. 1974, 195.
19. Branigan 1983, 30.
20. See Chapter III. 2, p. 105.



21. Killen 1984, 55.
22. See n. 4.
23. One good source of limestone is in Akropolis, a site lying a short distance from the kiln site (information given by P. Warren in a personal communication).
24. Poursat 1983, 277-280.
25. Such as Tablet An 1281, in which names of workmen who served the deity have been registered. Tegye 1984, 70-71.
26. An example is the perfume-maker Philaeos. Shelmerdine 1985, 42.
27. As in Tablet Jn 829, which refers to bronze material. Tegye 1984, 77.
28. Warren 1967, 66.
29. Tegye 1984, 66.
30. French 1981, 45.
31. See Chapter IV, p. 328.
32. The wine-press in Room XXVIII, 1. See Chapter IV, p. 372.
33. Robkin 1979.
34. Branigan 1983, 30.
35. See Chapter IV, p. 339.
36. Branigan 1983, 29-30.
37. With the exception of Gournia town, where the existence of a central authority (more or less strong) suggests an economic status similar to that of the palatial sites.
38. Branigan 1972, 757-758.
39. If we accept that they were to be worked in situ and not in the 'Sculptor's Workshop' upstairs. See Chapter IV, pp. 262-262a.
40. See Chapter IV, pp. 261-263.
41. See Chapter III. 2, 218-219.
42. Poursat 1983, 278.

43. With the exception of the specialized industrial installations, such as kilns and wine-presses which needed a separate area and an easy means of supplying materials.
44. Effenterre M. 1983, 72-73.
45. Effenterre M. 1983, 73.
46. McGillivray 1987a, 277-278.
47. Platon L. 1987, 220.

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