



THE WOODEN TOOLS IN GREEK PREHISTORY: SIGNS OF AN EARLY TECHNOLOGICAL DEVELOPMENT

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ABSTRACT

Reconstructing Prehistoric artifacts from the Paleolithic period enables us to recognize the genesis of systematically applying knowledge to primitive practical tasks. Despite the aforesaid, the real evolution of tools' technology took place during the Bronze Age. Except for the axe, the adze-axe and the hammer, familiar instruments in all the craft domains, there were tools of an advanced technology, among them the ruler and the level, evidence of early mathematical thought. These tools, made of wood and raw materials, have not been preserved due to the climatic conditions of Greece. Knowledge of said tools has come, however, from other sources namely the Minoan hieroglyphs and their Egyptian parallels occasionally depicted on wall paintings. We are able to recognize amongst them combined instruments like the plane and the compass. Today the comparative study of scripts and ideograms coming from different civilizations: Greek, Hittite, Sumerian, Egyptian and Hindu and their preserved stone, bone, wood and metal artifacts permit us to study influences between them.

KEYWORDS: Implements, Crete, Balkans, Egypt, Daedalus, Phaistos' Disc, wooden, technology

INTRODUCTION

According to Kenneth Oakley (1956), man has been defined in many ways, as the talking animal, the religious animal, and so on, but the most satisfactory definition from

the scientific point of view is probably Man the Toolmaker. Already from the Middle Paleolithic period we have the *Geometric Microliths* resembling isosceles and scalene triangles, crescents and trapezoids, reflecting

the thought of man who gives shape to nature (Papadopoulos 1974; Adam 1989). Luiza Barcan (2000) wrote "the tool itself, by the symbols added to it, became an object with a double function –ritual and useful. Symbols signaled the continuous relation between human life and the super-sensorial and super-human reality."



Fig. 1: Tools for woodworking made of bone from Glina, Cascioarele and Sarata-Monteoru (Gumelnita's Culture), Eneolithic period. International Museum of History, Bucharest (museum's photographic archive).

We have found ideograms of simple instruments as are "axes", "adze-axes", "hammers", which were utilized in all domains of craft, and symbols of combined instruments as are the "ruler", "level", "plane", "compass", etc used by the skilled ancient artisans. Easily perishable raw



Fig. 2: Stone matrix for bronze axes' casting. The gap for the wooden shaft is obvious. (photo: Istoria României, 1960)

materials such as wood (Fig. 1) that served the purposes of arts and crafts in antiquity (Neuburger 1930) are rare in prehistoric Greece (Horn 1976). Of course wooden hafts were often used for instance in conjunction with the bored axe-heads and hammer-heads (Fig. 2). Other uses were to make handles of knives, chisels, awls, sickles and other instruments; On some tools have remained traces from their riveted handles, but only a few. Furthermore wood was used in heavy industry for furniture manufacturing, sculpturing, architecture and shipbuilding. Though the climatic conditions weren't suitable for the preservation of wood in Greece and other regions, there are some exceptions. The lakeside settlements at Kastoria (Hourmouziades 1996; the same author 2002) or La Marmotta and Egypt (Horn 1976; Krasnov 1970; Schweitzer 1930; the same author, 1961; Sebek *et al.* 1976; Wasowitz 1959; the same author 1964; the same author 1966; Littauer *et al.* 1979; Kyrieleis 1980; Mallwitz 1982; Pinelli 1986; Richter 1988; *Bois et Archéologie* 1988; Blegen 1937) have shed new light.

Greek mythology gives us testimony of Daedalus "the mythic carpenter"- his name found on Mycenaean tablets (Chadwick *et al.* 1963; Rousseau 1968; Ducroux 1975; Bourdakou 2000)- who was the inventor of the saw, the axe, the level, the drill, the glue and the fish glue (Plinius *NH*, VII, 198). From the Roman up until the Early Byzantine period, Daedalus was considered "the protector" of carpenters (Jahn 1868; Burford 1972). The real evolution of tool technology took place in the Bronze Age. Recently, Downey C. (1996) observed that during the Bronze Age it wasn't agriculture, but carpentry that benefited from the introduction of bronze tools. In turn this required highly skilled and specialized woodworkers of whom we are able to trace based on script evidence. Early reference of woodworkers mentioned on Linear B tablets call them *te-ko-to-ne* (τέκτονες) carpenters

MINOAN	SANSCRITIC	HITTITE	TOOLS
<p>EVANS 36 042</p>	<p>214* 215</p>	<p>144</p>	DOUBLE AXE
<p>EVANS 18 044</p>	<p>EGYPTIAN</p> <p>Ub Shen</p>	<p>SUMERIAN</p>	TROWEL? CHISEL?
<p>056 EVANS 29</p>			MALLET
<p>EVANS 18 043</p>		<p>?</p>	SINGLE AXE
<p>EVANS 21 046</p>	<p>'SETEP' 'NW' ADZE OF XII DYN VI DYN. XII DYN.</p>	<p>?</p>	ADZE
<p>EVANS 22 045</p>	<p>'SET' 'WS' EVANS EVELY</p>		SAW/ PLANE
<p>EVANS 42</p>		<p>?</p>	ANGLE
<p>EVANS 20 085 EVANS 26</p>			LEVEL/ MACE
<p>EVANS 7 EVANS 2 007, 008, 010</p>	<p>KA WORKER ACTIVITY marching approaching agrarian measurement</p>	<p>kue/mesi né</p>	MEASURES AND MEASUREMENTS

1. Table with Hieroglyphic Ideograms (designer: Juliana Barnea, 2002)

and also classify them as *du-ru-to-mo* (δρυτόμοι, ξυλοκόποι) lumbermen and *na-u-do-mo* (ναυδόμοι) shipbuilders (Chadwick et al. 1963; Rousseau 1968; Ventris et al. 1956, Anna Michailidou (ed.) 2001).

Next we are going to approach and explain the symbols representing instruments of woodwork aside from the traces they have left on the surfaces of objects they have touched. To this end we have used the archaeological evidence published by J. Deshayes (1960; 1964), Sir Flinders Petrie (1974), Alexandru Vulpe (1970; 1975; 1989) and R.D.G. Evely (1993; 2000).

SYMBOLS REPRESENTING INSTRUMENTS OF WOODWORK

1. *The Double Axe (C.H.I.C.= Corpus Hieroglyphicarum Inscriptionum Cretae, 042, Evans no 36 a-g):*

According to W.L. Goodman (1964), "any comprehensive study of the history of woodworking tools must of necessity begin with the axe; it was not only the first, but for many years almost the only woodworking tool of any kind, and it was still important right up to the end of the Middle Ages" (Carcopino 1955). The axe symbol, and more specifically the double axe, (Table 1) is common in Cretan hieroglyphs (MMIA-LMI), identical to Cypriote *lo* and it is depicted in Hindu writing as well (Mahadevan 1977; Bengston 1991), although it is unknown in Egyptian hieroglyphs. (Karnava 2000; the same author 1997; Buchholz 1959; the same author 1960; Vulpe 1970; the same author 1975; Olivier et al. 1996; Evans 1894; the same author 1909) For the Greeks as Nilsson (1966) has said, that symbol was "the real sign of Minoan religion and as omnipresent as the cross in Christianity and the Crescent in Islam" (Mylonas 1977; Evans 1894; Papadopoulos 1976). Apart from its religious significance, the double axe is often depicted between mason's marks on the walls of the Minoan

palaces, for example, on a carved limestone from Zacro (Platon 1974; Philpot 1897; Pernier 1904; Merlat 1960). That symbol was commonly used by the Hittite civilizations of Asia Minor, and by the people of North Mesopotamia, as a symbol (*Karmalis*) of the Hurritic god Teschub, the god of thunderstorms; but for daily needs as in woodcraft, Hittites, as well as Sumerians used a single axe (Merlat 1960; Evans 1894; Wright 1884; Gelb 1931-1935; Kramer 1963). The axe was also really popular in ancient Egypt, but as Evely (1993) points out, in all instances of its use in the Ancient Mediterranean and Near East, the form of axe generally preferred was the single-bladed one (Killen 1980; Petrie 1974). The double bladed axe enjoyed local popularity in Crete alone. After all, as Deshayes (1960) points out: "Apart from some rare exceptions, all the double axes that we could state are of Aegean origin." Probably this is the reason why the same author considers some parallels of double axe, or double axe moulds, found in Enkomi of Cyprus, in Troy VI and in Yugoslavia, as Greek exports (Deshayes 1960). But why was the double axe so important for Crete? Was it for religious and political reasons, as in prehistoric Romania, or was there a more practical reason for this choice (Vulpe 1989; Petrescu 1977; Morintz 1978)? "For some reason", Evely (1993) points out, "Crete departed from the general trends. Whatever the original cause for its adoption was, the rapidly acquired symbolic and religious associations ensured the dominance of the double- over the single-axe form on the island." And the reasons were mostly practical. This tool was heavier and it had greater kinetic energy.

2. *The Adze Axe:* Although the double axe was the favorite one, the adze axe was not unknown (Table 1, 2). This type of axe, known from the Linear B' Script (Kober

1944), is also recorded once on Phaistos' Disc (Table 2, sign no 15). Vandenabeele F. and Olivier J.P. (1979) express their caution that this symbol represents the ideogram of a double axe, but according to Louis Godart (1995) it is a pick axe, a typical object of Crete, equally known in the mainland of Greece (Branigan 1974; Pernier 1905), where similar tools have been found. We could

identify this type of axe with Evely's (1993) adze axe, a subtype of the double adze, which is larger and heavier than the double axe. A similar tool has been found in a tumulus of Maïkop in Russia, among other bronze objects, with resemblances to analogous findings from Troy II, VI, and the Hittite civilization. As Mantzevitch (1971) points out: "This is the only object for which we

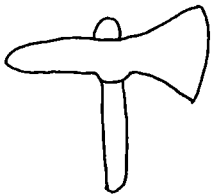
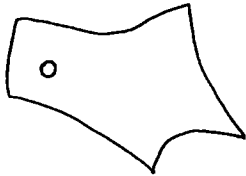



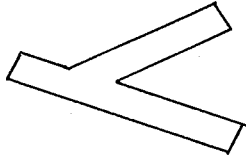
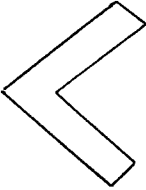
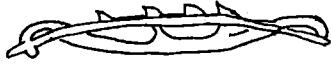
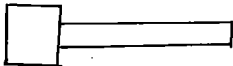

15 	44 
PY232 	17 
16 	19 
18 	11 
23 	42 
HIEROGLYPHS OF WOODWORKING	TOOLS FROM PHAISTOS' DISC E.B.

Table 2: Ideograms from Phaistos' Disc (designer: Eirini L. Bourdakou, 2002).

haven't found till now the analogies, neither in North Caucasus, neither in all the territory of Russia". He supports that we should search for analogies in the world of Asia Minor (Troy, in the 3rd millennium B.C.) and in the land of Summer, which had trade with today's Maikop, according to S.N. Bratchenko (Bratchenko 1968; Mantzevitch 1971; Piotrovsky 1959; Deshayes 1960). A similar tool was found in Mohenjo Daro. This kind of adze axe is still unique and completely strange for the Indus civilization. Trying to explain its presence, Deshayes (1960) states the possibility of an import by the invaders who destroyed Harapas' civilization.

3. *The Single Axe (C.I.H.C.), 043, Evans no 12 a-c*: A similar but also quite different ideogram is that of the single axe (Evely, 1996, 2000). It occurs on early seal-stones in the Ashmolean Collection, from Smyrna and North Syria, but is rare among Minoan remains (Evans 1894; the same author, 1909; Evely 1993; Petrie 1974). This type of axe wasn't very popular during the Early Minoan period, and it was used only as a talisman (Karnava 1997; Evely 1993; Olivier *et al.* 1996; Evans 1894). This is probably the reason why Evely (1993) claims that the linear symbol of the tool comes from Egyptian influences (Table 1). On the other hand, Evans (1894) mentions that although the single axe is a sign of divinity in Egypt, the present type of axe is altogether non-Egyptian. If we study the Egyptian hieroglyphs for the single axe (*qeh*) carefully and we compare the symbols with those of Cretan origin, the difference is obvious (Evans 1894; Budge 1966). According to W. L. Goodman (1964) the earliest Egyptian axes of copper and later bronze, "took the form of a flat semi-circular plate with a straight back and two projecting lugs." This linear symbol of the Cretan single axe is quite different. It does not have a flat semi-circular plate but rather a straight cutting edge. There are also differences with its

hieroglyphic sign (Evely 1993; Branigan 1974). A tool of the Early Cycladic II period exhibited in Goulandris Museum of Cycladic Art could function as the material parallel of the Cretan ideogram. It is characterized as a mallet-axe (Doumas 1984; see also Dumitrescu 1935-6; Bourdakou 2000). Another parallel is probably depicted on the Hittite monument at Bulgar Maden. But it could be a coincidence considering that a similar kind of mallet-axe survives until today in Mozambique (Bautz *et al.* 2000). In Deshayes' (1960) catalogue the author has published similar tools found in Kuban, Bulgaria, Bosnia and Serbia without knowing this EC II piece, which came to light only after 1984.

4. *The "Trowel", Arbelon, Tod, Chisel, or Trunnion Axe? (C.I.H.C.), 044, see also 056, Evans no 18 a-k, 24 a-d, 25*. This symbol is probably the most enigmatic of all (Table 1). As Branigan (1965) has said, it is the most frequent of the hieroglyphic signs, but (still) "the origin of the sign has never been satisfactorily determined." According to the older publisher, Evans (1895, 1909), it may represent an instrument—like an arbelon—for cutting leather (*τορμεύς, περιτορμεύς* or *ομίλη*). In this case, the symbol is connected with the Egyptian *Shen*, the chisel. This comment by Evans is not far from reality. It is true that until the Roman period shoemakers (*sutores, σκυτοτόμοι*) used this kind of chisel (Blümner 1979; Gelb 1931-1935; Evely 1993; Deshayes 1960). On the other hand, Evans (1894) compares the Minoan hieroglyph for arbelon or chisel with the Egyptian *tod (Ub)* used for hollowing out vessels. He connects by that discovery the ideogram C.H.I.C. 044 with C.H.I.C. 056, although he observes that the symbol 044 has projecting shoulders. Later Evans (1909) noticed that it could be a building trowel like the one used by the Egyptians, frequently coupled with an adze or

with a saw, in order to form the Egyptian ideogram signifying a *builder*, a title valued by the Pharaohs. As a result Branigan's (1965) words again come to mind: "the origin of the sign is still not satisfactorily determined." The questions become more problematic if we add a new interpretation, that of the trunnion axe, despite the fact that Evely (1993; 2000) does not mention the ideogram in his catalogue of Minoan tools. The basic shape of this tool is a rectangular tablet of metal, divided into two unequal parts by the trunnions or horns that may project on its sides.

5. *The Small Axe*: Louis Godart observed on Phaistos' Disc (Table 2, sign no 44) the shape of a small axe (*πελεκίνος*), which could have been used in joinery art by the joiners (*λεπτοουργοί*), or it could depict a talisman or even a votive object (Godart 1995).

6. *The Saw* (C.H.I.C., 045, Evans no 23): It was one of the most important tools in carpentry and masonry art, *τεκτονική τέχνη* (Orlandos 1966; Blümner 1979). According to Diodorus Siculus (IV, 76, 5) the one who invented the saw and its use wasn't Daedalus, one of the most famous mythological engineers, but his own student named Kalos or Talos. Kalos was the son of Daedalus' sister who was being educated in Daedalus' home while he was still a lad in years. But being more gifted than his teacher he invented the potter's wheel and, later, the saw. The myth states that when Kalos once came by chance upon the jawbone of a snake he thought he could saw a small piece of wood with it. Kalos tried to imitate the jaggedness of the serpent's teeth. Consequently he fashioned a saw out of iron with which he would saw the lumber, which he used in his work. For this accomplishment he gained the reputation of having discovered a device, which would be of great service to masonry art (Ducroux 1975; Bourdakou 2000). A medieval saw made of

jawbone is exhibited in the National Museum of History in Bucharest (Romania). The coincidence is amazing if we consider Talos' or Kalos' story. Nevertheless, the most extraordinary comment is that of Evans (1894). According to him, the ideogram of the saw (Table 1) is shaped like the jaw of an animal, probably formed at wood set with flint flakes (Petrie 1888). But this ideogram, well known from the linear and hieroglyphic scripts, is quite far from the recorded archaeological elements found in Crete, and closer to the Egyptian parallels (Karnava 1997; Godart 1995; Evans 1894; Budge 1966). One can study the function and use of this tool on the Egyptian murals. The Egyptian workers often used saws, probably for subordinate purposes with adzes (Goodman 1964). The hieroglyphic pair of the adze-saw is depicted several times on the stele of a priest of the IIIrd dynasty from Saqqara in the Cairo museum, and also in the mastaba of Tiye (Goodman 1964; Bourdakou 2000; Neuburger 1930; Petrie 1974). The only closest parallel to this ideogram is an untoothed saw of the Bronze Age found in the Hindu civilization of Mohenjo Daro. The saw found in the Harapa level is dated in the second half of the 3rd – beginning of the 2nd millennium B.C. (Deshayes 1960; Evely 1993). Although Petrie (1974) mentions that the "earliest European bronze saw is that from Knossos", Papathanasopoulos (1961) has published the discovery of a bronze saw from Naxos which has been dated between 2700-2300 B.C. (Dumas, 1990). On the other hand, the ideogram could depict a small-serrated saw (*οδοντωτός πρίων*), probably for joinery art (corn, ivory), widely spread all over the Minoan world (Blümner 1979; Deshayes 1960; Platon 1974).

J. Deshayes (1960) points out that, as far as the influences are concerned, only a few analogies appear between the saws of Indus, Summer, Egypt and the Aegean.

7. *The Adze or Plane (C.I.H.C., 046, Evans no 21)*? Although it is stated that there is little doubt that this symbol represents the adze or some similar tool with a wooden handle, we express our caution that the symbol 046 is also not satisfactorily identified (Karnava 1997; Olivier *et al.* 1996; Evely 1993; Evans 1894). According to Evans (1894), the handle shows affinities with the Egyptian hieroglyphic symbol (*stp, en*) for the adze or the plane (Table 1), and it could also be compared with the Hittite hieroglyphic symbol (Wright 1884). Although long adzes are among the most typical forms of bronze implements found in Crete, the ideogram is quite different from its material origin, and it looks more like the clamp found amongst the medieval joiner's tools (Goodman 1964). On the other hand, Evans (1894) mentions that it is designed like that because the end of the wooden handle of the Cretan implement was shaped like the hind leg and hoof of an animal, as in the case of many Egyptian tools. We think that this explanation is not entirely satisfactory because even its Egyptian parallels are quite different. The earliest adzes known from the prehistoric age of Egypt, according to Petrie (1974), are some small thin blades. However, a much larger blade is introduced during the reign of Mena, closer to the Cypriote form of the copper axe. Petrie (1974) does not hesitate to state that the new type in Egypt was an importation either from Cyprus or from the same source as the Cypriote form. Thus, he adds, the long narrow Egyptian adze of the prehistoric age is very close to one adze found in Kythnos (Petrie 1974; Killen 1980). After this short discussion we may not easily accept that this ideogram depicts a simple adze. Could we then accept Evans' (1894) second interpretation, that is, a wooden plane? In all cases stated above, the shape of this tool is different from the ideogram of the plane. Godart (1995) recognizes on Phaistos' Disc (Table 2, sign no 19) a type of prehistoric wooden plane (*ρυκάνη*) the form of which

does not change until the Byzantine period. It was the most important tool in a woodworker's kit for trimming the surface of wood by taking shavings from it.

In the hieroglyphic sign it is obvious that the bronze part of the plane (*πλάνη/ ξίφη*) is placed inside a wooden rectangular box. (Orlandos 1966; Blümner 1979) This statement of Godart (1995) changes the usual aspect mentioned by Petrie (1974), that the plane has been a Roman invention. According to Goodman (1964), there is a tradition that the Greeks also invented the plane and Daedalus' name is invoked in this regard as the archetypal craftsman. So far no actual Greek planes have come to light. There are only some controversial hieroglyphic signs or the Homeric adjectives, as well as the traditional wooden instruments exposed in Folkloric Museums as in Apeiranthos of Naxos, or in the Village's museum (Museum Satului) of Romania.

8. *The Hammer and the Mallet:*

Louis Godart (1995) recognizes a hammer with quadrangle head on Phaistos' Disc (Table 2, sign no 23). Although the shape looks strange, there is an example of a MMIII-LM bronze hammer found at Psychro in Crete, now displayed at the Ashmolean Museum (Evely 1993). It is rectangular like its hieroglyphic form, with rectangular and flat faces. Its shaft is cast in one piece, but unfortunately, it is now broken. Evans (1984) depicted a different type of tool between the *Primitive Pictographs*. This form may be compared to the Egyptian hieroglyph sign for a mallet, a primitive tool, which determined the verb *to fabricate or to build*. Many wooden mallets have been discovered in the Egyptian sands, but they are not in good condition. According to G. Killen (1980), the wooden mallet was cut from a single block of timber, which was cut from the center of a large trunk for there is no evidence of sapwood. The head

was carefully shaped with an adze into a domed form. The handle was reduced to an elliptical hape and the slicing marks were narrower a fact which indicates that this part was cut with a firmer chisel. The Hittite symbol from Gurun (Table 1), is the closer parallel to both of them (Evans 1894). This kind of wooden mallet was not unknown in the classical world. After all as Al. Wasowicz (1966) states, in the domain of woodworking in ancient Greece there is a technological continuity without serious changes. It seems that this kind of instrument continued to exist, often used for work on wood with a wooden chisel.

9. The drilling machine:

Godart (1995) recognizes an Asiatic bow on Phaistos' disc (Table 2, sign no 11), known also from the Linear's B. Tablet's and the MM seals. According to G. Killen (1980), the development of the bow drill was made from the bow and arrow most certainly shortly before the dynastic age of Egypt. From that point of view, we could also identify this ideogram with a bow drill, well known from its depiction on Egyptian tomb scenes. By the Vth dynasty we have a wonderful scene from the tomb of Ti, which accurately shows the operation of an early bow drill (Killen 1980; Petrie 1974).

The drilling machine (*τρύπανον/τέρετρον*) is well known from the early dawn of civilization as a fire apparatus (*πυρεία*), used in the process of lighting fire by friction (Manos *et al.* 1996; Boutié *et al.* 1997, Warren 1969). This apparatus well known by an example of a lighter found in Tutankhamen's tomb is also represented on many Egyptian murals. Later we see the same mechanism on Greek red-figured vases, functioning as a drilling machine for the construction of wooden urns. (L.L.N. 1929; Wasowicz 1966; Evely 1993; Hodge 1970; Caskey *et al.* 1954; Orlandos 1966) According to Homer (ix 384-

386), the first drilling machine for shipbuilding was constructed by an olive branch (*μοχλός ελαιῖνος*) similar to the mechanism, which was used in blinding the Cyclops Polyphemus. We could suppose that this mechanism was the awl of the Bronze Age which the carpenter used as a drill, or even the first points used as borers in bone and stone, already well known from the Neolithic Knossos, Bulgaria (Varna) and Romania (Verbicioara, Salcuta culture), (Evely 1993; Gwinnett *et al.* 1987; Istoria României 1960). The other broad division of implement, common in classical Greece, was the auger or bit (*αρίδα*). According to Evely (1993), it relies on a strap or string to achieve the higher speeds of rotation. A type of drilling machine is depicted among Cretan hieroglyphs (Evans 1909). We may easily observe the part of a drill-head, the drillstock, the bow and the bow-thong, but not the borer. Unfortunately, most of the component parts of these tools were of organic substances like leather and wood, and have disintegrated. On the other hand, their fixed bronze drills (*τρύπανα*) have survived as witnessed by that complex mechanism from the past.

10. The Architect's kit: plumb-line (C.H.I.C., 085, Evans no 20), Measures and measurements: *πους, παλάμη* (C.H.I.C., 007, 008, 010, Evans no 2, 7), *angle* (Evans 42), *compasses*: All these fine woodworking tools couldn't function without the support of mathematical knowledge, depicted on the hieroglyphic signs of numerical measurements (Karnava 2000). Evans (1894) recognizes in C.H.I.C. 007 (cf. 008) a gesture sign, depicted by the open hand, and also a palm measure identical to the Egyptian one (Table 1). The forepart of the arm with open hand may also be seen on one of the Hittite inscriptions of Jerapis or Carchemish (Wright 1884; Gelb 1931-1935). A similar approach could be adopted for the hieroglyphic sign of the bent

leg. Among Hittite symbols only the lower part of the leg is found, apparently booted-according to A. Evans (1894). But there is also a sign for *kue* or *mesi*, a non booted leg, far closer to a Cretan or Egyptian hieroglyphic symbol, probably more properly used to signify the measure of the later Greek foot (*πους*), (Wright 1884). This subdivision in Greek feet (*πόδες*) and hands (*παλάμαι* or *παλασταί*) was necessary for the construction of a ruler (*κανών*) as the one found in Quartier Mu of Crete (Poursat 1996), in order to draw straight lines, e.g. on a wooden surface (Karnava 2000). The hieroglyphic sign of this instrument common in Cretan and Hittite scripts has remained unchanged through centuries (Gelb 1931-1935; Orlandos 1986; the same author 1966; Hultsch 1882; Jodin 1975; Tanger 1953; Lang Mabel *et al.* 1964; Lorenzen 1966; Petrie 1974; Goodman 1964; Berriman 1953). The carpenter as the architect or the mason used a level besides the ruler. We would also add a woodworker's level because the plumb-line (*αλφάδι*) was -and is- a common implement of these arts, unchanged in shape and form through the centuries. According to Orlandos (1986), the Byzantine workers called it *alfadi* (*αλφάδι*), because of its resemblance with the Greek letter A, which according to Evans (1894; the same author 1909) was already known in Cretan Hieroglyphs. All these instruments, probably made of wood, have disappeared. We recognize them indirectly, through the perfect lines and the symmetry of the Minoan and Mycenaean buildings, or the drawn, sculpted lines on the earthen tablets, found among the wooden debris of the palaces.

Godart (1995) recognizes from Phaistos' Disc (Table 2, sign no 18) a type of Egyptian boomerang or even better a carpenter's triangle or angle. In both cases the Cretan hieroglyph is similar to the Egyptian symbol for angle (*knb*), known from a plain square of wood which has been found in the destroyers'

rubbish at the pyramid of Lahun, probably Ptolemaic (Evans 1909; Petrie 1974). In Cretan hieroglyphs it occurs in association with double axe, arrow, double spray, and the sign no 116 (Evans 1909). A similar but quite different type of triangle, probably in combination with a bob, is depicted between Hittite and Sumerian hieroglyphs (Wright 1881; Gelb 1931-1935). Kramer (1963) characterizes the sign of the angle as an axe, but if we look carefully at the sign we recognize not only a carpenter's angle, but also a combination of an angle and a ruler, graven on the vertical side of the instrument.

The most enigmatic instrument, we dare call it a phantom-tool, is the compass. Nothing is known of its physical appearance, according to Evely (1993) and there may have been more than one short. In its simplest form it consisted of a movable point within a fixed arm. Georg Karo (1930) recognized clearly compass-based designs on the stelae no 1429, and on the golden roundels of the Shaft Grave period (LH I) from Mycenae (Buchholz *et al.* 1973; Mycenaean World 1989). It was probably made of raw material like wood or even bone because it has not left any material trace. This proposition is logical, because until the Romano-Byzantine period, craftsmen used to make compasses from wood, like the one found in the Romano-Byzantine necropolis of Callatis in Romania. (Preda 1980). A trace mention of the use and the invention of this implement exists in the myth of Daedalus. We have already stated the story of his student Kalos who was more gifted than his teacher. Apart from the saw and potter's wheel, Kalos invented, according to Diodorus Siculus (IV, 76), the compass or lathe, because in the ancient Greek language the term *tornos* (*τόρνος*) was used in both senses (Wasowitz 1966). Athenaeus (X, 454 b) on the other hand verifies this terminology: *κύκλος τις ως τórνοισι εκμετρούμενος. Ούτος δ'έχει σημείων εν μέσσω σαφές*, that means "one circle is

circumscribed by compass. And it has a clear point in the middle." The ancient writer is using the term *τόρνος* instead of *διαβήτης* (Orlandos 1966; Blümner 1979). Before them, Homer had already used the past tense of the verb *turn* (*τορνῶω, τορνῶσαντο, τορνῶσεται*), in order to describe this time the act to circumscribe a circle, in the case of Patroclus' tumulus construction (*τορνῶσαντο δε σήμα*). Until we find some other evidence, which could confirm Homer's words, we have nothing but the lines left by the cutting compasses point on the surface of some vases as Evely (1993) has proved.

11. *Sharpening hone (ακόνη, ακονόπητρα)*:

Ancient wooden and metal tools, like the modern ones, were sharpened and smoothed on stones of slate or emery (Killen 1980; Evely 1993). Among the whetstones and abrasives the most popular for the Aegean world was emery, Naxian Stone (*Ναξία λίθος*), or Cretan whetstone (*κρητική ακόνη*). It existed in large quantities in Naxos and it continues today to be one of the basic products of the island. According to Gwinnett and Gorelick (1983; the same authors 1987), the copper and bronze drills in ancient Mesopotamia, or the Egyptian stone-drills were used with abrasives, as emery was. According to them (the same authors), "it is tempting to believe that emery was the abrasive used because of the well known statement by Plinius that emery or "Naxium" was available from Naxos. This may have been the Egyptian source for the abrasive. Another known source of emery is (today's) Turkey although there is no proof that it was known in ancient times." Emery has been found at Ur (not on the cemetery

site), and may have been employed by the bead-makers of ancient Diqdiqqeh (Woolley 1934). Godart (1995) states that a kind of grater is depicted on Phaisto's disc (Table 2, sign no 42). This kind of grater, later known as *lima lignaria*, was equally used in the domain of carpentry for wooden tools smoothing.

A type of abrasive survives until today in Romania as *gresie*, a word that signifies the abrasive stone, as the Ethno archaeological research has proved. According to Dumistracel (1990), the word is a magical-religious concept, related to one of the most important tools in the domain of carpentry and metallurgy. According to the writer (Dumistracel 1990), Scythes, Celts, Germanic populations, Protobulgars, Slaves, and people from ancient Russia, used these abrasives as votive offerings in tumuli and especially inside soldiers' tumuli. They were probably connected with the military equipment as those that have been found in the Shaft Graves of Mycenae. They seem also to have a religious significance like the precious abrasive stone in the Hermitage Collection of St. Petersburg (L'Art Scythe 1986). According to a mythological tradition, which is still alive in Naxos, the island of Cyclades, Hermes once went after Mars, the god of war. In order to avoid Hermes, the warrior god was hidden inside the dark corridors of emery's mines on the island of Naxos. After this statement Dumistracel's (1990) thoughts could probably be enriched by a mythological background which is connected with the Aegean (Greece) world and confirms Luiza Barcan's (2000) words: "the tool itself, by the symbols added to it, became an object with a double function- ritual and useful."

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