

***Byblos & the Sea* - an HFF funded Research Project**

**Summary report: Sediment Sampling at Sea / Mission 6 - February 2016**

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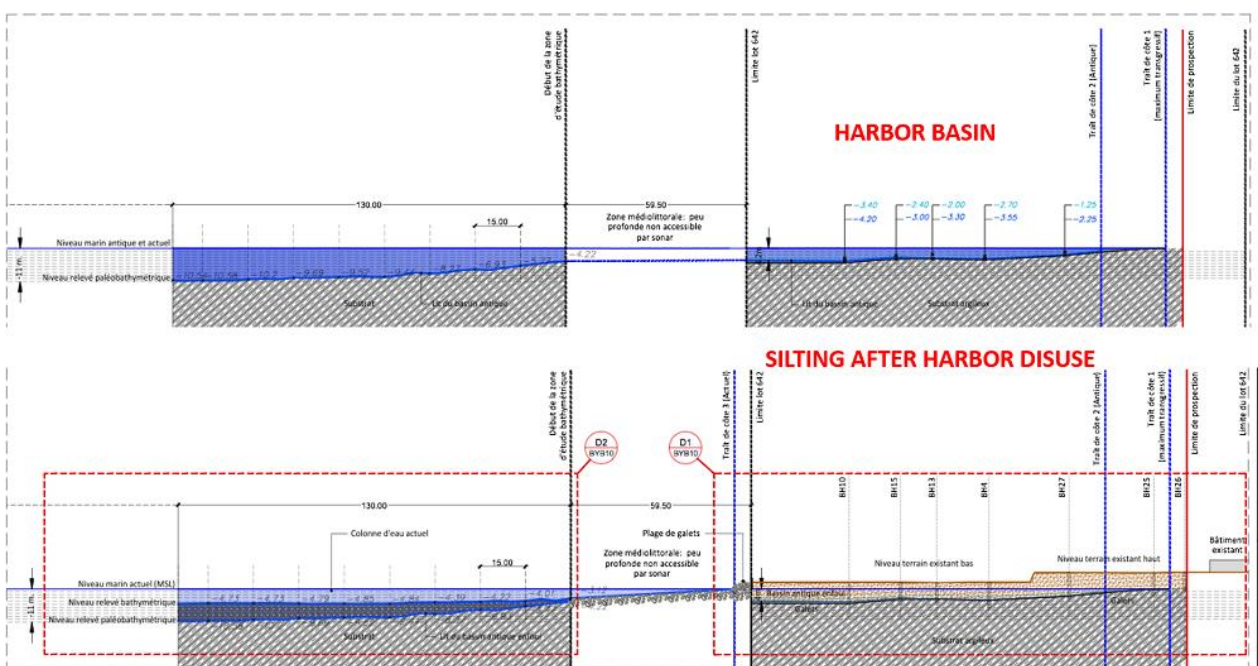
In February 2016, *Byblos & the Sea* conducted a Sediment Sampling Mission at sea in Byblos funded by the Honor Frost Foundation. On the bases of preliminary results of the underwater bathymetry campaign conducted in June 2014 in maritime Byblos, under the scientific direction of George Papatheodorou (Marine Geology Department, Patras University), this complementary survey took place in the maritime area of Jouret Osman, northwesterly of El-Yasmine Island, located in front of the Armenian Orphanage lot at the foot of the archaeological site of Byblos (Fig. 1).



**Figure 1. Jouret Osman, - northwestern maritime area of El-Yasmine Island, in front of the Armenian Orphanage land in southern Byblos (@*Byblos & the Sea*, 2016, Martine Francis-Allouche).**

First results of the bathymetric and paleobathymetric survey conducted southwards of Byblos, in the Bay of Jouret Osman, have proved to be quite outstanding since they concurred with results obtained by inland auger coring results: when diving today, the seabed of that Bay appears to be extremely shallow and rocky and the actual shoreline looks to be practically linked to the Island of El-Yasmine, almost forming a headland. However, the underwater bathymetric survey proved the seabed of that Bay to lay much deeper under its actual appearance: it is covered by a thick layer of concretions (5m depth), - an accumulation of loose sediments on the original deeper seabed as results have shown from the sea survey mission 4 conducted in 2014 (see Report mission 4).

This means that the actual depth of this buried seabed matches the depth of the basin floor which had been located inland (2013 and 2014 missions), buried under the Armenian Orphanage lot (Fig. 2). Therefore, the entire profile of the Qassouba Valley, extending from the hinterland of the Armenian Orphanage lot into the sea, appears to have been a deeper gulf, with an adequate mooring water depth. Auger coring results (mission 3, January 2014) have in fact proved the basin to be wide enough, - approx. 10.000 to 12.000 square meters of circumference (today silted-in), without taking into consideration the outer basin area which is still submerged (the Jouret Osman Bay in Fig. 1). The depth of the basin could also be estimated through auger coring extractions to about 1.5 to 2 meter of water depth at the shallow end of the basin, and to 3.5 to 4 meters of water depth below the actual shoreline (figure 2). In comparison, the 6<sup>th</sup> century B.C. harbor of Marseille had a water column of ca. 1m. Thus, the southern vicinity of Byblos had an optimal harbor basin to accommodate a fleet of commercial boats as stated in ancient Egyptian annals, - the *Wenamun* story for example.



**Figure 2. General NE-SW section showing the original state of the harbor basin (above) and the silting of the basin after disuse (below). The above section shows the depth of the basin: from its shallow end at – 1.5m inland, until its deeper seaward side at - 11m of water column (©Byblos & the Sea, 2016, Martine Francis-Allouche, Manuel Kerkunian).**

In the light of these important results, *Byblos & the Sea* conducted a rock and sand sampling survey onshore and offshore Byblos in February 2016, under the scientific direction of George Papatheodorou (Marine Geology Department of Patras University, Greece).

The main objective of this mission was to date the silted-in harbor basin which extends for more than a 100m inland, to about a 100m outwards at sea, under the actual seabed of Jouret Osman Bay (Fig. 1). The larger scope of this campaign was the study of Mean Sea Level changes as well as the reconstitution of the paleo-geography of coastal Byblos.

**The Field mission implied the sampling of sandy and rocky sediments:**

- 1) Onshore Rock sampling for dating at the coastal platforms using hammer and chisel (Fig. 4).

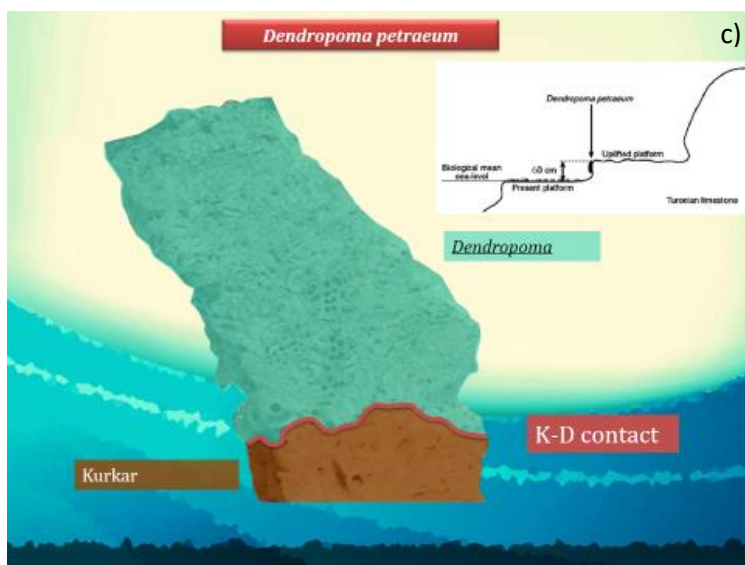
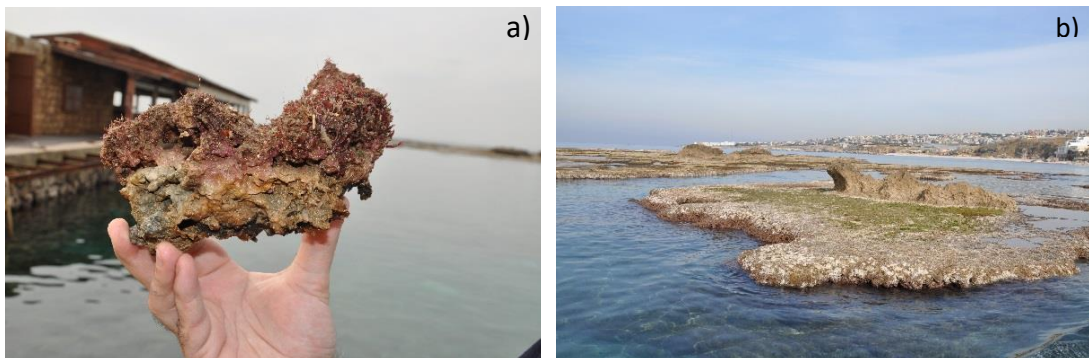


Figure 4. Ex. of an onshore rock sample (a) extracted from a coastal uplifted platform (b) in Byblos. The dating and analyses of the *Dendropoma petraeum* which forms on uplifted platforms, covering the Kurkar or the Turonian limestone of the present day platform at biological Mean Sea Level (c), contributes to the study on Sea Level Changes as well as for the paleo - geographic reconstitution of coastal Byblos (©Byblos & the Sea, 2016, G. Papatheodorou, M. Francis-Allouche).

- 2) Offshore sediment sampling for dating from shallow 5-15m waters (Fig. 5).

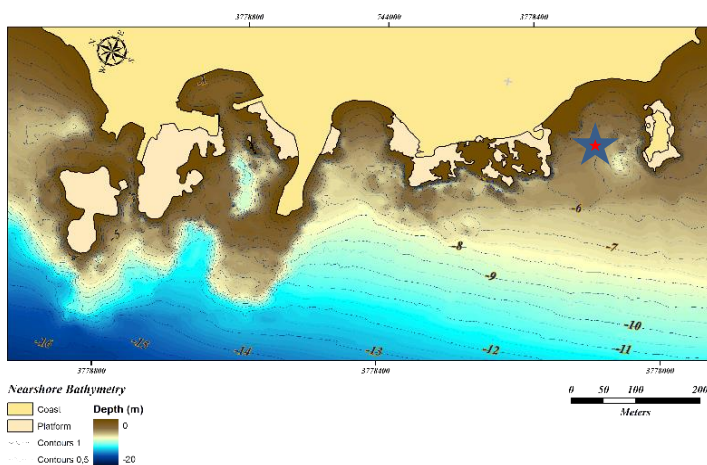


Figure 5. Map of nearshore maritime area of Byblos and diver in the Bay of Jouret Osman using PVC tube to collect short sediment cores (marked with blue star); (©Byblos & the Sea, 2016, G. Papatheodorou).

3) Offshore Rock sampling for dating on submarine platforms of *Dahret Martine* and *Dharet Jbeil* by divers using hammer and chisel (Fig. 6).

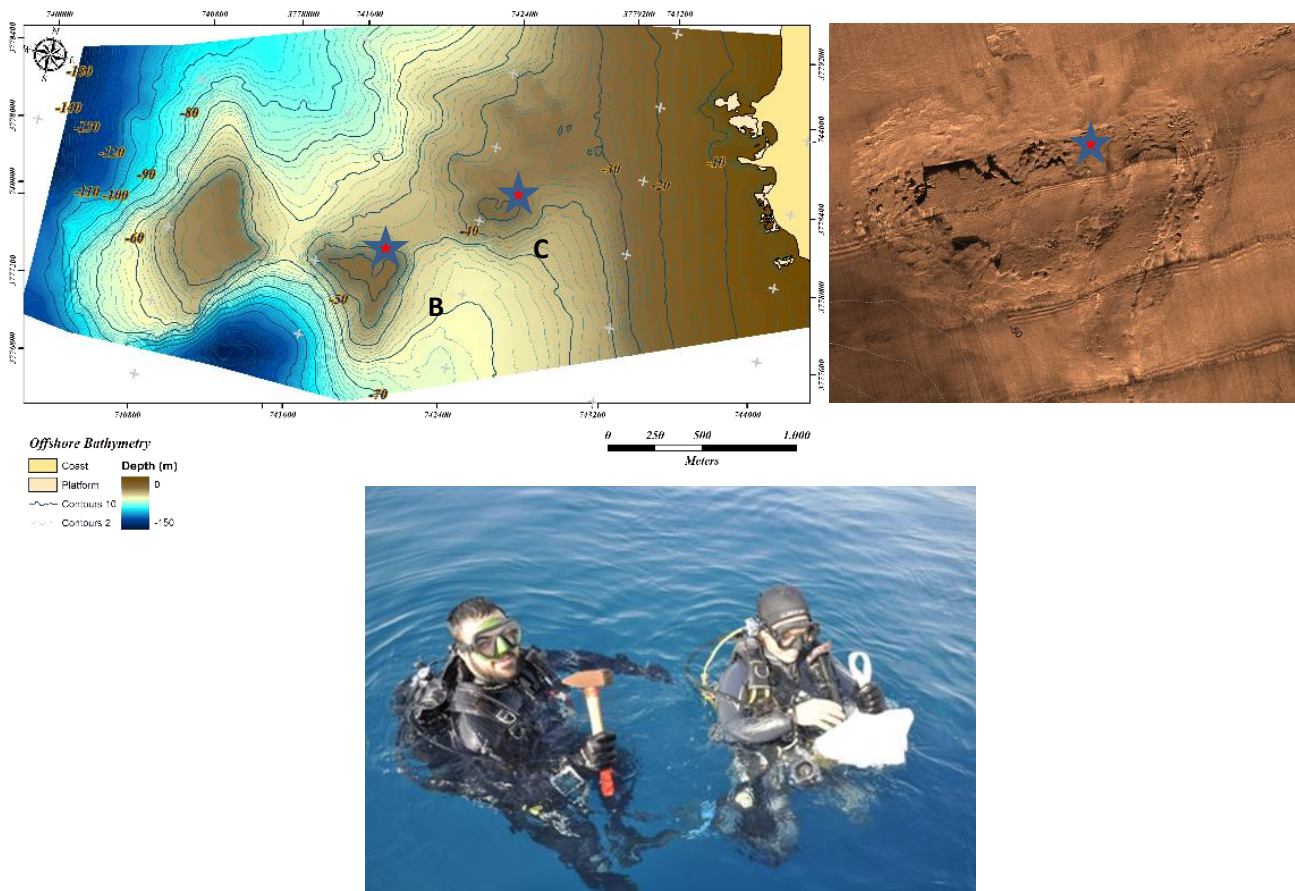


Figure 6. Rock samples collected at the edges of submarine platforms (B and C) at water depth of 30-35m, (©Byblos & the Sea, 2016, G. Papatheodorou, Martine Francis-Allouche).

All these samples were sent to the Laboratory of Patras University in Greece for analysis and dating;

Methods used on selected sediments:

1. AMS dating method
2. Pb210 dating method
3. \*Optically stimulated luminescence (OSL): a method used in optical dating of sediments as well as materials such as pottery, bricks etc.
4. Cs dating method

These sea sediment dating will be corroborated with results of C14 dating of extracted auger core samples from the Armenian Orphanage land, mission 3 - January 2014 (inland coring samples were sent to Poznan Laboratory in Poland).

Preliminary scientific results are published in the Bulletin d'Archéologie et d'Architecture Libanaises (Francis-Allouche, M. and Grimal, N. *et al.* 2017. "Byblos maritime : une installation portuaire au piémont sud de la ville antique", BAAL 17, p. 133-196).