CRAFTSMEN AND CRAFTSMANSHIP IN MYCENAEAN GREECE: FOR A MULTIMEDIA APPROACH *

Craftsmanship was undoubtedly a major affair in Aegean societies and craftsmen certainly played a prominent role in Aegean states. This is amply emphasized by the archaeological record that has given an enormous quantity of products of artisanal activity. Modern research has been interested mainly in the outcome of that activity, not much in its structure and organization. The present paper would like to have a closer but introductory look at that aspect of craftsmanship in Mycenaean times and lay stress on some basic issues of methodological interest. It will concentrate especially on productions belonging to the so-called minor arts and mainly on finds from the first phases of the Mycenaean period.

Of major importance are the close technical affinities between objects worked in different materials, especially gold sheets with repoussé figurative designs and glass paste or faience relief beads, produced respectively through hammering the metal sheet and pouring the paste into the cavities of moulds. Stone moulds of that type have been found in the excavations [1], but other materials like wood, metal or even clay [2] may have been used as well and have either not been preserved or been smelted for reuse. Real *identities* are concerned rather than mere affinities when sheets and beads made in two different materials prove to have been worked on the same mould. A systematic examination of the finds would be necessary to determine the extent of that practice, through observation of indentity of general shape of design, details and dimensions. This is not the concern here and some examples from the chamber tombs at Mycenae will be sufficiently convincing: the identity between glass paste beads in the form of a lily from tomb 95 [3] and gold beads of the same type from tombs

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* The following abbreviations will be used:
DAVIS = E.N. DAVIS, *The Vapheio Cups and Aegean Gold and Silver Ware* (1977);
KARO = G. KARO, *Die Schachtgräber von Mykenai* (1930-1933);
MYLONAS = G.E. MYLONAS, *Ὁ ταφικός κύκλος Β΄τῶν Μυκηνῶν* (1972-1973);
XENAKI-SAKELLARIOU = A. XENAKI-SAKELLARIOU, *Οἱ θαλαμωτοὶ τάφοι τῶν Μυκηνῶν ἀνασκαφῆς Χρ. Τσούντα* (1985).

1 A catalogue of moulds is given in Th.E. HAEVERNICK, "Beiträge zur Geschichte des antiken Glases, III. Mykenisches Glas", *JRGZM* 7 (1960) 39, n. 9, E.T. VERMEULE, "A Mycenaean Jeweler's Mold", *BMFA* 339 (1967) 31, n. 4, O. SARGNON, *Les bijoux préhelléniques* (1987) 363-365 and fig. 349-357 and J.A. SAKELLARAKIS, "Matrizen zur Herstellung kretisch-mykenischer Siegelringe", in *Studien zur minoischen und helladischen Glyptik, CMS* Beiheft 1 (1981) 167, n. 3. Some moulds have been discovered recently in Mycenae (*Well Built Mycenae*, Fasc. 27, *Ground Stone* [1992] 29-31, Pl. 4), Nichoria (*Hesperia* 44 [1975] 121 and pl. 28, a), Thebes (*AAA* 7 [1974] 164-165 and fig. 1-2) and Knossos (J.N. COLDSTREAM, *Knossos. The Sanctuary of Demeter* [1973] 121 and fig. 26).

2 Clay moulds have been used for embossing the gold sheet ornaments covering the chryselephantine cult statue of Zeus at Olympia: E. KUNZE, "Olympia", *Neue Deutsche Ausgrabungen im Mittelmeergebiet und im Vorderen Orient* (1959) 281-284, fig. 15-21.

3 XENAKI-SAKELLARIOU 272, no 4561 (7) and pl. 134 (306, type 105; height 1 cm, L. 2 cm).

78 [4] and 520 [5]; between glass paste beads in the form of two antithetic ivy motifs excavated in 1887/1888 [6] and gold beads of the same type from tomb 8 [7]; between a gold rosette found in 1887/1888 [8] and glass paste and gold rosettes from tomb 55 [9]. That the different items are in each case more or less contemporary is not the less important implication. The chronological difference indeed must have been limited, since a single mould does not appear suitable for a long use. Faience relief beads have been manufactured by the same process as early as the shaft grave period, the use of hollow moulds allowing again the repetition of identical designs on different series of ornaments [10]. The few identical faience relief beads found in the grave circles [11] were obviously manufactured by pouring into the cavity of a mould [12].

The prevailing funerary nature of early Mycenaean gold jewellery implies an essentially local use and certainly not a wide distribution of objects. This is probably true to a great extent, but there is some evidence, however, even though scanty in the present state of research, that in a few specific cases items of gold or glass paste jewellery found on different sites, especially relief beads, have surely been manufactured in the same workshop, since they appear to be identical and consequently to have been beaten or cast on the same mould. An absolute certainty on this would imply to check whether an ornament perfectly suits the hollows of a modern casting made from a second ornament that is suspected to have been made on the same mould as the first one. This, of course, is a most difficult and risky task, even when the two items are kept in the same place. In a more practical manner, we have to be satisfied with the observation of the identity in shape and dimensions between several ornaments, in the same way as for a series of identical ornaments found in the same context and as for the identity between gold and glass paste beads referred to above. The concern here, however, is not to give a systematic inventory of those cases of identity, but just the most significant examples. A first instance of identity is to be found on the gold sheet ornaments with the embossed image of an owl from the tholos tomb near the palace at

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4 XENAKI-SAKELLARIOU 218, no 3087 and pl. 100 (306, type 105; height 1 cm).

5 A.J.B. WACE, *Chamber Tombs at Mycenae* (1932) fig. 12, 38 (L. 2 cm). On the contrary, slight differences in dimensions allow to consider that beads that look identical do not come from the same mould: glass paste and gold beads of the same type 105 found in tombs 68 and 71 (XENAKI-SAKELLARIOU 194, no 2943 [2] and pl. 83; 205, no 2945 [1] and pl. 92) are smaller than those in tombs 78 and 95; beads from tomb 103 (XENAKI-SAKELLARIOU 288, no 4932 [7] and pl. 143) show at least two different dimensions and none of them, although belonging again to the same type 105, appears to be identical with beads from tombs 78 and 95; gold beads of lily shape type 106 from tomb 76 (XENAKI-SAKELLARIOU 211, no 2941 [7] and pl. 97) and glass paste beads of the same type from tomb 82 (XENAKI-SAKELLARIOU 233, no 3222 [2] and pl. 110), though apparently identical, have slightly different dimensions (1 x 0,8 cm and 1,3 x 1 cm respectively); glass paste and gold beads of the same type 106 probably from tomb 27 (XENAKI-SAKELLARIOU 141, no 2495 [19] and pl. 41) and from tomb 93 (XENAKI-SAKELLARIOU 268, no 4547 [5] and pl. 133), again apparently identical -but with a design slightly different from the preceding one- differ in their dimensions (1 x 0,6 cm and 1,2 x 0,8 cm respectively).

6 XENAKI-SAKELLARIOU 140-141, no 2495 (17) and pl. 41 (306, type101; height 0,7 cm, length 1,3 cm).

7 XENAKI-SAKELLARIOU no 2325 (7) and pl. 5 (306, type101; height 0,9 cm, length 1,1 cm). The slight differences in dimensions, here, are probably due to the cutting of the gold sheet.

8 XENAKI-SAKELLARIOU 143, no 2295 (6) and pl. 44 (303-304, type 87β; diam. 2,5 cm).

9 XENAKI-SAKELLARIOU 170-171, no 2816 (3) and 2791 and pl. 68 and 70 (303-304, type 87β; diam. 2,5 cm).

10 See faience beads from grave circles A (KARO no 71, pl. XX and XXIII) and B (MYLONAS pl. 159 α, 209β and 210α) at Mycenae. About the casting of faience beads and trinkets in moulds, see K.P. FOSTER, *Aegean Faience of the Bronze Age* (1979) 6-7 and 120-121.

11 KARO no 71; MYLONAS no Ξ-241, Y-243/245.

12 About the casting of faience beads and trinkets in moulds, see FOSTER (*supra* n. 10) 6-7 and 120-121.

Pylos [13] and from tholos tomb A at Kakovatos [14]. Identity in general shape, modelling of details as well as outline, and identity in dimensions are easily observable [15]. A second occurrence is given by glass paste beads of the 'double barrel' type found at Mycenae [16], Athens [17] and Pylos [18], the identity of which appears evident from the dimensions and from the shape and number of groves and the distance between them [19]. Glass paste beads with a relief design of stylized ivy leaf from Attica [20], from Ialysos on Rhodes [21] and from Diasela near Olympia [22] provide a third example of identity. An important implication of this is the relative contemporaneity between the documents of each series, as noted above for identities observed on jewellery items from a same site. For the present question, however, the geographical distribution of the finds is of even greater significance. It gives clear evidence of the circulation of manufactured pieces or of the circulation of the moulds themselves, and in the latter case evidence that the material has probably been transported by itinerant craftsmen travelling in the Peloponnisos and from there to Attica and even as far as Rhodes [23]. Such a conclusion, that a further and systematic approach would no doubt confirm, is essential for the problem of transmission of artistic influences. This is generally considered just in terms of an abstract transmission of motifs that appears too easily as self-evident, but we should keep in mind that the transmission of iconographic influences implies the necessary transmission of concrete and specific objects on which the designs appear.

Such affinities and identities imply a different structure and degree of specialization of workshops from the ones that can be deduced from later or even modern productions or from the ones that are usually assigned to the documentation by a classification of workshops based on materials only. Significant is the fact that the carving of moulds appears as the common denominator for shaping different materials. Equally worth emphasizing are the close technical connections that the manufacture of moulds implies with gem cutting and which may well account for some iconographical and stylistic similarities between gold ornaments and seals [24] and might lead to the suggestion that the engraving was made in both cases by the same people and in the same workshops since it requires much the same skill. A still closer connection with glyptic is indicated by the manufacture of seals of glass paste on matrices with relief designs, a variety of mass production that I. Pini considers as having

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13 C.W. BLEGEN *et alii*, *The Palace of Nestor at Pylos in Western Messenia* III (1972) pl. 192, 1-4.

14 Sp. MARINATOS and M. HIRMER, *Kreta, Thera und das mykenische Hellas* (1973) pl. 225, bottom left.

15 The slight variations in dimension (Pylos: H. 3,95, 3,6, 3,2 and 3,9 [BLEGEN *et alii* [*supra* n. 13] 117]; Kakovatos: H. 3,6 [K. MÜLLER, "Alt-Pylos II. Die Funde aus den Kuppelgräbern von Kakovatos", *AM* 34 [1909] 271]) are due to a different cutting of the sheets, either very close to the outline of the design or at some distance.

16 WACE (*supra* n. 5) 66, no 5 and fig. 25, c (1 specimen : 3,5 x 2,6 cm).

17 M.A. PANTELIDOU, *Αἱ προϊστορικαὶ Ἀθῆναι* (1975) 63, no 9, 65 and pl. 10, a (2 specimens : 3,6 x 2,6 cm).

18 BLEGEN *et alii* (*supra* n. 13) 131 and pl. 194, 20 (2 specimens : 3,85 x 2,65 cm; 1 fragmentary specimen: p. 170).

19 A similar bead from chamber tomb LI at Prosymna (C.W. BLEGEN, *Prosymna* [1937] 306 and fig. 575, 12) has probably been cast on the same mould, but it is badly preserved and its identity with the specimens from Mycenae, Athens and Pylos remains uncertain.

20 HAEVERNICK (*supra* n. 1) pl. 5, 2.

21 A. FURTWÄNGLER and G. LOESCHCKE, *Mykenische Vasen* (1886) 71, no 9 and pl. A 9.

22 N. YALOURIS, "An Unreported Use for some Mycenaean Glass Paste Beads", *Journal of Glass Studies* 10 (1968) 11, no 2 and fig. 4-6 (2,8 x 1,2 cm).

23 Similarly, the identity of the printed ornamentation on fragments of EH II pithoi from Lerna, Tiryns and Zygouries (running spirals and quadrupeds) indicates that they have been decorated by a single wooden cylinder and that they have probably been traded (S. HOOD, *The Arts in Prehistoric Greece* [1978] 214).

24 *Infra* p. 198-199.

probably been initiated on the mainland [25]. A second implication concerns the structure of such workshops, namely the hierarchy within them, since the far most important task in the production appears to be that of the craftsmen in charge of carving the moulds, whereas the hammering or pouring was just a subsidiary, repetitive and non-creative process that could be done by mere executants.

The extent of such a technical interdependence and of the primary role played by stone carvers can be measured from the variations of that main process of manufacture observed in the archaeological record.

A first variation consists in repeating an identical relief design several times on a single gold artefact through successive hammerings of the sheet in the same cavity of a mould. Examples are known from the shaft graves, chamber tombs and tholoi at Mycenae: sheet with waz-lily motifs from shaft grave III [26]; fragments of gold sheet from tomb 55 decorated with several motifs of the double argonaut type [27]; similar sheets excavated in 1892 [28] and bearing designs nearly identical to the cavities of a steatite mould from Mycenae [29]; sheets with oblique ivy designs from tomb 91 [30], with oblique waz-lily designs from tomb 102 [31] and with oblique lotus (?) designs from tomb 88 [32]; sheet with two antithetic sphinxes from tomb 102 or 103 [33]; sheet with ivy motifs from chamber tomb 515 [34]; sheets with ivy and waz-lily motifs from the tholos tomb of Clytemnestra [35]. Other specimens are attested outside Mycenae [36].

Beating gold foil in a hollow mould has been used for ornaments of various types [37] and most probably also for three-dimensional human and animal figures, the former made of a front half and a rear half soldered together, the latter of a single sheet attached to a flat base. Identical figures are attested in only one instance, in grave circle A at Mycenae [38], but the regularity of modelling and details that other single figures exhibit confirms that they could only be achieved by such a process -that is quite possible since the dimensions of the figures do not exceed 4 cm in length. Each part was produced by beating a sheet of gold in a hollow mould and as in the case of relief beads glass paste may have been poured in the cavities as well. The well known gold female figure from chamber tomb 68 at Mycenae [39], with

25 I. PINI, "Spätbronzezeitliche Ägäische Glassiegel", *JRGZM* 28 (1981) 77.
26 KARO no 23, pl. XXI.
27 XENAKI-SAKELLARIOU no 2848 (2) and pl. 69.
28 XENAKI-SAKELLARIOU no 2844 and pl. 80.
29 *Well Built Mycenae*, Fasc. 27, *Ground Stone* (1992) 29-31, Pl. 4. The similarities with gold sheets 2844 and 2848 (preceding n.) are striking (number of tentacles, general proportions, wavy lines on the body), but it is not certain whether the gold sheets have been beaten on the steatite mould. The dimensions of the latter are not known and the tentacles of the double argonaut figures on it are outlined with a row of small hollows intended to give an imitation of granulation which is not present on the gold sheets. The rows of pseudo-granulation are absent on the cavity of another stone mould, which show an equally similar design, but the item has been purchased in Smyrna and its exact provenance is unknown (FURTWÄNGLER-LOESCHCKE [*supra* n. 21] 34, fig. 22).
30 XENAKI-SAKELLARIOU 257-258, no 3191 (1) and pl. 125.
31 XENAKI-SAKELLARIOU 283, no 4918 (3) and pl. 139.
32 XENAKI-SAKELLARIOU 247, no 3156 (1) and pl. 118 and III. The stalks and small rosettes have been made separately, probably by direct hammering.
33 XENAKI-SAKELLARIOU no 5405 (3) and pl. 144.
34 WACE (*supra* n. 5) pl. XXXII, no 80a.
35 A.J.B. WACE, *Excavations at Mycenae*, *BSA* 25 (1921-1923), fig. 79, d and j.
36 E.g. WACE (*supra* n. 35) fig. 68, a, b and e (Heraion tholos tomb, double waz-lily motifs).
37 E.g. the rectangular gold sheets with animal figures covering the wooden hexagonal box from grave circle A at Mycenae : KARO no 808-811 and pl. CXLIII-CXLIV.
38 KARO no 32, pl. XXVII (4 small lions from shaft grave III).
39 XENAKI-SAKELLARIOU 194, no 2946 and pl. 84 (H. 2,5 cm).

additional granulation, is a good illustration of metal small sculpture in the round. The identity of the 20 small glass paste female figures from chamber tomb 2 at Mycenae [40] gives evidence that they have been made by successive casts in the same mould. The difference is that the glass paste figures have apparently a flat back -to get really three-dimensional figures would imply the use of a bivalve mould. Gold animal figures in the round are known from grave circle A [41] and from chamber tombs at Mycenae [42], but also from other sites [43]. The regular modelling of two faience ox figures from chamber tomb 82 at Mycenae [44] suggests, together with their identical dimensions, that casting was also used for faience small sculpture. The technical connections between the three materials, gold, glass paste and faience, are the same as attested above for relief beads.

There is clear evidence that both bezel and ring of solid finger rings in precious metal were made by casting gold in hollow stone moulds, many specimens of which have been preserved [45]. The oval outline of the cavities makes the identification of those moulds for solid bezels unmistakable, as well as the fact that the design appears in relief -a positive design different from the negative design on moulds used for beating gold sheets- in order to produce a negative corresponding design on the bezel. The manufacture of each finger ring of solid type consequently requires the use of two different moulds, one for the bezel and another one, of bivalve type, for the ring [46]. But some moulds may have been used also for beating bezels of non-solid type, which were then plated over a bronze core, like the example found at Varkiza in Attica [47], and the ring occurs in the non-solid variety as well and is made of simple sheet gold [48]. That second technique gives further evidence of the close connections with funerary sheet gold jewellery [49].

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40 XENAKI-SAKELLARIOU no 2286 and pl. 1 (5 specimens illustrated).

41 *Supra* n. 38.

42 XENAKI-SAKELLARIOU 181, no 2868 and pl. 76 (2 gold oxen from tomb 58, L. 2,5 cm; the two illustrations probably refer to a single specimen so that observation of the identity is not possible); 194, no 2947 and pl. 84 (gold bull from tomb 68, L. 3,8 cm; body attached to a flat base, head, horns and ears made separately); 215, no 2949 and pl. 98 (gold lion found in 1893, no exact provenance, L. 3 cm).

43 A gold bull's head from Amyclae, Laconia, is the only preserved part of a complete animal figure of the same type as the one from chamber tomb 68 at Mycenae and a companion piece is kept in a French private collection (R. LAFFINEUR, "Propos sur l'orfèvrerie mycénienne de Laconie", in *Πρακτικὰ Α' Λακωνικοῦ Συνεδρίου Σπάρτη-Γύθειον 7-11 Ὀκτωβρίου 1977, Λακωνικαὶ Σπουδαί Δ'* [1979] 46-52 and fig. 1-2). Another specimen is a gold stag figure from the Kadmeion at Thebes (*Das mykenische Hellas. Heimat der Helden Homers* [1988] 115, no 50 : head and body made in separate sheets, flat bottom made of a third sheet).

44 XENAKI-SAKELLARIOU 233, no 3124 and pl. 111 and II (L. 2,9 cm; the figure illustrated is very similar -but not identical- to the oxen from tomb 58).

45 See SAKELLARAKIS (*supra* n. 1) and *supra* n. 1.

46 See the summary drawing in SAKELLARAKIS (*supra* n. 1) fig. 26. Each half has a channel of semicircular section that gives only half of the volume of the ring. Small holes are cut in the main side of moulds used for both bezel and ring and small funnel-shaped channels connect the cavity to the external surface on moulds for rings only. Holes allow the precise setting of the second part on ring-moulds or of a cover plate on bezel-moulds, both bearing symmetrical holes as marks for joining. The exact correspondence of the two parts and their firm securing through the insertion of small sockets into the holes appear indispensable on ring-moulds to get regular castings, the liquid metal being poured through the funnel-shaped channel after joining the two parts.

47 *AAA* 7 (1974) 427 and fig. 8. Other examples mentioned by W.-D. NIEMEIER and J.G. YOUNGER in the discussion following Sakellarakis' paper (*supra* n. 1) 179 and in A. XENAKI-SAKELLARIOU "Techniques et évolution de la bague-cachet dans l'art créto-mycénien", in *Fragen und Probleme der bronzezeitlichen ägäischen Glyptik, CMS* Beiheft 3 (1989) 326-329.

48 XENAKI-SAKELLARIOU (*supra* n. 47) 326.

49 See J.G. YOUNGER, "Aegean Seals of the Late Bronze Age: Masters and Workshops, II. The First-Generation Minoan Masters", *Kadmos* 22 (1983) 132-133.

The manufacture of precious metal vases, another much developed production for the beginning of the Mycenaean period, should be considered briefly here. Shaping metal vases does not make much problem since most vases are made of thin gold and shaping consequently must have been relatively easy, even though in most cases from a single sheet of metal, sometimes with the handle raised of one piece with the body [50]. Repoussé decoration of metal vessels, however, leaves important questions unanswered. Descriptions generally just mention that the designs have been raised, either from the back or from the front, but do not investigate *how* they have been raised. A first possibility is that the relief motifs might have been modelled after the shape had been completed. In that case raising would imply beating the sheet from inside the vessel, definitely not an easy task, when applied in addition to a convex surface. Direct or freehand repoussé would have been the only usable process -except of course when the designs are hammered on a separate sheet, probably into a mould [51]. This appears acceptable for ornamentations of rudimentary geometric type like those on cups from grave circle B at Mycenae and on some *keftiu* cups from grave circle A [52]. But it seems incompatible with the extreme regularity in outline and quality of modelling that may be observed on vases with figural designs and scenes, especially the shallow cups with octopuses and ivies from Dendra [53], some of the specimens from grave circle A at Mycenae with images of animals and human figures [54] and some others with elaborate curvilinear ornaments from Mycenae and Peristeria [55], not to mention the two famous Vapheio cups.

An alternative process, that accounts better for such qualities, consists in hammering the vase over a solid core made of hard material, bronze or stone, with designs in relief. The technique has been suggested for the Euboean third millennium specimens in the Benaki Museum [56] and matrices with raising designs have been used also for the manufacture of glass seals with intaglio designs [57]. A major limitation is that the process can only apply to open shapes, since the core has to be removed from inside the vase when the ornamentation has been completed and the vessel has got its definite form. *Keftiu* cups, stemmed cups -their upper part at least- and most shallow cups, as well as the silver siege rhyton meet such a necessity, but closed shapes like jugs or jars certainly not. These, therefore, have to be made in two parts and the fact that the joint between them is generally situated at the point where the profile is inverting [58] makes the technique of forming over a core quite possible, since the two joining parts of the vase are of open type when taken separately. There are apparently two exceptions : the small gold jug from shaft grave III , made of a single sheet of gold, but

50 DAVIS 351-352 (with a list of examples).

51 See for instance a gold-plated silver shallow cup from Vapheio: *Das mykenische Hellas. Heimat der Helden Homers* (1988) 103, no 31.

52 DAVIS fig. 98-104 and 108-111.

53 DAVIS fig. 214-216, 224-227 and 232-233.

54 DAVIS fig. 132, 176-180 and 185.

55 DAVIS fig. 112, 120 and 196-199.

56 B. SEGALL, *Museum Benaki, Athen. Katalog der Goldschmiedearbeiten* (1938) 11.

57 As suggested by J.G. YOUNGER, "Aegean Seals of the Late Bronze Age: Masters and Workshops, II. The First-Generation Minoan Masters", *Kadmos* 22 (1983) 132: "Matrices carved in relief but located within a tondo recessed in the stone die are necessary for the production of glass seals, whose designs, by definition, must resemble intaglio work". Mass production through the use of moulds (on the technique, see PINI [*supra* n. 25] 64-68) is evidenced by the identities observable on the glass lentoids from Medeon: some lentoids, with identical designs, come from the same matrix, while some others show slight differences and were either recut or formed on a different but similar matrices.

58 DAVIS fig. 120 (silver jar from shaft grave V) and 192-193 (miniature gold lidded vase from shaft grave III).

the chains of spirals on its body have been modelled by chasing rather than repoussé [59], and the silver krater with a battle scene from grave IV, but the reconstruction of the fragments of its body shows significant lacunae and these are mainly situated at a level just below the shoulder, *i.e.* precisely where a joint could possibly have existed [60]. The four shallow cups belonging to an homogeneous category that I have proposed to call "Dendra type" [61] also make problem. The inward curving shoulder and concave-splaying neck give them a closed profile. Two of them, a silver specimen from chamber tomb 2 at Dendra-Midea [62] and a gold one from chamber tomb 10 on the same site [63], both with a chain of ivy motifs on the body, have a neck that has been modelled in a succession of lobes from a separate gold strip. But the two remaining examples have been raised out of a single metal plate : the famous gold octopus cup from the Dendra tholos [64] and the silver cup with a tricurved arch pattern from chamber tomb 78 at Mycenae [65]. The only way of accounting for the perfect quality of the decoration -especially on the octopus cup- that certainly implies the use of a core is to consider that the last two vases have been modelled in two successive stages, first the raising of the body and its decoration over a core and second the freehand shaping of shoulder and neck that had been left straight or even sloping in the first stage in order to have the core easily removed. A removal when the shaping of the closed form has been completed would be possible only if the core is made of relatively soft and fusible or breakable material, respectively wax or terracotta. The former may appear not rigid enough, even though beating gold sheet does not require much pressure -pressing and rubbing with the fingertips proves to be sufficient [66]. The latter gives stronger support, but the core could hardly be broken and removed without causing damages to the shape.

Stone is finally the most appropriate material but no solid core for beating precious metal vessels has been preserved [67] and this may well appear unexpected -unlike for wax or terracotta cores intended for single use-, especially when compared to the numerous moulds for beads and trinkets referred to above. This is rather strange, since carving an elaborate scene in stone is a most difficult task that is worth taking advantage of by making it suitable for several successive uses. A second objection is that not a single occurrence of identical vases, *i.e.* vases beaten over the same core, can be identified. The two shallow cups from chamber tombs 2 and 10 at Dendra [68] make a crucial point in that respect : they have the same dimensions -13,2 and 13 cm in diameter and 5 cm in height, without handle- and their decoration shows close similarities, but a real identity between the two ivy chains on their body, though highly probable, cannot be accepted for sure, because of the bad state of preservation of the former.

The possibility of stone cores is also worth considering because relief figural decoration on metal vases is closely related to the technique of early LM stone vessels, the high qualities

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59 DAVIS fig. 186.

60 A. SAKELLARIOU, "Un cratère d'argent avec scène de bataille provenant de la IVe tombe de l'acropole de Mycènes", *Antike Kunst* 17 (1974) 5, fig. 1a-b for the reconstruction of the scene and 6, fig. 2 for a localisation of the missing parts on the profile.

61 R. LAFFINEUR, "A propos d'orfèvrerie mycénienne, les tasses basses du type de Dendra", *SMEA* 17 (1976) 189-204.

62 DAVIS 287, no 121 and fig. 232-233.

63 DAVIS 267, no 110 and fig. 214-216.

64 DAVIS 276, no 116 and fig. 224-227. On this see lastly J. HURWIT, "The Dendra Octopus Cup and the Problem of Style in the Fifteenth Century Aegean", *AJA* 83 (1979) 413-426.

65 DAVIS 296, no 128 and fig. 239-240.

66 H. HOFFMANN and P.F. DAVIDSON, *Greek Gold Jewelry from the Age of Alexander* (1965) 27.

67 The only possible core is a stone vase made in two parts from chamber tomb 26 at Mycenae (XENAKI-SAKELLARIOU no 2490, pl. 18).

68 *Supra* n. 62-63.

of which certainly postulate an earlier tradition on the island. The manufacturers of early Mycenaean precious metal vases, whether Mainlanders or Minoans working for mainland centres, would thus have accommodated a Cretan type of ornamentation, together with its iconographical repertory, from one medium to the other and the stimulus for this has perhaps been provided by the fact that some LM I stone vases must have been covered with gold foil [69]. Terracotta might have played a non negligible role as well. Relief work in clay has been considered by K.P. Foster as an "essentially nonceramic device intended to imitate the repoussé of metal vessels" [70]. But the reverse influence could be equally true to a certain extant. The much decisive development that precious metal plate has been experiencing at the beginning of the Late Bronze Age through the introduction of pictorial raised decoration could well have been prompted by the imitation of relief work in other media, ivory, stone, faience and terracotta, the tradition of which goes back to Middle Minoan period. Relations between artistic productions in different materials, again, prove to be significant.

The above review of some of the techniques practised by mainland craftsmen during the Late Bronze Age allows an identification of some specific and recurring features. The most characteristic appears to be a certain mass production that is made possible by using moulds or dies and that has been applied to different types of objects, to various ornaments and beads and also most probably though less frequently to precious metal vessels, as well as to different materials, gold, silver, glass paste and faience. This gives evidence of the great homogeneity of the production and this in turn is an obvious sign of its essentially local character. The main impression that we gain from the technical examination is that of a strongly homogeneous production in which craftsmen working on different media were closely related to each other and at the same time directly dependant from the ones in charge of carving the moulds. This leads us to investigate whether there is a relation between the situation described above and the organization of the workshops.

Mycenaean jewellery workshops have been revealed in the excavations on the Greek mainland, especially at Thebes. They give clear evidence that different materials have been worked up into shape at the same place, not only precious metals, fragments of which were discovered both in finished and unfinished form [71], but also glass paste, shells and amber and raw stones like rock crystal, steatite, onyx, amethyst, agate, lapis lazuli [72]. Stone moulds are also attested [73]. Especially significant is the presence of small gold sheet ornaments of regular geometric shapes [74], but also cut along the outline of pictorial designs [75]. These were surely intended as inlays for bronze objects, most probably vases rather than daggers, since the manufacture of the latter had ceased at the time when the Thebes workshop was in activity, immediately before its destruction at the end of LH IIIB:1, whereas inlaid metal vessels were

69 The "sanctuary rhyton" from Zakro is a good example (Sp. MARINATOS and M. HIRMER, *Kreta, Thera und das mykenische Hellas* [1973] pl. 108-110). For stone vessels with traces of their original gold covering, see P. WARREN, *Minoan Stone Vases* (1969) 45, 86-87, 97 and 162-163.

70 *Minoan Ceramic Relief* (1982) xiii (see also 121). Cf also G. WALBERG, *Kamares. A Study of the Character of Palatial Middle Minoan Pottery* (1976) 40.

71 S. SYMEONOGLOU, *Kadmeia I. Mycenaean Finds from Thebes, Greece. Excavation at 14 Oedipus St.* (1978) 63-66 and fig. 263-266 (workshop located on Site 4 in Symeonoglou's catalogue : *The Topography of Thebes from the Bronze Age to Modern Times* [1985] 47 and 232).

72 K. DEMAKOPOULOU, *AAA* 7 (1974) 168-169 (workshop located on Site 165 in S. Symeonoglou's catalogue: [*supra* n. 71] 47-48 and 283); S. SYMEONOGLOU, *Kadmeia I. Mycenaean Finds from Thebes, Greece. Excavation at 14 Oedipus St.* (1978) 66-70 and fig. 267-273. For a core of rock crystal from the palace workshops at Thebes, see *Das mykenische Hellas. Heimat der Helden Homers* (1988) 217, no 202.

73 DEMAKOPOULOU (*supra* n. 72) 166-167 and fig. 1-3.

74 SYMEONOGLOU (*supra* n. 72) 65 and fig. 264:6-9 and 13-17.

75 SYMEONOGLOU (*supra* n. 72) 64 and fig. 264:10-11 (18 and 25 are possibly also parts of figural motifs).

still being made at the end of the LH IIIB period [76]. This seems to indicate that at least in this particular case ornaments made of precious metal, semi-precious stones and other coloured materials were manufactured in the same workshop as the inlaid precious metal vessels. This is a confirmation of the strongly homogeneous character of the production that has been observed above, as well as a confirmation of the close relationship between the different varieties of "painting in metal". Not less important for the reconstruction of the successive stages in the manufacture are the six small pieces of rock crystal identified by the excavator as inlays to be assembled on a panel -even though he does not know of any similar motif in the same material in Late Bronze Age Greece- [77], but that I would interpret rather as magnifying glasses. The craftsmen certainly were in the need of a magnifying system when working on such small items as gold beads, and especially when they had to put granulation on them [78]. The slight convexity of the six items from Thebes gives them some properties to enlarge things that are looked at through them [79] and the double cutting at the bottom may be the best means of allowing an easier grip for the lenses rather than a shape feature. Stone moulds found at Mycenae give also evidence of the existence of jewellery workshops on the site.

These are the few pieces of evidence that can be gained from an examination of the remains of Mycenaean jewellery workshops [80]. Written sources do not provide greater information on that matter. The Pylos linear B tablets give some references to bronze (tablets Jn), especially to the system of distribution of raw material to specialized workshops of *ka-ke-we* [81], but there is just one indirect hint at gold working, namely on tablet An 207 that mentions four *ku-ru-so-wo-ko* or goldsmiths working in a place called *a-nu-wa* [82]. Whether this single occurrence could be an indication that the manufacture of precious objects in the Pylos kingdom was limited to a single workshop or a single place, as has been suggested [83], is far from certain. The control of the palatial administration might well have been stricter for gold than it was for bronze, but there is no evidence of such a centralization as to imply an absolute monopoly. Significant is, on the other hand, that artisans are designated by the name of a specific material (*ku-ru-so-wo-ko*, *ku-wa-no-wo-ko*) and that the differentiation between

76 See the inlays in the form of male heads in profile from the palace at Pylos (C.W. BLEGEN and M. RAWSON, *The Palace of Nestor at Pylos in Western Messenia* I [1966] 57-58 and fig. 261; the same technique attested on silver fragments with gold floral motifs : *op. cit.*, fig. 262), belonging probably to the decoration of a silver cup similar to a specimen from chamber tomb 24 at Mycenae (XENAKI-SAKELLARIOU pl. 15).

77 SYMEONOGLOU (*supra* n. 72) 69 and fig. 270.

78 SYMEONOGLOU (*supra* n. 72) fig. 263:1-3.

79 The same properties may be observed on much later rock crystal plano-convex lenses from Amathus on Cyprus (P. AUPERT, A. HERMARY *et alii*, *BCH* 104 [1980] 811, fig. 12 and R. LAFFINEUR, *Amathonte III. Testimonia 3. L'orfèvrerie* [1986] 118-120). On magnifying glasses in antiquity, see lastly G. SINES and J.A. SAKELLARAKIS, "Lenses in Antiquity", *AJA* 91 (1987) 191-196.

80 The Northeastern Building in the palace at Pylos has been identified as the Palace Workshop, but no significant precious metal fragments were found in the different rooms (BLEGEN and RAWSON [*supra* n. 76] 299-325). At Mycenae the "Artists' Quarters", immediately to the West of the "House of Columns", have yielded numerous ivory chips, fragments of copper ore and some stone cores, but again just a few fragments of gold leaf. The discovery of pieces of a substance probably used for inlaying seems to confirm the association of different jewellery techniques on the same place (a summary on the finds in G.E. MYLONAS, *Mycenae Rich in Gold* [1983] 118). About workshops for gem-cutting, see J.H. BETTS and J.G. YOUNGER, "Aegean Seals of the Late Bronze Age: Masters and Workshops. Introduction", *Kadmos* 21 (1982) 115.

81 On these see lastly E. STAVRIANOPOULOU, *Untersuchungen zur Struktur des Reiches von Pylos. Die Stellung der Ortschaften im Lichte der Linear B-Texte* (1989) 95-110.

82 STAVRIANOPOULOU (*supra* n. 81) 116 and 119.

83 *Ibidem*.

them appears consequently to reflect a differentiation between the workshops in which those different materials were shaped. This might suggest that the structure had evolved from a multimedia structure in the early Mycenaean period to a more specialised structure at the time of the palatial archives. The evidence from Thebes, however, seems to reflect a situation in the 13th century that is not different from the one prevailing in the shaft grave period. Does this mean that the suggested evolution was limited to central regions in the Peloponnisos, whereas no significant change occurred in the structure of workshops in more peripheral regions during the centuries? Or are we to suppose that terms such as *ku-ru-so-wo-ko* and *ku-wa-no-wo-ko* refer to people in charge of shaping the different materials, not to those responsible for the general organization of the workshops?

Anyway, the relatively scanty information about jewellery workshops appears rather disappointing. We should not forget, however, that a substantial part of Mycenaean precious metal objects belongs to the category of funerary ornaments made specifically for funerary use and that it has been recently suggested that at least in one case the manufacture of gold ornaments had taken place within the tomb itself, during the process of laying down the deceased and the offerings. This is the way in which E. Protonotariou-Deïlaki quite convincingly interprets the tiny pieces of gold sheet found near one of the skeletons in the tholos tomb at Kazarma, that are most probably the scraps fallen to the ground while the craftsman was cutting the pieces of the funerary ornamentation [84]. This particular practice, which is attested also in the shaft graves [85] but has probably not been used systematically, seems to give additional insight into the conditions in which the goldsmiths were working. On the other hand, the possibility cannot be ruled out that workshops were also active outside the palaces, in connection with settlements [86]. The mention of bronze and gold collected as tax, respectively on PY Jn 829 and PY Jo 438 [87], probably indicates that there was some circulation of metal in the periphery and consequently some metallurgical activity and that it escaped to a great extent the control of the palatial administration. Branigan's statement concerning the existence of workshops for metallurgists both in palatial residences and in surrounding settlements during Early and Middle Bronze Age may certainly apply to Late Bronze Age as well : "Palatial and communal workshops were serving different markets, and to a certain extent satisfying different needs, so that we might expect both to flourish" [88]. Finally, the probability exists that there were also itinerant craftsmen, even though "the most persistent types of evidence for itinerant smiths -stray finds of moulds and smiths' hoards- simply do not appear in the Aegean" [89].

To come back to the general organization of manufacture we have here a confirmation of the identification of multimedia workshops suggested by J.G. Younger in his *Kadmos* articles. The basic idea of multimedia workshops seems highly acceptable, since one can hardly imagine that the shaft graves rulers, however rich they may have been, had at their disposal, in order to satisfy their artistic needs, as many individual craftsmen or workshops as the number of different materials used or as the number of different classes of objects made. Such an overleaping of the arbitrary partitions that are usually set between works of art in

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84 "Burial Customs and Funerary Rites in the Prehistoric Argolid", in *Celebrations* 79-80 and fig. 15.

85 KARO no 108 (small fragments of thin gold foil, "... offenbar Abfälle, die beim Ausschneiden von Plättchen aus einem grösseren Blech übrig blieben").

86 On this, see lastly R. TREUIL, P. DARCQUE, J.-Cl. POURSAT and G. TOUCHAIS, *Les civilisations égéennes du Néolithique et de l'âge du Bronze* (1989) 504 and I. OZANNE, *Les Mycéniens. Pillards, paysans et poètes* (1990) 158-159.

87 M. VENTRIS and J. CHADWICK, *Documents in Mycenaean Greek* [2] (1973) 258.

88 K. BRANIGAN, *Aegean Metalwork of the Early and Middle Bronze Age* (1964) 132 (with reference to Gournia).

89 *Ibidem*.

different media is also significant since it provides reasonable possibilities of identifying the hand of individual artists and Younger's contribution has been important in that respect.

Among the associations between objects belonging to different classes, I would lay particular stress on those between objects sharing really similar techniques and requiring really similar skills, such as gem cutting and carving stone moulds for beating gold sheet ornaments or pouring faience or glass paste beads [90] -the gilding of stone seals is a further sign of close connections between gem cutting and jewellery [91]- or even for raising the decoration of precious metal vases, or, when different techniques and materials are concerned, between the processes involved in the successive stages in the manufacture of individual items, such as the prestige weapons with gold plating (covering of haft) and additional parts in stone or ivory (haft and pommel).

Whatever the consequences on possible attributions to specific workshops or hands may be, the multimedia organization of workshops no doubt emphasizes the essentially local character of the production -the faience relief beads have been made on the mainland according to K. Foster [92]-, as well as the direct and strict control that the palatial administration must have exercised on the activities -though evidence for this can be attested in later phases only.

This leads directly to the question of the relationship between craftsmanship and power. Especially relevant here is that the two main classes of symbolic images expressing typical aspirations of a social and political elite during the shaft grave period seem to be associated with significant technical improvements or innovations: the images of regeneration used in the funerary context, the efficiency of which is increased by the repetition of identical motifs that the hammering on moulds allows, and the warlike images on inlaid prestige weapons manufactured in a technique of eastern origin that has probably been learned directly from Levantine craftsmen travelling to the Aegean [93]. This emphasizes the social and political role of craftsmen and craftsmanship, a feature that is certainly not specific to Mycenaean society, but that had no doubt an especially great importance at the beginning of Late Bronze Age on the Greek mainland, when a leading class was developing and asserting its authority [94]. It emphasizes at the same time the necessity for the ruling elite to have sufficient means at its disposal to exhibit signs of its power, further to have control over artistic production and to be able to put that production in the necessary conditions for a development that meets the requirements of the expression of authority and power.

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90 For the related technique of manufacturing glass seals, see PINI (*supra* n. 25) 63-69.

91 On gilded seals, see J.G. YOUNGER, *Aegean Seals of the Late Bronze Age: Masters and Workshops, II. The First-Generation Minoan Masters*, *Kadmos* 22 (1983), 130.

92 K.P. FOSTER, *Faience from the Shaft Graves*, *TUAS* 6 (1981), 10-11.

93 On the levantine origin of the technique, see R. LAFFINEUR, "Material and Craftsmanship in the Mycenae Shaft Graves: Imports vs Local Production", *Minos* 25-26 (1990-1991) 269-273.

94 On the relationship between advances in craft specialization and the emergence of powerful elites in various cultures, see P. PEREGRINE, "Some Political Aspects of Craft Specialization", *World Archaeology* 23 (1991) 1-11 ("... craft specialization... linked to strategies employed by elites to maintain political authority..."). I thank J.-C. Poursat for the reference.