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Stone anchors off the shore at Byblos

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This article is in memory of Michel el Hélou, my friend and dive partner.

This paper aims to shed light on the possibility of a previously unknown anchorage area used since the Bronze Age at Byblos, Lebanon. Indeed, it is possible the anchors found during the 2001 survey belong to the Bronze Age, or Iron Age, and as such, create evidence that this area was in fact an ancient anchorage site.

Introduction

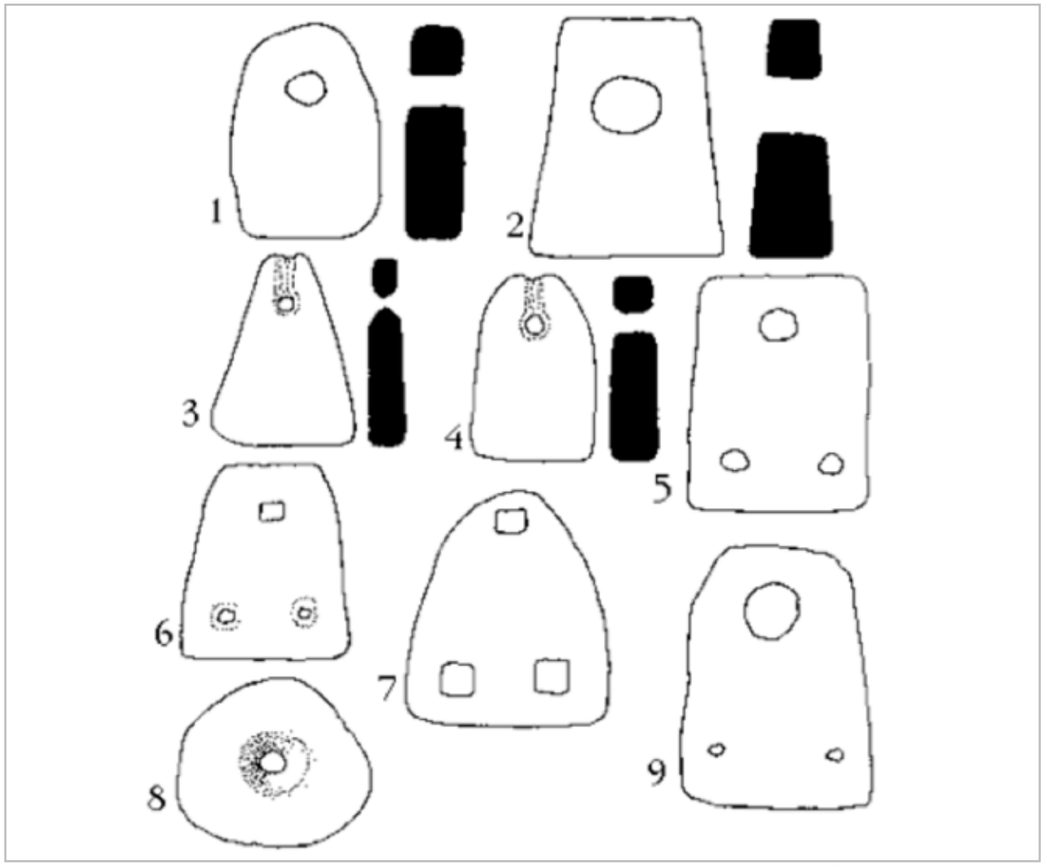
In 2001, a maritime archaeological survey was conducted on an uncharted reef located about two kilometres southwest of Byblos, Lebanon. During one of the dives on the reef, while accompanied by Michel el Hélou we found a stone anchor on the rocky sea floor. The anchor was found at the depth of 33.6 metres and was on a slope surrounded by an enormous drop that fell off to an unknown depth, which was has since been discussed in a Geo-Archeological study (Collina-Girard and Frost *et al.* 2002). We located the anchor on the reef first with visual references and photographs of the (three-holed) anchor and its environment. On later dives, we simply tied a thin, long rope, attached to a floater on the surface, to the anchor. Then GPS points were taken of the floater from the boat. This practice was very successful and the coordinates took us to the same area within a five-metre accuracy. Furthermore, additional dives have revealed the presence of several other anchors that carry the Bronze Age characteristics. The presence of these anchors indicates the reef of "Dahret Martine[1]" due to its natural formation and relatively shallowness may have once served as an offshore anchorage area, not only in the Bronze Age but also in later periods.

Stone Anchors

Bronze Age ships have not been located in any large number and are considered rare. However, the anchors they lost are not as rare (Frost 1969a: 428). Yet, finds and studies of these stone anchors and their utility are still considered recent sources of information in contrast to amphorae, for instance, in 1976, Dr. Nicolaou, K. and professor Catling, H. emphasized the stone anchors can be used to indicate the origins of the ships which carried them. Thus, the marine merchants can be determined without actually finding the ships and or without the need of reports on such

vessels (McCaslin 1980: 4). The stone anchors can therefore allow us to study maritime communication without having to locate or excavate complete shipwrecks. Stone anchors from Egypt, Byblos, Ugarit, Crete, Athlit, and Cyprus, have been identified (**Pl. 1**). The chronology and variety of stone anchors were reviewed by Nibbi who suggested that the earliest anchor is from Egypt, and dates back to 2400 BC (Nibbi 1993: 11).

Stone anchors from Cyprus have been studied in the most detail. These anchors have been found in relatively large numbers in land sites as well as at sea. The Island of Cyprus, due to its geographic position was an important seafaring nation with maritime sea routes between the Near East and the Aegean world (McCaslin 1980: 13). It is useful to point out that, while there are three-holes anchors in Cyprus, one-hole anchors also appeared in Ugarit, and square and round holes were also cut into these kinds of anchors. None of the Ugarit anchors, except for the inscribed Egyptian anchor, have the rope-hole groove; and since the most distinctively triangular Ugaritic anchors are composite, the triangular Ugaritic anchor are clearly distinguished from the triangular Byblian weight anchors (Frost 1969b: 244-245, McCaslin 1980: 12).



Pl. 1- N° 1 & 9: Cyprus. N° 2: Italy. N° 3: Byblos N° 4: Egyptian. N° 5, 6, 7 and 8: Canaanite- Phoenician (McCaslin 1980: 4-5). 1 Weight anchor from Kition in Cyprus 2 Pyramidal stone anchor from Taremtum area in Italy 3 Bronze Age anchor of Byblos 4 Egyptian Bronze Age anchor 5 6 7 8 Canaanite - Phoenician stone anchors 9 Bronze Age anchor from Cape Pyla in Cyprus (McCaslin 1980: 4-5).

Byblos anchors

In Byblos, 28 stone anchors were excavated within the vicinity of the temple, and were considered sacred when found *in situ*. Byblos is not the only site where temple anchors have been found; they were also discovered in Ugarit at the temple of Baal. However, none of the 28 Byblos anchors were used or came from the sea. These anchors were found within the land excavations, they have dated strata, and their discovery is as great of importance as some of the anchors found in Kition and Ugarit. This discovery stresses the symbolic significance of anchors during the Bronze Age period, the Byblos temple anchors were placed as votive dedications. Another example is the discovery of an Egyptian anchor, dated from 2300 BC, which was found at the entrance of the "sacred enclosure" at Byblos (McCaslin 1980: 44). This anchor consists of limestone and has a triangular shape with a rounded top.

Fortunately, the Byblos anchors display a characteristic shape in line with the Bronze Age, which is in the time period the archaeological data confirmed. Honor Frost, who published the Byblos anchor corpus, explains that the form that emerges as indigenous (at Byblos) is the tall, triangular anchor with rope-hole grooves (**Figs 1 and 2**). The anchor was excavated by Dunand from the temple of obelisks and was found lying on the outer wall, but had possibly fallen from among the standing obelisks in the *cella*. (Frost personal communication: 2003).

There are distinctive features that set apart the Byblos weight anchors' shape (with or without the rope-hole groove) from known Ugaritic, Cypriot and Egyptian shapes. The importance of the discovery of the Byblos anchors is that they help identify similar anchors found at sea (Frost 1969a: 428).

There are several key characteristics to the anchors of Byblos found during Dunand's excavations. Among the anchors found at Byblos, there were no composite anchors (three-holed). Composite anchors are common in Cyprus and Athlit, and also were found at Ugarit (Frost 1969a: 427). The anchor holes are round and the anchors themselves are not extremely heavy such as the (half-ton) anchor found at Ugarit. Also, none of the Byblos anchors that displayed the L-shape notch found on some Egyptian stone anchors. Finally, the Byblos anchors have been found only at the home

Fig. 1- tall, triangular anchor with rope-hole grooves byblian stone anchor was excavated by Dunand, at the temple of obelisks and was found lying on the outer wall but possibly fallen from among the standing obelisks in the cella. (Photo, 2007).

Fig. 2- The temple of obelisks at Byblos where the triangular anchor was found lying on the outer wall (Photo, Frost 1960's).

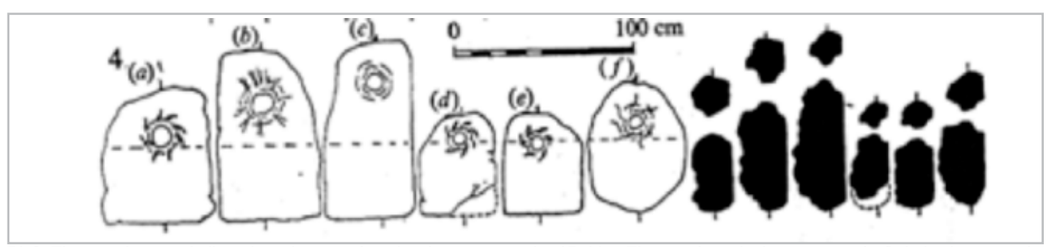
site itself. In comparison, the Ugaritic anchors have been found in Cyprus while Cypriot anchors have been found in Kition and possibly Ugarit (McCaslin 1980: 45).

At the site, a 2300 BC building, called the tower temple, where the Egyptian anchor was found, six weight anchors of chalk **(Pl. 2 and Fig. 3**) were set up in a row to serve as stepping-stones up to the temple. We know that these are replicas and are not real anchors because chalk is not suitable in use in the sea and because one side of the anchors was left unfinished (Frost 1969b: 229-230, McCaslin 1980: 12).

Fig. 3- Six chalk weight anchors found at twenty-third century BC building called the tower temple near the location of the Egyptian anchor that was found by Dunand.

Three-hole-composite anchors and sand anchors

Generally, stone anchors from the Bronze Age have a single hole. The three-holed composite anchors were used together with single-holed anchors. At the Dunand excavations in Byblos, there were no composite examples found from the Bronze Age, however, one anchor with a L-shaped piercing form Egypt was found (**Fig. 4**), (McCaslin 1980: 35; Frost 1991: 371). The essential problem with the composite anchors, which were considered as a revolutionary type by the late Bronze Age, is that there is no solid evidence as to their first appearance, however, (Raban 2000: 260-270), land sites attest to their by the end of the 13th century BC (Shaw 1995: 285). Composite stone anchors are stone slabs with two or more holes drilled into them, and labeled as "composite" to match with their dual function (McCaslin 1980: 18 - 21) of first its weight and secondly, its ability to hook on a sandy seabed. The composite anchor was designed to hold the ship when it anchored above sandy sea floor and also when over a rocky or reef-covered bottom. These anchors also had sufficient weight (at least 40 kilograms, or usually more) to assure a secure mooring among the rocks or reefs. Usually, this type of anchors had three holes. One hole was located on the uppermost of the stone anchor and functioned as a rope-hole through which the anchor rope is fixed. The other two holes located at the lower part of the stone anchor are the tooth-holes in which wooden fluke-bars are fixed to help in fasten the anchor to the seabed (**Fig. 5**). This class of anchors holds the ship not only by its weight, but also by the teeth hooked into the sea bottom. However, the idea that these objects were used as "sand-anchors" on sandy seafloor is not yet supported by archaeological facts (McCaslin 1980: 18-21). Infact, materials found at several ports and anchorage sites demonstrate that both weights and composite anchors were used on the same sea floor types. Limestone is the most common type of stone used for most anchors, including composite ones. According to McCaslin, the uppermost hole is often squared and normally a bit larger than the two lower holes near the base (Shaw 1995: 290, Toth 2002: 92). However, Raban describes two types of composite stone anchor found in the Red Sea that had upper holes of the same size as the lower two Raban 2000: 262). This type of the composite anchor was considerably larger and had also wooden flukes that could stab into the sand (**Fig. 5**), allowing the ship to be relatively held fixed against winds, waves, and the currents. Another element of interest is to determine the origins of the Red Sea stone anchors and the homeport of their ships.



Pl. 2- These anchor are chalk anchors that were found in the tower temple of Byblos. They are from the bottom step of a flight leading up to the 23rd century BC. The back of the anchors are left unfinished, Frost thinks that these anchors might represent a compliment carried on a single ship.

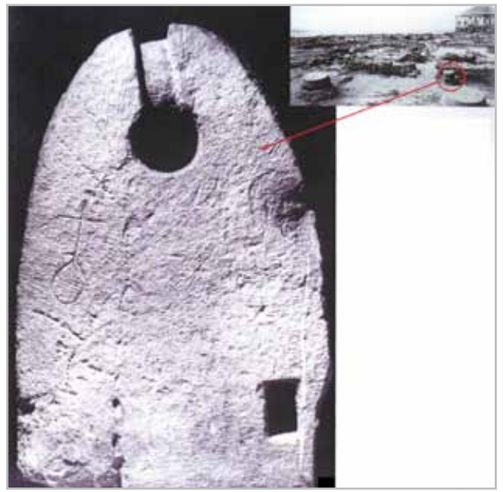


Fig. 4- Stone anchor wearing the Egyptian Hieroglyph NFR was found in the sacred enclosure at Byblos (view location where it was found).

Sand anchors are usually pierced with two or more holes, the rope hole aside, the others serve as multiple fluke holes for trimmed branches or carved sticks to wedged through and thrust into the sandy floor (Frost 1963:7-8, Frost personal communication 2008). They often weighed less than 30 kilograms and their function was probably to hang on the anchor line extending from the first composite anchor "coming from the vessel". Using many sand anchors would have strengthened the holding power of the vessel and it would have made the line of the anchors act like an anchor chain (**Fig. 6**). So, the anchors here

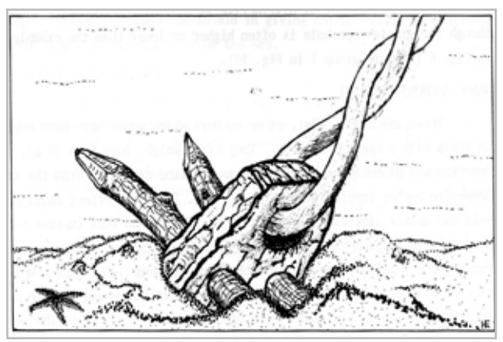


Fig. 5- A composite anchor while holding a vessel in a sandy seabed

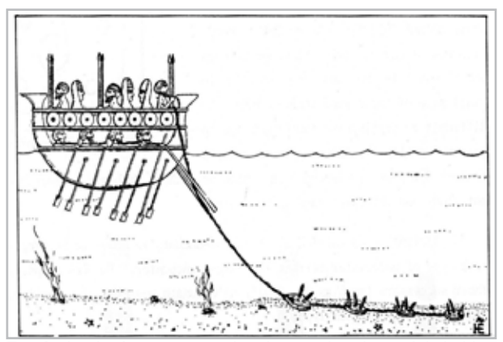


Fig. 6- sketch of composite and trailing sand anchors while holding an Iron Age vessel in shallow water.

had multiple duties besides holding the ship when it anchored above sandy and rocky sea floors; the sand anchors would help direct the vessel's rope to make sure that the main anchor had a higher possibility to attach to its floor. Furthermore, no chains existed in the Bronze Age; metal anchor chains were first mentioned during the siege of Alexander the Macedonian in the 4th century BC when he was attacking Tyre (McCaslin 1980: 20). Finally, anchors have been considered to be "the pottery" of Maritime archaeology. However, without analyzing the stone material and using archaeological characteristics, it would be difficult to identify the origin. In fact, although there are types of anchors that have been identified as Byblian, Ugaritic, and Egyptian types, they may not have actually been manufactured in those areas.

Geological Aspects

The most prominent topographic features of the continental shelf off central Lebanon are a number of submarine canyons and sea valleys and a submarine promontory. These canyons were investigated initially by Goedicke during surveys conducted between 1968 and 1970. Seven undersea valleys were surveyed (Goedicke 1972: 664, Noureddine 2001: 55) with most located off a mouth of the El- Fidar Sea valley associated with El- Fidar River. Many references consider the mainland Phoenician cities to have been equipped with two harbours or anchorage areas, with one facing north and the other would be oriented towards the southwest. The reason for that is depending on winds, while large cargos are safely anchored off shore, smaller boats could make more frequent calls for watering. Two harbours also allowed for easier loading and unloading of freight (Drower 1973: 508). Similarly, Martine's reef in Byblos could have served as an offshore anchorage area. The reef of Dahret Martine is located about two-kilometers off shore from Byblos toward the southwest. The reef runs parallel to the shore and is divided into two sides. According to my personal dives on this reef with Frost, Hélou, and Collina-Girard, one side has a minimum depth of 26 metres going down to about 70 metres, where there is a flat floor that leads back up to the other side to a flat formation about 28-metres deep. This formation is bound from its sides by edges that lead to a slope of a greater depth of about 32 to 34 metres and deeper. During these dives, we found and since documented several stone anchors, some of which were found near the edge of the reef (Noureddine 2001: 91-102). The anchors and their typology will be discussed later in this paper. The two-kilometre offshore shallows (Martine's reef) were charted and the findings published by Collina-Girard *et al*. in 2002. The top of this submerged cape lays at 20 to 30 metres underwater (Collina-Girard *et al*. 2002: 319; Frost 2002: 313; Stefaniuk *et al.* 2005: 24). The ridge is oriented NE-SW and is composed of three irregular masses of *Dahret Martine* and *Shakfi* and the shallower mass of *Dahret Jbeil* that narrows down and ends north of Ras Byblos (**Fig. 7**) (Collina-Girard *et al.* 2002: 319).On both sides of the *Dahret Martine*, the sea depths rapidly fall from 26 to 70 metres into fissure-like holes, oriented NE-SW, which are called

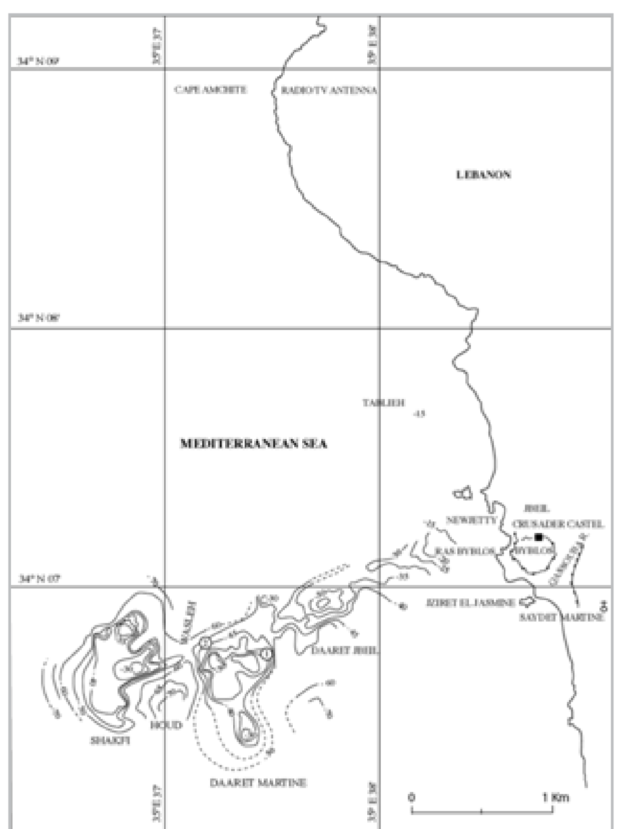


Fig. 7- The 2 km offshore shallows (Martine's reef) were charted and published by Collina-Girard et al. in 2002.

Housh and *Wasleh* and separating it from the area of the *Shakfi* (Frost 2002: 313, 2004a: 335). In terms of seafaring, the shallows of Byblos are a useless mass of rough disorganized surfaces ranging from scattered ravines, basins, flat platforms of desolated rock, cliffs, and pockets of sands (Frost 2002: 313). They are neither a hazard nor a help to navigation and consequently, they do not appear on any standard marine chart (Frost 2004: 334). These shallows today are used as fishing grounds for local fishermen at Byblos. However, the area may have been used in the timber trade since it is located opposite a valley, which ends in the sandy beach. It's likely the sandy beach was used for stacking timber at the mouth of what used to be the Qassouba River (Frost 2004: 334). Although there was no shelter at the open beach, the area could have served as one of several anchorage sites in calm weather conditions during the Bronze Age as the sea level has not dramatically changed since; this charting was a first step toward further archaeological investigation (Frost 2004: 335; Collina-Girard *et al.* 2002: 322).

Finds, Descriptions and Dimensions

Six stone anchors were found on the reef of Dahret Martine during the 2001 survey (**Pl. 3**)[2]. These anchors were found after numerous dives over the reef's relatively shallow floor. The expectation of finding many more anchors is high; Due to the shallow waters over the reef, which are surrounded by considerable depths, it's very possible that ancient mariners found it convenient to anchor their ships over this reef while waiting for the sea to become favorable to enter the harbor, or for loading and unloading cargo ships. However, the depth of this reef could have changed since antiquity due to tectonic activities. Seismic data indicates that at least one earthquake has occurred in the submarine valley of El-Fidar. As mentioned previously, Dahret Martine's reef is located on the shoulder of this sea valley and its depth might have been affected by this seismic activity. So, the area requires further marine geological studies to know if the depths have changed over time. However, during the survey, one of the anchors was found at 38 metres, which is relatively too deep for mooring a vessel. The anchors that were found are of two different types: composite anchors and weight anchors (**Fig. 8**)[3]. They were made out of limestone and the level of conservation varies from one to another. Following is the descriptions of those anchors:

Fig. 8- Tyre Fisherman still producing three holed anchors using cement. (Photo: H. Frost).

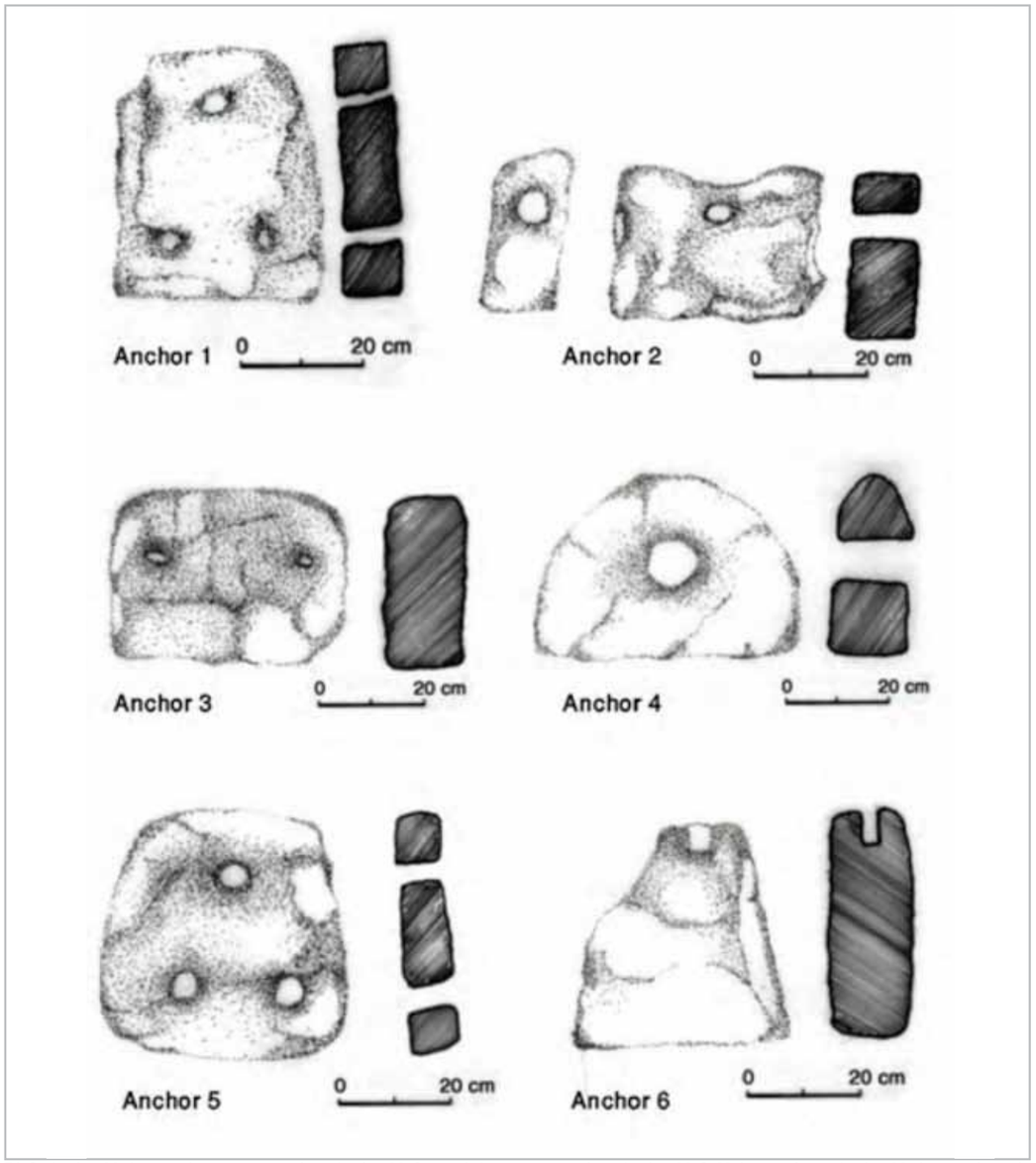
Stone anchor 1

Examining this anchor shows that it is a limestone composite anchor that is pierced with three rounded holes. The anchor lays at the depth of 33.6 metres (**Fig. 9 and Pl. 3**) or at 4.36 (ATM[4]). The anchor is on a flat rocky seabed, two meters away from an edge that leads to steep depth. The top of the anchor was oriented toward the south. The natural corrosion on the surface of the anchor is due to the length of time is has been resting in salty waters.

Dimensions:
Height: 40 cm.
Width: bottom 40 cm, and top 25 cm.
Thickness: 9 to 10 cm.
Holes: 3 holes.
Shape of the holes: Round
Diametre of the holes: 4 cm.
Approximate weight: 30-35 kg

The shape of the anchor is triangular and it's pierced with three round holes, one centred in the middle toward the top of the anchor, and the other two holes are placed in its lower part, and they are fixed about 15 cm apart from each other. The anchor

is made out of limestone, and its angles are somewhat pointy. Its weight could be about 35 kilograms or more (Image **Fig. 9 and Pl. 3**). The corrosion from the length of time in the salt water, the underwater pressure and the bottom currents could all be factors that affected the original weight of this anchor.



Pl. 3- Anchor N° 1: typical composite anchor. Anchor N° 2: weight/composite anchor. Anchor N° 3: Unknown form. Anchor N° 4: typical weight anchor. Anchor N° 5: typical composite anchor. Anchor N° 6: unknown form.

Fig. 9- Stone anchor 1 as listed in the text. (Photo: I. Noureddine).

Fig. 10- Stone anchor 2 as listed in the text. (Photo: I. Noureddine).

Stone anchor 2

This anchor is not classified and it has a square shape. It was found standing next to a little edge on a ragged seafloor at the depth of 32 metres, 4.02 (ATM). This anchor seems to be like a weight anchor with one hole centred in the upper middle of its corpus. Another hole is centred in the middle of its left side (**Fig. 10 and Pl. 3**), and the diameter for both holes is about 4.5 cm. The anchor is also made out of limestone and its angles are relatively pointy.

Dimensions:
Height: 26 cm.
Width: 35 cm.
Thickness: 10.5 cm.
Holes: 2 holes.
Shape of the holes: Round.
Diametre of the Center hole: 4.5 cm.
Diametre of the Side hole: 7 cm.
Approximate weight: 20-25 kg

The way this anchor was used is not clear and the fact that it has two holes gives the impression that it belonged to the composite character. The closest parallel to this anchor would be AN 113 at the Kingsley Plate 37 (Kingsley and Raveh 1996: 41). However, the function of the side-hole is unusual. Also, the middle hole is clearly the rope hole since the rope groove, created by the friction of the vessel's rope, can be seen at the top of the anchor.

Stone anchor 3

An unusual stone cut was found near the area where other stone anchors were found. This stone was classified as a stone anchor for several reasons: it was cut in a purposeful rectangular shape, the location where it was found near the anchors, and finally, because of the piercing in its corpus. The anchor was found lying next to anchor N° 4 at the depth of 36 metres. Like the rest of the anchors, this stone anchor is made out of limestone and its angles are pointed. Its atmospheric underwater pressure is 4.06 atmospheres (**Fig. 11 and Pl. 3**).
Dimensions:
Height: 32 cm.
Width: 42 cm.
Thickness: 14 cm.
Holes: 2 holes.
Shape of the holes: Round.
Diametre of the holes: 2 cm.
Approximate weight: 40-45 kg

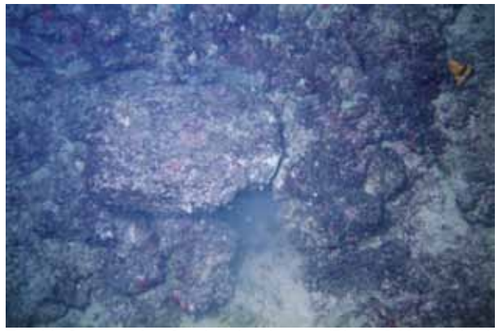


Fig. 11- Stone anchor 3 as listed in the text. (Photo: I. Noureddine).

This anchor could possibly be considered as a composite anchor, for having two holes on one side of its corpus that could have served as rope holes. Perhaps the rope goes into one hole and comes out from the other in order to hold the anchor while it connects to other anchors as sand anchors described above. The weight of this anchor could be around 40 to 45 kilograms.

Stone anchor 4

Located about 3 metres toward the west from anchor N° 3, lies the anchor N° 4 at the depth of 36.4 metres. This anchor is identified as a weight anchor where its weight played the major role in holding a vessel with or without the support of other anchors. It has one rope hole located in the centre of the corpus and the rope groove shows on the upper part of the anchor (**Fig. 12 and Pl. 3**). The rope hole is round and the edges of its body are cut smoothly. The atmospheric underwater pressure that is surrounding this anchor is 4.64 (ATM).
Dimensions:
Height: 40 cm.
Width: 50 cm.
Thickness: 15 cm.
Holes: 1 hole.
Shape of the hole: Round.
Diametre of the hole: 8 cm.
Approximate weight: 65-75 kg

This anchor is a weight anchor and according to its dimensions, it could weigh about 65 to 70 kilograms, which makes it capable of holding a vessel with or without the help of other anchors depending on the size of the ship.

Stone anchor 5

A composite anchor that probably has a rope groove, partly shown in the photographs above the upper hole. The anchor was found at the

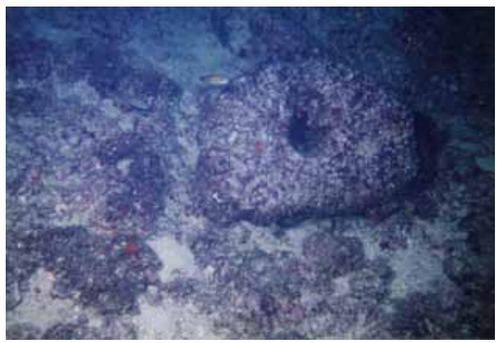


Fig. 12- Stone anchor 4 as listed in the text. (Photo: I. Noureddine).

depth of 38 metres, which puts this anchor at 4.08 underwater atmospheric pressures. The anchor lies at this enormous depth, which is nearly 5 underwater atmospheric pressures, and its thickness is 12 to 14 cm.
Dimensions:
Height: 45 cm.
Maximum Width: 45 cm.
Minimum Width: 32 cm.
Thickness: 8 cm.
Holes: 3 holes.
Shape of the holes: Round.
Diametre of each hole: 5 cm.
Approximate weight: 35-40 kg

This anchor falls into the composite category like anchor N° 1, but with some differences. This one is a bit larger and its edges are rounded and not pointy like those of anchor N° 1. Furthermore, references about composite anchors state that the upper hole is larger than the other two located in the lower part. But in the anchors found offshore of Byblos contradicts this idea as these composite anchors have holes with almost all the same diameter (**Fig. 13 and Pl. 2**) and resemble the Red Sea anchors mentioned earlier. This fact does not disqualify the anchor as being a composite anchor, but points to how this category of anchor may have been used.

Stone anchor 6

This anchor stands upright on the depth of 34.3 metres on a very rugged seafloor; the depth of the location of this anchor puts this anchor at 4.43 atmospheric pressure. Its shape is pyramidal and underwater examination shows that it has one hole on its top (**Fig. 14 and Pl. 2**). But it's still may be possible to find other holes should the anchor be inspected above water as it was very difficult underwater to tell if there were any features that could help classify this anchor.
Dimensions:
Height: 40 cm.
Maximum Width: 40 cm.
Minimum Width: 45 cm.
Thickness: 16 cm.
Holes: 1 hole.
Shape of the hole: Round.
Diametre of the hole: 3.5 cm.
Approximate weight: 60-65 kg

The anchor is broken, and the part we are discussing is the upper part.

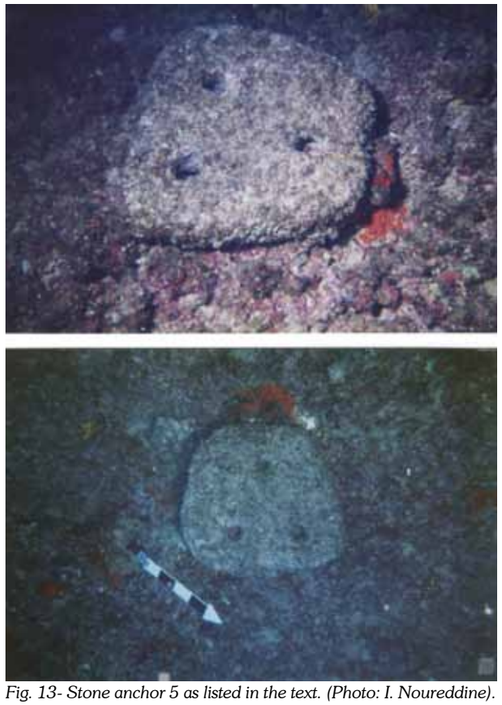


Fig. 13- Stone anchor 5 as listed in the text. (Photo: I. Noureddine).


Fig. 14: Stone anchor 6 as listed in the text. (Photo: I. Noureddine).

Archaeological, geological discussion and conclusion

According to historic references, Phoenician cities had two anchorage areas, one facing north and the other south. The northern one was for domestic use, and the southern one, the so-called "the Egyptian harbour" named by historians, was for foreigners. In Byblos, Honor Frost suggested that the outer Egyptian harbour could be the "Martine's reef". The reef is located at the northern shoulder of the El-Fidar sea valley. The Fidar River is named after the coastal ancient village of El-Fidar, and it is located about 22 kilometres to the north of the capital of Beirut, and approximately three kilometres south of Byblos. The total length of the El-Fidar River fault appears to be approximately 15-20 kilometres (Gedeon, 1999: 57, 63) and its relation with Martine's reef can be seen in (**Figs 15 and 16**) where the reef lays on the shoulder of the river's valley. A marine geologist Thomas R. Goedicke described the sea valley and made a preliminary bathymetric measurement in the area between Jounieh and Byblos in the late 1960's. He revealed the presence of three submarine valleys, two of these are the Adonis Canyon and El Fidar Sea valley. The third sea valley is in Ras El Maameltein, on the northern side of Jounieh bay. El-Fidar Sea valley is in the exact alignment with El-Fidar River; which has a particularly straight course of flows in a steep-walled canyon (Goedicke 1972: 664). Its fault would pass through the offshore valley where it extends into the continental shelf (Gedeon 1999: 63). The emphasis is going to be on El-Fidar sea valley for its geological connection with Byblos and its reef. The valley heads in a wide depression at the depth of 86 metres, directly from the mouth of El-Fidar River. It is oriented east-west and is divided into two canyons (Collina-Girard 2003 personal communication). The deeper of the two canyons has been followed to the depth of 490 metres. At this point, the south wall has a height of 420 metres (Goedicke 1972: 664) (**Fig. 16**). El-Fidar Sea valley is developed only at a great depth above which there are only wide depressions marked with hummocky topography. This may be due to the large supply of sedimentbrought onto the narrow shelf of the Ibrahim River and El-Fidar River, both of which have large drainage basins (Goedicke 1972: 665).

Finally, Byblos has a rich maritime history with active sea expeditions in as early as 2800 BC during the reign of Khasekhemwy the last king of the second dynasty, until the "supposed" adventure of Wenamun in the 1100 BC. Many, including Ernest Renan in 1860 and Pierre Montet from 1920 to 1924, up to the excavations of Maurice Dunand, have conducted research. Despite the more than 150 years of research work in Byblos, there has still been no great marine archaeological discovery, as far as finding the chief harbour of the Canaanite-Phoenician period or its anchorage area. Even though none have a securely datable context, the stone anchors have emerged as the most important discovery of the Byblos maritime survey. The existence of these anchors on Dahret Martine reef adds to the possibility that this reef was the exterior anchorage area during the Bronze Age (Noureddine 2015: 186). However, archaeological diving on the shoreline of Byblos did not reveal any traces of the submerged harbour installations or structures. The references that deal with the anchors that were found on the site of Byblos assume that Byblos has no composite anchors, whereas we found at least two anchors of the composite type, but their origin is not yet known. Moreover, references have mentioned previously due to the characteristics of the composite anchor that the uppermost hole of the anchor, which is for the rope that drops from the vessel, is bigger than the other two holes in the lower part of the anchor and has a square shape (See composite anchor). During this study, and after examining the anchors underwater, I detected that the composite anchors that we found on Dahret Martine reef, have three holes that are nearly the same size, and that are all rounded. Finally, more investigations and more finds of Byblian anchors would surely help create the basis of the as-yet-determined criteria of a Byblian Type Anchor.

Certainly finding more anchors underwater would add to the characteristics of the Byblos Type Anchor. Yet, it also poses several questions, such as: how did Bronze Age sailors manage to load and unload freights in the offshore areas? Specifically, how did they pull anchors that could be over half a ton of weight? Did they use a form of rollers, tackles or any kind of bobbins to help them pull up the heavy stone anchors?

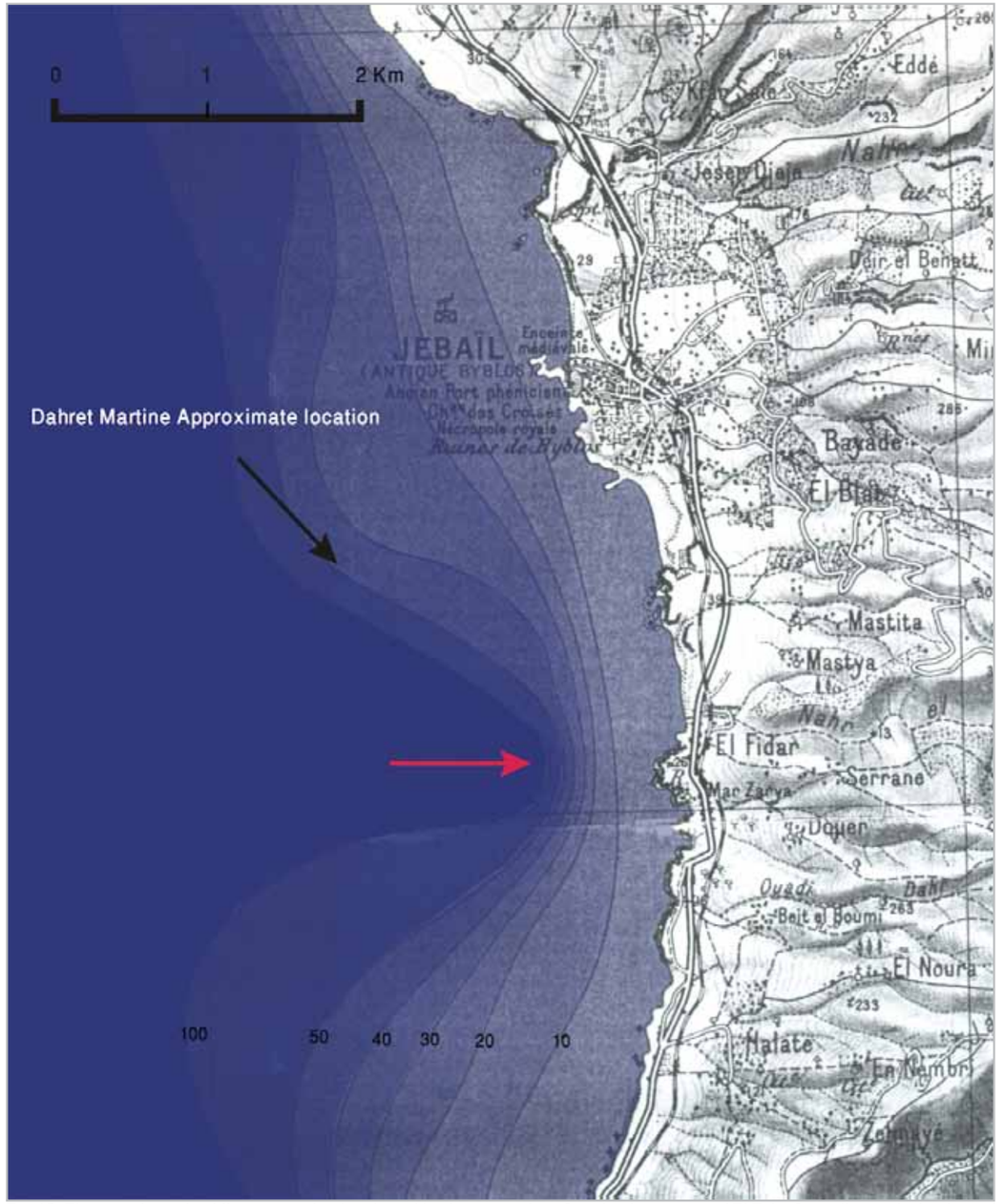


Fig. 15- This map shows the different water levels indicated by the contour line. See also the top view of El-Fidar Sea valley marked with a red arrow. The map was drawn back in 1940 (AUB Geology Department), and during this survey in 2001, the approximate location of the reef of Dahret Martine.

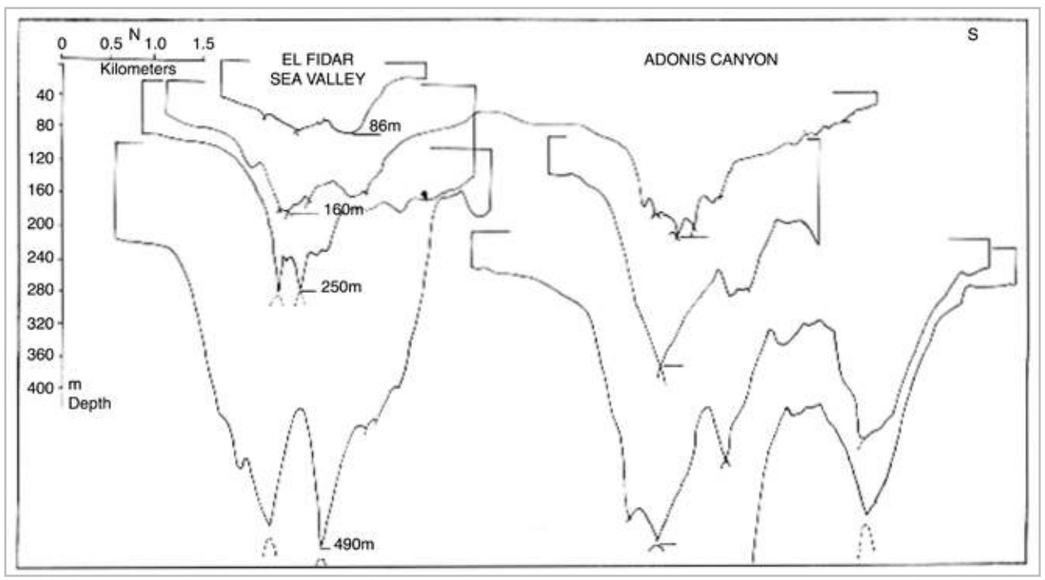


Fig. 16- Bathymetric profiles of the area between Byblos and Tabarja point. The southernmost, Adonis canyon is approximately in line with the lower course of Ibrahim River. El-Fidar Sea valley, to the north, is in exact alignment with El-Fidar River, where Martine's reef is located on the northern side of the Sea Valley.

Notes

1- Byblos fishermen named the reef Dahret Martine, meaning Martine's reef after the "Lady of Maritime church" in Byblos since they use the church as a reference from the sea to locate the reef. Likely over time, Maritime became Martine as it is easier to pronounce in Lebanese Arabic.

2- Please note that these stones anchors are only sketches and were measured underwater, therefore some discrepancies may occur.

3- This does not defy the possibility that they were also used in later periods. Three-holed anchors were used until recently, while fishermen on the Lebanese coast still produce similar three-holed anchors but made of cement (Fig. 8).

4- Atmospheric pressure unit.

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