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THE INITIAL APPEARANCE OF ASHLAR STONE IN CYPRUS. ISSUES OF PROVENANCE AND USE.

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ABSTRACT

In Cyprus stone was the primary building material, either as rubble or in a dressed form (called ashlar), since the Neolithic period. Initially stone was used only as rubble but later during the Late Brone Age ashlar stone appeared for the first time on the island. The aim of this paper is the presentation of the results of a systematic research regarding the different types and uses of ashlar stone and the techniques followed during the Late Bronze Age in Cyprus in comparison with other Mediterranean areas. The macroscopic and microscopic examination of selected samples showed that sedimentary rocks of various geological formations were used as ashlars. One, two or even three different types of stones were transported from the quarries nearest to the settlements. Some characteristic methods of stone dressing, such as finishing only the visible faces and creating drafted margins around the face of the ashlar blocks, are to be found not only in Late Bronze Age settlements but also in more recent examples from the last two centuries. The choice of ashlar and the methods of construction can be related to social, religious and political factors and were not only based on aesthetic criteria and practical issues. Thus, the most impressive structural solutions were followed in the construction of temples and public buildings, whereas more simple methods can be observed in residential complexes.

KEYWORDS: Quarries, Drafted margins, Orthostats, Courses, Calcareous sandstone

INTRODUCTION

Since the Neolithic period and until the last two centuries, stone has constituted the primary choice in the construction of walls in Cyprus, giving structures stability and satisfactory aesthetic appearance (e.g. Khirokitia, Marki-Alonia, Alambra-Mouttes, Maroni-Vournes, Alassa-Paliotaverna, Kalavasos-Ayios Dhimitrios: Philokyprou 1998a). The most primitive Neolithic circular houses made of perishable materials - timber, reeds etc. (Kalavasos-Tenta) were succeeded by more permanent structures using rubble stone (Khirokitia: Le Brun 1984, Kalavasos-Tenta: Todd 1987). Rubble stone seems to be the only choice of stone during the Neolithic, Chalcolithic, Early and Middle Bronze Age in Cyprus for economic and technological reasons whereas during the Late Bronze Age, stone in a dressed form (called ashlar) was also used in combination with rubble. According to G. Hult (1983), Bronze Age ashlar stone refers to wrought blocks which approach the ideal of a rectangular visible face when the blocks are in place. The faces that are not visible are mostly unwrought and the sizes of the blocks vary considerably from 0,50X0,30X0,30m (Hala Sultan Tekke) to very large sizes with a length of 1,00-5,00m, a height of 0,50-1,50m, and a thickness of 0,50-0,90m (Kition, Alassa). There are also some partly carved (worked) pieces of stone that are often used among unworked stone blocks (rubble stones) in domestic buildings of the Early Bronze Age (Marki-Alonia) to the Late Bronze Age (Hala Sultan Tekke, Enkomi etc.). Ashlar blocks with all faces perfectly worked to shape and usually of uniform size and occupying the entire thickness of the wall occurred mainly during the Classical period ("true" ashlar masonry). Ashlar was always left exposed on the external facades of buildings, and for this reason its use had an important aesthetic value in addition to its structural one.

The use of stone has always been associated with the geology of each area, the immediate environment of the settlements and the availability of suitable material to be quarried. These factors resulted in the emergence of the use of different types of rock in the various areas of the island and in the absence of the use of dressed stones in areas where suitable rocks were not available especially during the earliest periods of antiquity.

The initial appearance of ashlars did not take place simultaneously in every civilization due to many factors (available rocks, urbanization, bronze tools etc.). In Egypt its use is dated back to the beginning of the third millennium and in Syria to the middle of the same millennium (Hult 1983). In Ugarit (Wright 1985), ashlar appeared in the beginning of the second millennium. The extensive defences of Ebla (Damascus Gateway) dating to the Early and Middle Bronze Age (3rd and 2nd Millennium BC) were constructed with the use of ashlar (Hadjisavvas 2007). In Palestine, somewhat limited use of ashlar can be observed in the Middle and Late Bronze Age. In Anatolia and mainland Greece, this technique was adopted during the end of the Middle and especially in the beginning of the Late Bronze Age (Hult 1983). More specifically, limestone blocks with a regular shape were found to be used in many parts of Greece during the Pre-hellenic period due to the easy way in which rocks were split into rectangular blocks (Laurence 1983).

The development of ashlar in Crete is thought to originate in the Early Minoan period (Shaw 1983). Ashlar masonry seems to have been initially used in elite residences located in the surroundings of urban settlements of Crete (Mallia, Chrysolakkos: Schoep 2006). Monumental architecture in Crete using ashlar blocks (orthostats etc.) was observed from the Middle Minoan period onwards (Phaistos, Mallia-Chrysolakkos, Quarter Mu, Hypostyle Crypt). Shortly after the beginning of the Middle Minoan period, large orthostats were used in the Middle Minoan IB palaces at Phaistos and at Chrysolakkos, which constitute the earliest examples of orthostats in the Aegean area (Shaw 1983). According to Driessen and Schoep (1995), for the rest of the island of Crete during the Middle Minoan II period, orthostats are absent and ashlar is very limited until the Late Minoan period. In the Middle Bronze Age in the settlement of Keos, large roughly-squared limestone blocks were used for the construction of a new defensive system, while in northern Rhodes

ashlar masonry appeared during the Late Bronze Age I and II (Davis 1992).

In Cyprus, the first use of ashlar is dated to the Late Bronze Age IIC (1325-1225 BC) when the first public and administrative building complexes appeared (Kalavasos, Maroni). It was more widespread later during the Late Bronze Age IIIA (1225-1125 BC) when the first urban centers with buildings of differentiated use were established in various sites such as Enkomi, Kition, Kouklia and Myrtou. The use of ashlar is related to the widespread use of bronze tools at that period (Philokyprou 1998a). The appearance of ashlar always demanded the fulfillment of some prerequisites (appropriate type of rock, tools, wealth, social organization, available workforce). This is the reason for the time difference in the dissemination of this technique in the various cultures.

Fig.1. Late Bronze Age settlement of Kalavasos

Fig.2. Late Bronze Age settlement of Kition

The use of ashlar, in Cyprus, during the Late Bronze Age was mainly limited to important public buildings and administrative complexes (Kalavasos-Ayios Dhimitrios: Fig.1, Maroni-Vournes, Alassa-Palaiotaverna), places of worship (Kition-Kathari: Fig.2, Kouklia-Palaipaphos, Myrtou-Pighades, Enkomi) and major residential complexes, some of which are considered as palaces. To a lesser degree, ashlar was used in fortifications, simple houses and tombs. Thus, the more primitive temples (rural worship places) of the beginnings of the Late Bronze Age (e.g. Ayios Iakovos, Dhali-Ambelleri) constructed mainly of rubble stone were succeeded by the ashlar monumental urban structures of the Late Bronze Age. Tombs constructed entirely of stone and in some cases of ashlar stone appeared also during the same period – Late Bronze Age (Westholm 1939).

EXPERIMENTAL WORK AND RESULTS

Aims and methodology of research

In this paper, the results of a first systematic research aiming to investigate the different types and uses of ashlar stone as well as the different structural solutions followed during the earliest periods of antiquity in Cyprus are presented. At the same time, comparisons are made with the use of ashlar in other Mediterranean areas as well as in the recent vernacular buildings of the island (19th and early 20th centuries) in order to investigate similarities and differences in characteristics and construction techniques. The research aimed at ascertaining the composition of the various types of stone used and the reasons for the particular use of each type. This research was considered essential because of the absence of an overall study on the use of ashlar stone in Cyprus throughout antiquity and the associated stone quarries.

During this research, the different types of buildings as well as the different parts of each structure where ashlar stone was used were investigated. The present research was based primarily on the study of rocks used as ashlars in the Late Bronze Age settlements in Cyprus. For the investigation of the provenance of ashlar stone, samples from different types of stones from the various structures were selected for macroscopic

and microscopic examination, followed by a systematic survey around the prehistoric settlements. After ascertaining probable source areas, a search was made to find traces of old quarrying: channels and trenches in rocks, step formations, etc. The secondary use of many quarries during more recent periods constituted a serious hindrance to any attempt to date the old quarries, as in many cases the ancient trace marks have been completely dissipated. Comparisons were made of samples gathered from the quarries with the ashlar blocks of the settlements on the basis of lithology, porosity, grain size and colour. Petrographic techniques were employed in order to identify all components including mineral matrices in the ashlar stone of each settlement as well as in the samples from the corresponding quarries.

The selection of rocks to be used as ashlar

A rock can be used as ashlar only if it can be quarried in a sufficient size in order to satisfy the construction purposes for which it is intended, and if it is free of any minerals that may cause chemical decomposition or be affected by weather conditions. In Cyprus, ashlars were almost exclusively derived from local sedimentary rocks of various geological formations, which could be easily quarried and at the same time were resistant to mechanical and physical stresses.

The fine-grained calcareous sandstone that belongs to the Pachna geological formation had the most widespread use since it is an especially durable rock with a good aesthetic appearance (Fig.3). It consists mainly of biogenic components with a few particles of silicate, all bound together by microcrystalline calcite, micrite and sparite. Use of the above rock can be observed in the Late Bronze Age sites in Kalavasos, Maroni, Alassa and Kouklia.

Quarries of this rock are to be found in the Limassol, Larnaca and Paphos districts (Pachna, Kivides, Tochni etc.). This rock appears very often in layers of thickness ranging from a few centimeters to a few meters. Between the layers there are usually narrow marly layers. In some cases the natural rock discontinuations create a rectangular grid that serves the easy removal of rectangular pieces of stone.

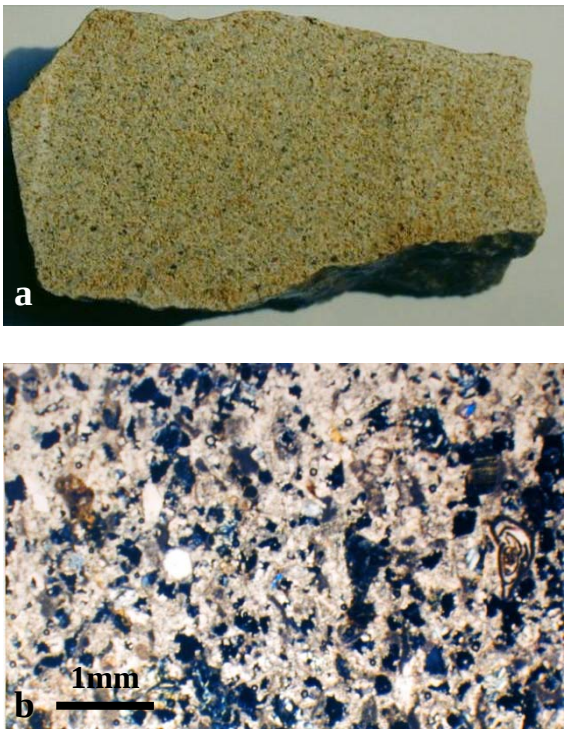

Fig.3: Calcareous sandstone of Pachna geological formation (a. Specimen and b. Thin section - cross nicols – showing a dense structure composed of a few particles of silicates (quartz etc.) and many biogenic components bound together by calcite, micrite and sparite)

A rather extensive use was made of a highly porous yellowish-ochre calcareous sandstone that belongs to the Nicosia-Athalassa geological formation (Fig.4). During the prehistoric period, rocks of this type were used in secondary structures of important buildings (Kition sanctuary) and in a few residential buildings of other settlements (Hala Sultan Tekke). All the biogenic and silicate grains of this rock are loosely bound together by microsparry and sparry calcite. According to the classification of Dunham (1962) this is a grain stone, while according to more recent publications (Ioannou *et al*. 2009) this stone can be considered as a vuggy limestone.

Quarries of this porous calcareous sandstone can be found in both Nicosia (Aglantzia, Mammari, Gerolakos etc.) and Larnaca districts (Oroklini and Dhekelia). The less prevalent use of this type of rock compared to the sandstone of Pachna formation can be attributed to its moderate diagenesis and the weak bonding components, which makes it a highly porous rock.

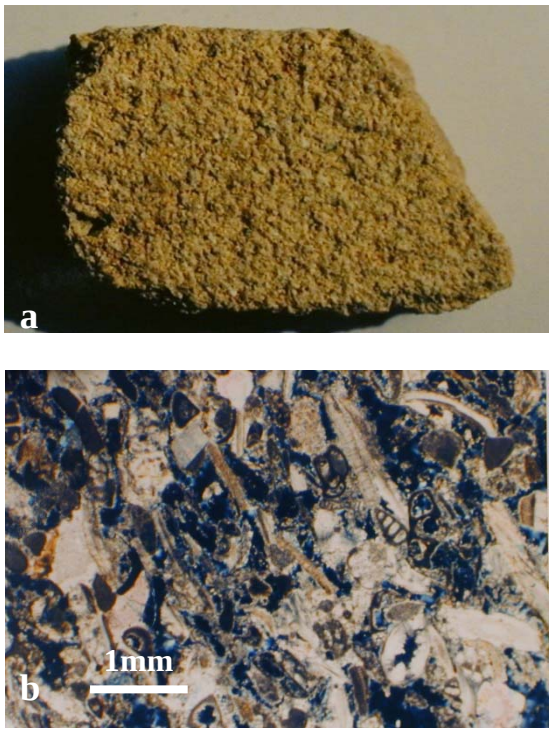

Fig 4: Calcareous sandstone of Nicosia -Athalassa geological formation (a. Specimen and b. Thin section - cross nicols – showing a very porous rock composed mainly of biogenic material bound together with calcite and micrite)

Use of the whitish reef limestone that belongs to the Koronia geological formation, composed mostly of microspar, was confined to significant prehistoric buildings such as the magnificent sanctuaries in Kition (Fig.5). Its pleasing colour and great durability makes this stone particularly attractive for what must have been very impressive monumental structures. Quarries of this rock have been discovered in two places: Potamos tou Liopetriou and Mosfiloudhia, southwest of the village of Xylofagou (Xenophontos 1985).

In 1968 at the area of Mosphiloudhia unfinished statues of the Hellenistic-Roman period together with three incomplete capitals were found (Vermeule 1979). It is therefore evident that this quarry has been used both for the carving of statues as well as for the supply of building stones during the Hellenistic and Roman periods, without precluding the possibility of an earlier use of this quarry predating these periods (e.g. Late Bronze Age).

The fine-grain chalk that belongs to the Lefkara geological formation had a limited use in the prehistoric period. Use of such a rock has been observed at Kition and at the neighbouring Late Bronze Age settlement of Hala Sultan Tekke (Fig.6).

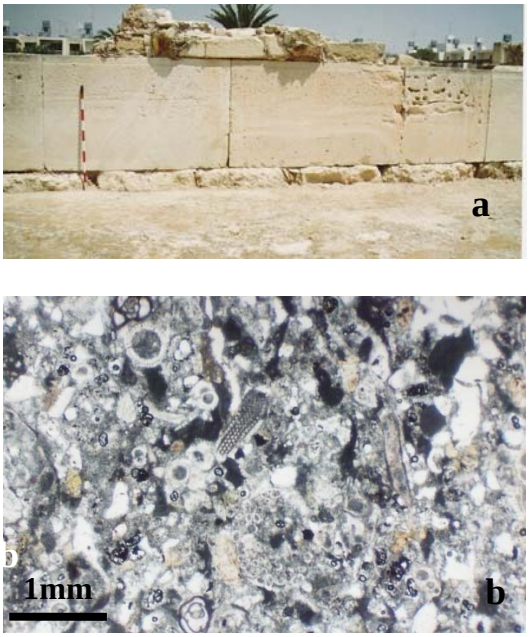

Fig.5: Whitish reef limestone of Koronia geological formation (a. General view of ashlar orthostats of Kition and b. Thin section - cross nicols – showing a dense rock composed mainly of microspar).

Fig.6. Fine grain chalk of Lefkara geological formation (a. Thin slabs of chalk used as wall facing in a bathroom in Hala Sultan Tekke and b. Thin section - cross nicols showing many fossils and foraminifers bound together with microcrystalline calcite)

The rock is composed almost entirely of microcrystalline foraminifera, tightly bound together with micrite and microcrystalline calcite. It was used for architectural components which demand fine carving, cutting into thin slabs for wall facing, bases and thresholds. Rock of this type appears in the Koshi and Lymbia area where quarry faces can be observed. Another very suitable type of rock used when there was a demand for fine carving was gypsum. Gypusm slabs (called gyphomarmara) were employed during all the prehistoric and historic periods because of the abundance of this material on the island and the easy way of cutting it into thin slabs.

In most of the Late Bronze Age sites only one type of rock was used as ashlar for all building purposes, although there were cases where a selective use of two, three or more different types of rock were used in very important building complexes (such as the ancient Kition temples). It is therefore evident that since the Late Bronze Age there has been a clear knowledge of the qualities, properties and capabilities on which the selection of the most suitable type of rock was based. These rocks were transported from the nearby quarries on land or via the sea (Xenophontos 1985). It is clear that the prehistoric people decided to transport large pieces of ashlar stone from a very long distance in order to obtain the most appropriate and durable rock for the construction of impressive buildings during the Late Bronze IIIA period (1225-1125 BC), whereas other quarries existed more closely to the settlements but with less durable rocks (e.g. calcareous sandstone of Athalassa formation) (Fig.7). This practice of transporting a specific type of stone over a long distance can be observed even in more ancient periods of antiquity (2100 BC) for the construction of important monuments such as the Stonehedge. Despite the fact that the huge trilithons of the Stonehedge were made of local stone, the Bluestones for the construction of the inner part of the monument were transported from over 250 miles away, from the Preseli Hills in Pembrokeshire, West Wales (Jones 2008, Wright 2000).

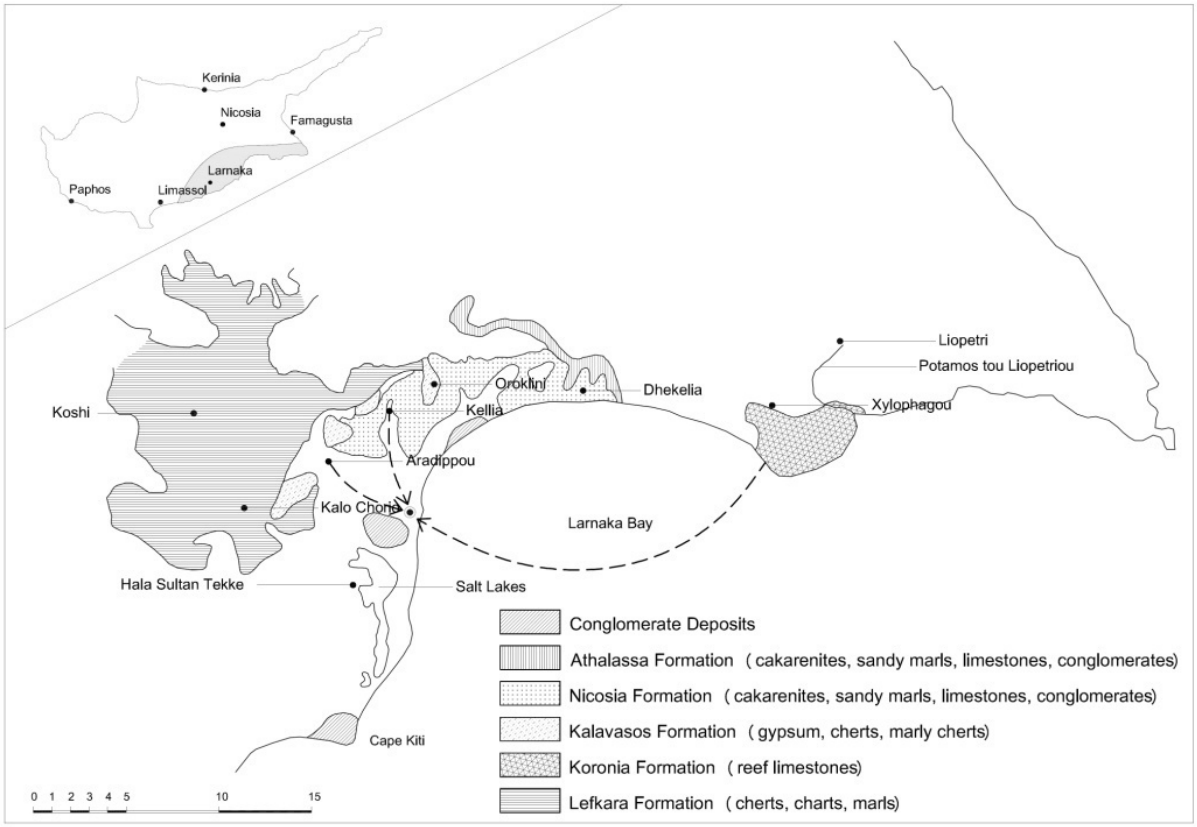

Fig.7. Geological map of Kition area showing the provenance of ashlar stone for the construction of the ancient Kition temples

The investigation of the ancient quarries revealed that during antiquity the quarrying of stone followed more or less one general method (Fig.8). The stone to be quarried was removed from the parent rock by the opening of circumferential trenches to the required depth with the use of axes, chisels, saws and sometimes wedges. This procedure was followed by the undercutting of the rock with the use of levers, chisels and more often metal or wooden wedges. Most of the ancient quarries were on hill slopes or near the sea and quarrying was carried out in consecutive steps. In cases where suitable material was not present at or close to the surface, underground quarries were created (e.g. Dhekelia, Gerolakkos, Aglantzia).

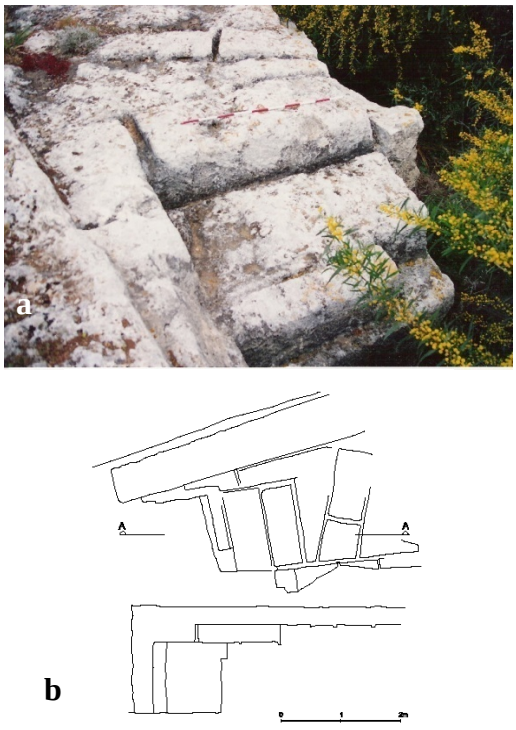

Fig.8: Potamos tou Liopetriou. Ancient quarry (a.Photo and b.Sketch - plan and section)

It is important to note that in contrast to other Mediterranean regions and Mainland Greece, in Cyprus during all prehistoric and even historic periods the calcareous sandstones constituted the prime construction material whilst marble and other harder and more durable materials were almost completely absent. On the other hand, marble was used in different buildings in Attica and in many Aegean islands due to the abundance of marble quarries in these areas (Kea: Mendoni 1998, Kythnos: Chatzianastasiou 1998, Andros: Koutsoukou and Kanellopoulos 1990). Soft creamy yellow-limestone, sandstone as well as very hard close-grained blue limestone (sideropetra) were used in different settlement of Minoan Crete and were quarried from the nearby areas of each settlement (Rehak and Younger 1998). Limestone and schist stones were used in other Mediterranean areas such as the Euboea Dragon Houses at Styra of the Classical to Hellenistic period and were provided from the nearby schist peaks (Chindiroglou 2010, Reber 2010, Liritzis and Artelaris 2010).

In the Syro-Palestinian region, good building stone such as white coarse-grained limestone was widely used as this rock was available in all parts of the region. Calcareous sandstone was distributed in the coastal plain and basalt was only used in monumental buildings because of its hardness and for its striking chromatic effect (Wright 1985). Thus, in each country the material used is related to the geology of each particular area. The absence of marble and other hard (dense) materials in Cyprus led to the widespread use of local calcareous sandstones in all the periods of antiquity.

Main characteristics of ashlar stones

A key feature of the ashlar masonry which has appeared on the island since the Late Bronze Age onwards is the dressing and smoothing of only its faces which were meant to be visible (free visible surfaces) and partially of the surfaces set against other stones, whereas the back of the stone almost always remained "unworked". Dressing the stone only on its visible face and leaving the back face rough constitutes a common technique during antiquity in the Syro-Palestinian coast, in Crete (Shaw 1973) and Anatolia (Wright 1996), but not in Egypt and mainland Greece. The dressing of the contact surfaces of ashlar stones of the Late Bronze Age settlements in Cyprus did not incorporate *anathyroris,* which is a very common characteristic of the Classical monuments of Mainland Greece.

In many cases there is a smooth, carefully-worked peripheral band called drafted margin

on the external visible surfaces of ashlars surrounding a central panel that protrudes slightly (Fig. 9).

This panel –called *apergon*– had a rough rectangular, unworked or worked flat surface. A great variation in the number of drafted margins and their degree of carving can be observed. These appear either as peripheral around the face of the ashlar, or are restricted along one, two, or three sides of the face of the stone (Fig.9).

In some cases, these margins are clearly visible and in other cases hardly distinguishable. Margins were drafted before commencing the building process in order to direct the placing of the blocks and to show to what depth the dressing should be.

Fig.9-10: Drafted margins in Late Bronze Age masonry (1200 BC – Fig.9) and in a colonial building (19th century AC – Fig.10)

In order to dress a stone, it is essential that four points defining the same level are located at its four corners. After the carving of the peripheral margins the rest of the surface can be more easily worked. With the help of these margins the piece of stone could be set at exactly the same level as the neighboring blocks. The central surface was carved entirely or partially before, or more often, after placing the stone. During the earliest periods of antiquity, it seems that this carving process was as a rule carried out after the installation of the stone and sometimes the smoothing work was never completed. Thus the margins are still visible today. Working ashlar stone with the help of drafted margins was also recognized in other areas of the Eastern Mediterranean Area (Syro-Palestinian coast: Reich 1992, Ugarit: Wright 1996 and Anatolia: Wright 2000) during the last quarter of the second millenium.

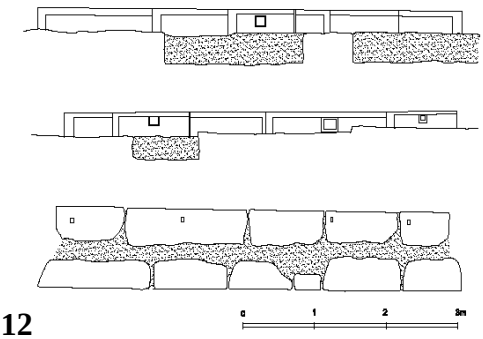

Fig.11-12: Bosses observed on the surfaces of ashlar stones (Fig.11: Alassa - Photo, Fig.12: Kalavasos - Plan and elevations)

These margins were also employed in Cyprus later during the Cypro-Archaic and Cypro-Classical periods (Karageorghis and Maier 1984). The presence of margins is also very common in mainland Greece during Archaic and Classical periods (retaining wall of Athena Pronaia terrace at Delphi, temple of Athena Aphaia at Aegina island: Orlandos 1959-60). In the colonial architecture of the late 19th and early 20th centuries in Cyprus, the drafted margins appeared again and were widely used in the facades of public buildings and private houses (Fig.10). Whilst initially the

margins played a clear structural role, they later acquired an aesthetic value since their presence created an interesting decorative effect (Fig.9-10). It is a general rule in masonry development that functional devices survive during later periods as decorative ones (Wright 1992).

Fig.13-14. Ashlars from Kition showing small mortises at the top of the orthostats

Some interesting structural features of the Late Bronze Age ashlar stones are the small protrusions (bosses) that are observed in the middle of their visible surfaces (Fig.11-12). These were usually of a square, triangular or irregular cross section and were left on the stone surface at the beginning of its working so as to ease its handling with the use of levers (Coulton 1974). Such protrusions can be found both in the low, non-visible parts of buildings as well as in orthostats and other prominent parts of masonry. During the final working of the stone surfaces the bosses were cut off. There are, however, examples where these remained, probably for economic reasons, thus forming a decorative element and being "witnesses" of the initial size of the stone which had been quarried. In most cases, one boss can be observed on each block, whilst there are examples of two protrusions usually on corner stones (Kition, Alassa). The presence of bosses can be usually observed on stones of relatively large size used mainly in public buildings. The bosses are very common features of Greek Architecture that can often be observed in many Classical monuments (Temple of Aphaia at Aegina, Thesion, Temple of Athena Nike, Propylaia of Acropolis: Orlandos 1959-60).

On the upper surface of some orthostats and also on the upper surface of the lower course of the walls on which these orthostats stood, small-sized shallow mortises (blind holes) were cut. The irregular size and shape of these holes at the top of the lower course of stones lead to the theory of their possible relation to the use of a lever for the placement of the stones above them. On the other hand, the uniform regular form and size of the mortises (rectangular or square) and the frequency of their appearance on the top of the orthostats (Fig.13-14) indicate their possible use in fastening the timber elements of the superstructure. Wooden dowels would have been set in these holes. (Karageorghis and Demas 1985).

Methods of construction using ashlar

During the Late Bronze Age, ashlar masonry was not employed for building entire structures, mainly due to economical reasons. Its use was often confined to the lower part of the walls and frequently in the construction of only certain parts of the structures. Most of the public buildings have the lower part of their walls (socle) constructed entirely of ashlar for better stability and for the protection of the masonry against rising damp caused by capillary action. In many cases, the use of ashlar was limited to the visible important parts of the buildings as shaping ashlars was time-consuming and ex-

pensive. The use of ashlar can also be observed in key positions (wall corners, frames of the openings, etc.). This selective use reinforced the structures and at the same time created an interesting aesthetic effect. Selective use of ashlar in rubble walls for improving the stability of the various structures appears since the prehistoric periods in the territory of Minoan Crete (Rehak and Younger 1998) and in Ugarit (Hult 1983, Niemeier 1991). These areas share common characteristics during the Late Bronze Age (Niemeier 1991, Cline 1995) that show close connections between them (Crete, Cyprus, Ugarit) and underline an Aegean presence in the Levant during the Late Bronze Age (Tell el Kabri, Tell Quasile etc.).

Ashlar stones, since the Late Bronze Age were usually laid lengthways along both the interior and exterior faces of a wall, creating a shell-type construction (Alassa, Maroni, Kalavasos: Fig.15-16). Often a small number of stones with a width equal to the thickness of the wall or slightly less were placed transversely at regular intervals as headers connecting its two faces (Hala Sultan Tekke: Fig.16). Thus the masonry wall acquired a certain degree of stability. In the shell-type walls, the intermediate hollow space between the two parallel stone faces was usually filled with rubble, mud and earth.

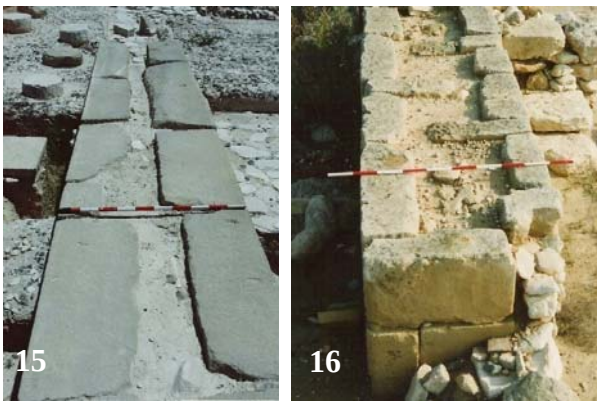

Fig.15-16: Ashlar walls of shell-type (Fig.15: Kalavasos: Wall with stones laid lengthways along both faces. Fig.16: Hala Sultan Tekke: Wall with some stones laid transversely as headers)

This building technique is described by *Vitruvius* (Second Book of Architecture), who assigns to the Greeks the use of headers called *diatonoi* (Atzeni 2003), but this construction method seems to have been used since the Late Bronze Age (Cyprus – Hala Sultan Tekke, Enkomi: Philokyprou 1998a). It is evident that Ancient Greeks used this technique in a more systematic and regular way. There are only a few examples of compact structures created by large stones occupying the entire width of a wall. Ashlar was, as a rule, combined with other materials, both along the length of the wall as well as in its height. There are several cases in which one single face of the wall was built with ashlar masonry while the other interior face, which was of less importance, was constructed of rubble. A similar construction technique with the faces of fortification walls being constructed with large stones and the space in between filled with mud and smaller stones can be observed in Neolithic settlements in Cyprus (Khirokitia: Le Brun 1994, Kalavasos-Tenta: Todd 1987) and in the Aegean world (Strofilas fortification wall in Andros: Liritzis 2010) as well as in the cyclopean walls of the Late Bronze Age in Cyprus (Kition, Enkomi, Maa etc.).

A simple method of construction comprises the setting of ashlars in successive horizontal courses. Coursed masonry was not used very often during the Late Bronze Age in Cyprus but saw much greater use in the periods that followed and up to modern times. During the Late Bronze Age in the few examples of coursed masonry, the stones did not have a uniform length and each successive course was of a different height. In some cases, such as an altar in Myrtou-Pighades, there was a reduction of the height of the consecutive courses of stones (Hult 1983). Coursed masonry was widely used in the Classical period and *Vitruvius* (Second Book of Architecture) mentions the names of various techniques following this system (isodomic, pheudoisodomic). The most ancient and well-developed coursed masonry system of the island is represented in the Late Bronze Age built tombs of Enkomi (Westholm 1939, Schaeffer 1952). In the roofs of these tombs, the corbelling system of building blocks was followed with slightly more prominent blocks in successive courses (Westholm 1939). A similar way of roofing using the corbelling system is observed mainly in tombs of the same or earlier periods excavated in Syria, at Ebla (Middle

Bronze Age: Hadjisavvas 2007), also at Ugarit (Late Bronze Age) in Ras Shamra, Minet-ell Beida, Ras Ibn Hani, as well as in Mycenae (Hult, 1983). The various similarities between the Cypriot ashlar tombs and the corresponding but earlier ones of Ugarit and Syria (Ebla) indicate that the latter were probably prototypes of the Cyprus examples. The tombs of Enkomi are probably associated with new settlers ("Achaeans", "Sea people"), who came to the island during this period and brought with them their local traditions.

It is worth mentioning that whereas until the end of the Early Bronze Age Cyprus had close relations mainly with the East Mediterranean, since the Middle Bronze Age (1900-1650 BC) Minoan pottery appeared on the island. Later, at the end of the Middle and during the beginning of the Late Bronze Age (1700-1400 BC) the connections with the Aegean world became closer as Cyprus took a leading role in the trade of the Eastern Mediterranean. The Minoan ships used Cyprus as an intermediate stop when travelling to Ugarit. During the Late Bronze Age the connections with the Aegean became more close (existence of a large number of imported Aegean items on the island) and during 1500 BC a new writing system, the so-called Cypro-Minoan script was introduced in the island probably due to the relations between Cypriots and Minoans in Ugarit. During 1450/1400 BC many Mycenean items were imported to Cyprus and a new type of local pottery called Mycenean MCIIIC:2b appeared that showed Mycenaean influences.

The building technique which was most often used during the prehistoric era involved the use of orthostats (upright placed stones) set on a horizontal course of larger, slightly protruding stones (called plinths) (Fig.17). This method had a wide application mainly during the earliest periods of antiquity (Philokyprou 1998b) but not at a later period. In the construction of walls with the use of orthostats, several variations as to the method of placing the orhtostats and forming their base can be observed (Fig.17).

Usually the orthostats rested on a horizontal course of ashlar stones (Fig.17. A2) and very rarely on irregularly-shaped large blocks (Fig.17. A1). The plinth was either formed into a single horizontal level (Fig.17. A2) or there was a difference in the levels between the two horizontal stones of the two sides (Fig.17. A3). The difference in the levels might have provided more stability to the orthostats or was merely due to a difference in the ground level on the inside and outside of the building. There are also some very elaborate structures with two series of orthostats arranged on a single large ashlar (Fig.17. B1). In some cases the upper face of the plinths on which the orthostats were to be set had two rabbets for placing and fastening the orthostats (Fig.17. B2, B3). Thus, the wall was made entirely of true ashlars and appeared very solid. The upper part of the orthostats was formed into a single horizontal level with the use of orthostats of the same or different heights (Fig.17. B3, C1) or a difference in level was created between the two faces with the use of orthostats of different heights (Fig.17. C2).

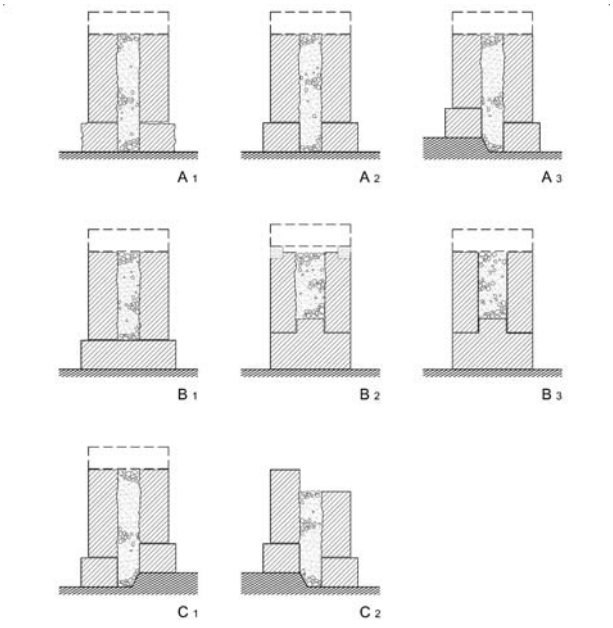

Fig.17. Different Methods of the orthostat system

There were some cases of the existence of rabbets (cut off part of the top surface) along the top of both orthostats maintaining the rest of the surface in a more rough condition (Fig.17. B2). This method resulted in the better support of horizontal tie beams, which probably served as a base of the superstructure. Sometimes the double row of orthostats was covered by slabs placed horizontally surmounted by the timber

and mud brick superstructure. This technique of using orthorstats was applied at a high level of development during its first appearance in Cyprus. The extensive use of this technique and its continuation later, especially when in the neighbouring countries this was succeeded by the method of building in successive courses, might be a result of the conservatism of the Cypriots (Hult 1983). Building with the use of orthostats appeared in Palestine (Megiddo, Beth-Shear) during the Middle and Late Bronze age (Shiloh, 1979) and in Ugarit and Anatolia (Tel Kabri: Niemeier 1991, Alalakh, Alaya Huyuk, etc.) since the second millennium. In Tel Kabri many other aspects of civilization (painted floors etc.) show common characteristics with the Minoan civilization (Niemeier 1991). Ashlar masonry using orthostats set atop a footing course constitutes a common architectural feature mainly in the Protopalatial palaces of Minoan Crete and was rarely observed in the Neopalatial palaces (Rehak and Younger 1998). The Cypriot technique of orthostats presents several similarities to that used in the Syro-Palestine coast and especially that of Ugarit (Shiloh 1979) and Crete (Hult 1983).

Ashlar, apart from its use for walls, was incorporated in the construction of floors and as a lining for walls which resulted in securing water-tightness. Thus, a wide application in the construction of bathrooms took place (Rehak and Younger 1998; Schoep 2006; Hult, 1983). Floors of ashlar slabs and walls lined with vertically-placed slabs that were observed in prehistoric bathrooms in Cyprus (Hala Sultan Tekke and Enkomi), appeared very frequently in the area of Minoan Crete in purification rooms (Hult, 1983). Similar floors with slabs were also found in Ugarit (Tel Kabri: Niemeier 1991). However, the examples of Cyprus present many similarities but also show some differences when compared with the Minoan examples (less glamorous etc.). These floors may have Cretan inspiration but present particular Cypriot characteristics.

The impermeability of ashlar stone has also led to the use of dressed stones in the construction of water channels (Karageorghis and Demas 1985), tanks and olive presses (Philokyprou 1998a). The need for achieving a carefully prepared final appearance of certain architectural elements and the acquisition of a greater stability led to the use of ashlar in the construction of staircases and pillars. Rooms with pillars were common architectural features of Minoan palaces (Rehak and Younger 1998). Another key factor was the protection of wooden elements (staircases and supports) from moisture. Thus the bases of timber posts were made of dressed stone. The particular aesthetic requirements and probably the need to ensure longer life led to the use of carved stones in the construction of symbols of worship during antiquity such as sacred horns of "consecration", as well as stepped capitals and bases (Late Bronze Age: Fig.18-19). In addition to having steps, the capitals are also characterized by a cavetto, similarly marked. The origin of these capitals is not clear and may be related to Minoan as well as Near East civilizations. These stone elements play an important aesthetic role as they constitute the first form of capitals found on the island.

Fig.18-19. Stepped capitals from Kition-Kathari (Fig.18) and Paphos-Palaipaphos (Fig.19)

Incised decoration was observed only in a few cases during the Late Bronze Age in Cyprus and was observed mainly in some stepped bases or other members of the stone walls. In the first case, the decoration includes geometric shapes (rosettes, circles), while in the latter case the illustrations were mainly boats. Such incisions are observed in the large pillars on the

south wall of the Temple of Kition 1 and the sacred altar of the Temple 4 (Karageorghis and Demas 1985). The display of ships seems to have a symbolic significance. They were probably sacred offerings and had a similar role to the many anchors observed near the holy shrines of Kition (Karageorghis and Demas 1985). A similar mark boat was recognized on a piece of carved stone in Bâtiment 18 of Enkomi and dates to the 12th century BC (Schaeffer 1952). Graffiti of ships was also found on two pieces of carved stone in Hala Sultan Tekke (Öbrink 1979). Carvings on rock walls of earlier periods (Neolithic) which mainly depict ships were found on some blocks of Andros-Strofilas (Liritzis 2010). Some enigmatic mason' s marks sometimes incised on ashlars of porous, sandstone or gypsum, but not always on the exposed outer wall surface, are to be found in Protopalatial palaces of Minoan Crete (Rehak and Younger 1998). Incised letters and numbers can be observed in many pieces of ashlar stones of later periods (Classical monuments) which served for their easier placement into the correct position (Temple of Aphaia, temple of Apollon at Delphi: Orlandos 1959-1960).

DISCUSSION

During the Late Bronze Age, the construction solutions which were followed using ashlar mainly depended on the function and size of the corresponding buildings. The most impressive structures were the temples of Kition and Kouklia where huge orthostats measuring up to 5m can be observed. Very elaborate solutions were followed in the administrative public buildings in Kalavasos, Maroni, Alassa and Enkomi. More simple solutions can be observed in smaller residential complexes such as the houses at Hala Sultan Tekke as well as the fortifications and tombs at Enkomi (courses of ashlar). It is obvious that social and religious factors led to the use of ashlars in certain buildings and dictated the construction methods to be followed. Thus, the use of ashlar was not based only on practical and aesthetic criteria, as architecture reflects the cultural, social, political and economic life of every period. It can be deduced that ashlar structures in the Late Bronze Age were associated with the establishment of well-organized urban centres (Negbi 1986). The use of ashlar stone was the result of the general prosperity of Cyprus linked directly to the intensification of the exploitation of copper and the active participation in trade with neighbouring countries (Hadjisavvas 2000). It is clear that the ashlar buildings appear as the most obvious manifestation of the status of the elite after the accomplishment of a long process of urbanization sometime during the Late Bronze Age (Hadjisavvas 2000). The use of ashlar in Cyprus involved high costs and the availability of the appropriate tools and labour necessary for the quarrying, transportation, processing and installation. Ashlar was definitely a means of promoting the wealth and power of the leaders and constituted a symbol of prestige. Ashlar masonry did not appear simultaneasly in all the settlements of the island. In some settlements (Kalavasos, Maroni) ashlar can be observed in the Late Bronze Age IIC whereas in other sites (Kition, Enkomi, Paphos) it appeared later during the Late Bronze Age IIIA. A similar phenomenon can be observed in Minoan Crete (Driessen and Schoep 1995). At some sites (Mallia and Pseira) the presence of ashlar was limited, despite the presence of suitable quarries. Thus, this proliferation of ashlar masonry must be connected to social and political relationships.

In order to study the complex phenomenon of the influences between different civilizations and to arrive at some conclusions regarding the use of ashlar, it is essential to investigate other architectural characteristics of ashlar buildings. For example, some of the prehistoric ashlar buildings of the island (Maroni, Kalavasos) established in the Late Bronze Age IIC share common features. They were built on special commanding positions and were provided with some spacious rooms and considerable storage facilities. It is noteworthy that the construction techniques of ashlar masonry are very similar in the majority of the settlements on the island indicating a quite uniform civilization (Hadjisavvas 2000). At the same time, the introduction of some other innovative architectural elements with social interpretations in Cyprus such as the cyclopean walls, the central hearths and the

bathtubs not found in previous periods constituted important characteristics of the civilization of this period and lead to direct relations with the Aegean world. It seems that Cyprus during the Late Bronze Age had very much interaction with Crete and the Syro-Palestine coast. The similarities with Anatolia, Egypt and mainland Greece are fewer (Hult 1983). S. Hadjisavvas (2007) connects the history of the ashlar buildings of Cyprus with an Aegean tribe, most probably the "Achaeans", who moved to the island of Cyprus as part of the colonization by the "Sea Peoples".

In the recent vernacular architecture of the last two centuries, no special innovations with regard to the use of ashlar stone and the construction methods followed can be observed compared to the prehistoric examples (Ionas 1988, Sinos 1976). The most significant difference regards the more widespread use of ashlar in the last centuries. Although during the Late Bronze Age ashlar constructions were encountered almost exclusively in monumental public buildings, in the recent vernacular architecture of the 19th and 20th centuries, ashlar was also used in simple domestic structures. In the latter case, this may be attributed not only to social factors but also to practical issues, such as ease of quarrying and cutting and transportation as compared with the requirements of a great labour force needed during the Late Bronze Age. Social and economic reasons also lead to the widespread use of ashlar as the community changed and more people could take advantage of this ashlar masonry. The preference for the use of coursed masonry in recent vernacular architecture and not the system of the orthostats can be attributed to its more simple structural requirements and its easier incorporation into domestic structures.

Some of the characteristics and building techniques observed in the Late Bronze Age structures as well as in vernacular architecture of the 19th and 20th centuries are to be found in structures of various historical periods (Classical, Roman etc.), perhaps passing from one generation to the other, and thus covering the gap between prehistory and recent vernacular architecture. These observations underline the conservative attitude of the Cypriots and show an excellent construction development during the very early periods of antiquity. Since the Late Bronze Age the ancient builders devised some excellent solutions that were followed on the island without the need for great improvements and changes. The same structural requirements in identical climatic and environmental conditions and the same availability of materials have probably led people of different periods to resort to similar simple and functional solutions.

CONCLUSION

The appearance of ashlar stone in Cyprus during the Late Bronze Age was associated with the great prosperity of the area during this period and the development of the first urban settlements. Some characteristics of ashlar masonry (drafted margins etc.) and methods of construction (orthostats) observed in Cyprus during the Late Bronze Age are to be found in the ashlar masonry of neighbouring countries (Near East, Aegean World) showing connections and relations between these civilizations. The same characteristics were also recognized in the structures of later periods (Classical, Hellenistic) and even in the vernacular architecture of the 19th and 20th centuries.

The choice of the stones used as ashlars was always related to the geology of each area and was also dictated by social, economic and functional criteria. The different types of stones employed in the same settlement showed the routes followed for the transportation of ashlars and give valuable information about the level of technology during the Late Bronze Age. It shows that the builders acquired the knowledge of selecting the best quality of rock for each particular use very early. This explains the preference of transporting a type of rock over a long distance despite the fact that there was a rather good quality of rock nearer to a settlement. The transportation of stone over long distances reveals key facts about the organization of the groups of workers responsible for the erection of the monumental public buildings of the Late Bronze Age.

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