

Byblos & the Sea - an HFF funded Research Project
Summary report: Bathymetric Sea Survey / Mission 4 - June 2014
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In 2014, an extensive marine remote sensing survey was performed in the maritime approaches to Byblos within the framework of the research project *Byblos & the Sea*. The actual sea survey was conducted by the Marine Geology Department of Patras University, under the Direction of George Papatheodorou.

A complete under water mapping survey of the near-shore and offshore waters of Byblos was carried out, covering a total maritime surface of 8km² with a total length of 250km of track-lines, from the medieval harbor of Byblos to the Nahr El-Fidar river canyon, till 3km at large (Fig.1).

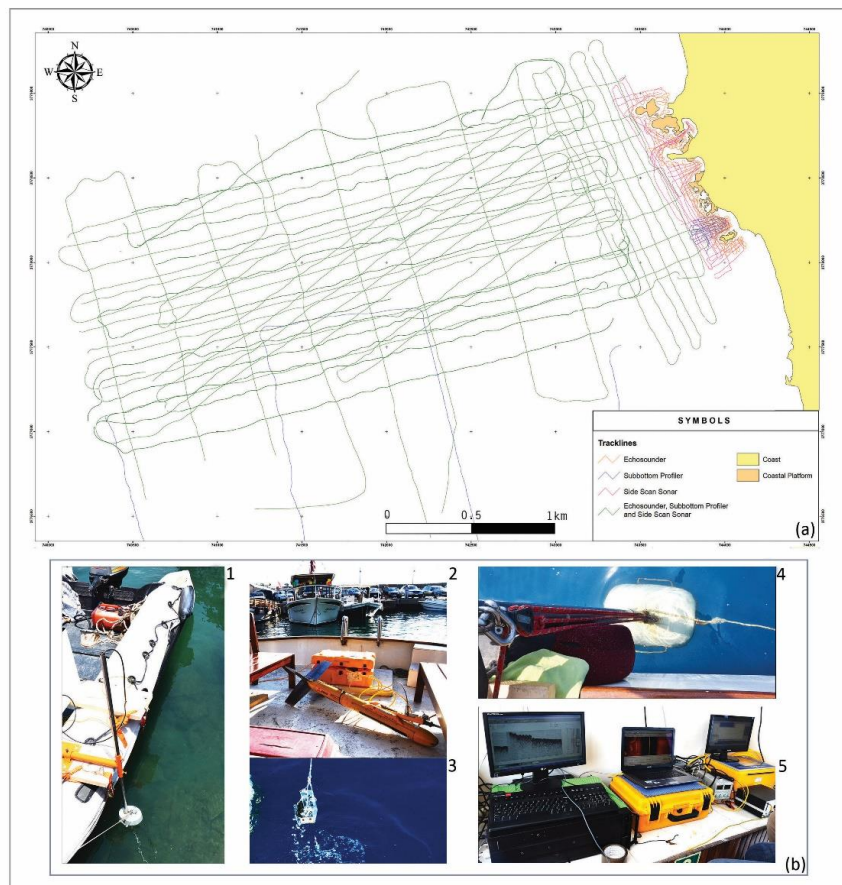


Figure 1. Map showing the surveyed near-shore and offshore waters of Byblos (above); Photos of boats (1-2) and equipment used for the remote sensing surveying (bottom): an Echosounder (1) a Side Scan Sonar (3), a Subbottom Profiler (4) and an Acquisition system for all marine remote sensing devices (5) (©Byblos & the Sea, 2014, George Papatheodorou).

Objectives

With the help of performing technical equipment provided by Patras University Geology Department, such as:

- A wide Side Scan Sonar system: for planimetric measurements of a wide seafloor area, resulting in geomorphological mapping and the detection of man-made features;
- A Subbotom Profiler system: for providing a geological profile of the sub-bottom (buried layers) up to 50m beneath the actual seabed depending on the seabed composition; it also evaluates the seismic stratigraphy of the seafloor, detects paleo-shorelines, buried seabeds and possible structures;
- A digital Single-beam Echosounder for vertical readings with an accuracy of 5cm (in shallow waters)
- An Acquisition System for all of the above marine remote sensing devices;

The proceeded data of this survey resulted in:

- A bathymetric map of the actual seabed;
- A paleo-bathymetric map of a deeper laying seafloor;
- A seafloor composition map;
- The detection of submerged paleo-shorelines;
- A man-made target map, spotting unusual manmade features;

Results and Data

1. This mapping of the maritime area of Byblos was necessary to complete a topographical master plan of the coastal rocky stretch of Byblos which was undertaken as a first task by *Byblos & the Sea* in 2011. This scope of work resulted in a continuous map connecting the antique city of Byblos to its historical shoreline and further to its maritime approaches (Fig. 2).

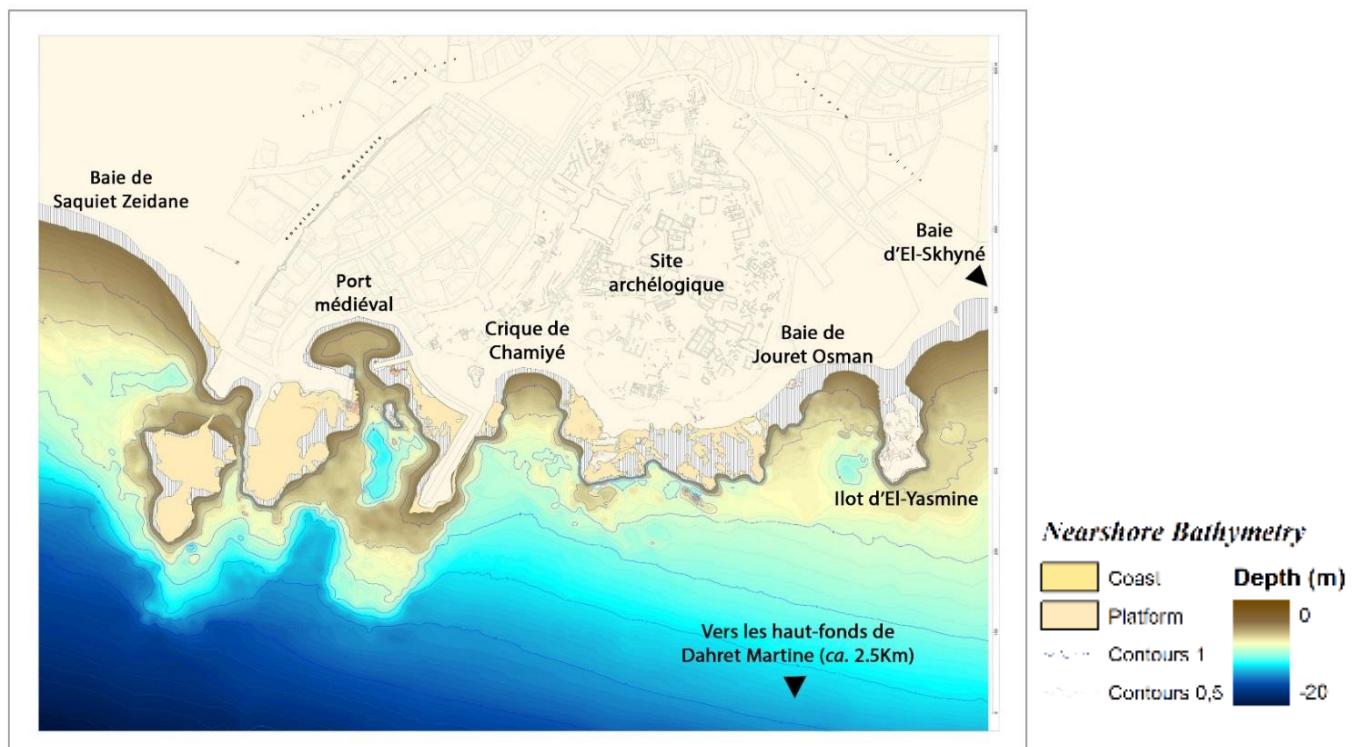


Figure 2. Topographical plan of the coastal area of Byblos and bathymetric survey of the near-shore maritime area (©Byblos & the Sea, 2014, after G. Papatheodorou).

2. The marine survey results confirmed results of previous coring investigations carried out on the Medieval Harbor quay (Projet CEDRE, 2000) which had led Honor Frost to look towards the southern end of Byblos, rather than considering the Medieval Harbor area itself: the

bathymetry map correlates with these former results; they show a shallow and rocky maritime approach around the medieval harbor basin (Fig. 3)

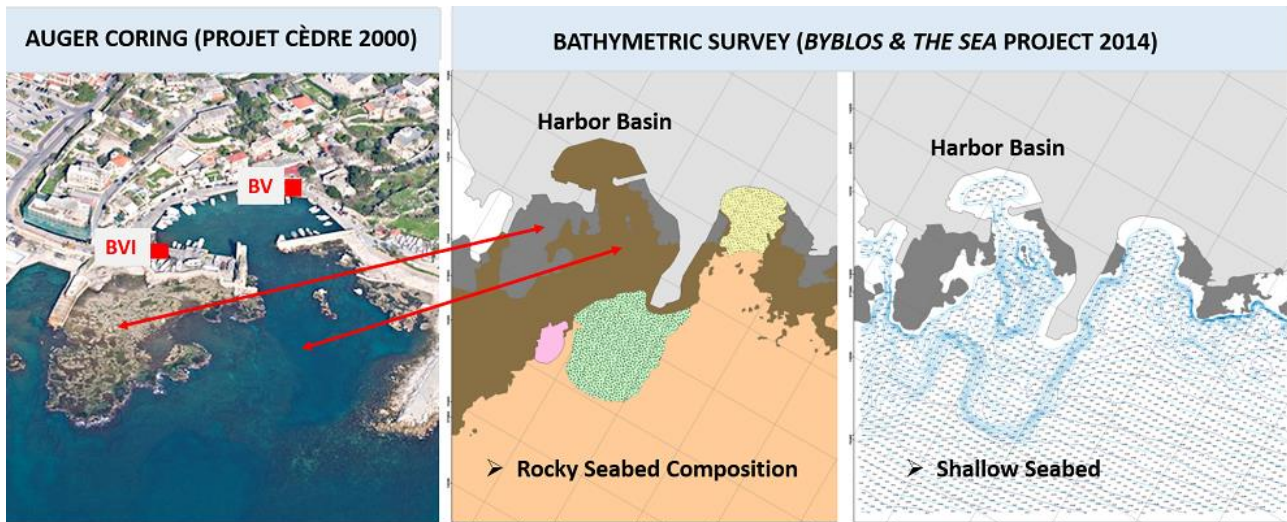


Figure 3. Bathymetric survey of the medieval harbor area, showing shallow and narrow seaward approaches, in spite of 1968 excavation works of rocky outcrops inside and outside the basin; Seabed composition in the medieval harbor area of Byblos, showing in brown an important shallow rocky seabed (small square): even today the maritime approaches are rather difficult for bigger boats (©Byblos & the Sea, 2013, after G. Papatheodorou).

3. This remote sensing survey resulted in a general reconstitution of the geomorphology of maritime Byblos. It has specifically concurred with results obtained from missions on land:
 - a) The Geophysical Survey on the Armenian Orphanage lot (Mission 2 - October 2013)
 - b) The results of the analyses of sediments extracted during the Auger coring campaign performed on the same above mentioned lot (Mission 3 - January 2014).

Explanation

Today, the seabed of Jouret Osman Bay appears to be extremely shallow and rocky; the actual shoreline looks to be practically linked to the Island of El-Yasmine, almost forming a headland. The bathymetric survey has rendered a concurring image: it is a mapping of the seabed as seen today. However, further investigation through the Subbottom Profiler, - a system which reads and detects deeply buried layers (paleo-bathymetric levels), proved otherwise: the original seabed of that bay lays deeper, it is covered by an accumulation of loose sediments which formed a thick layer of about 5m over the years (Figs.4-5).

Scientific Results are published in 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).

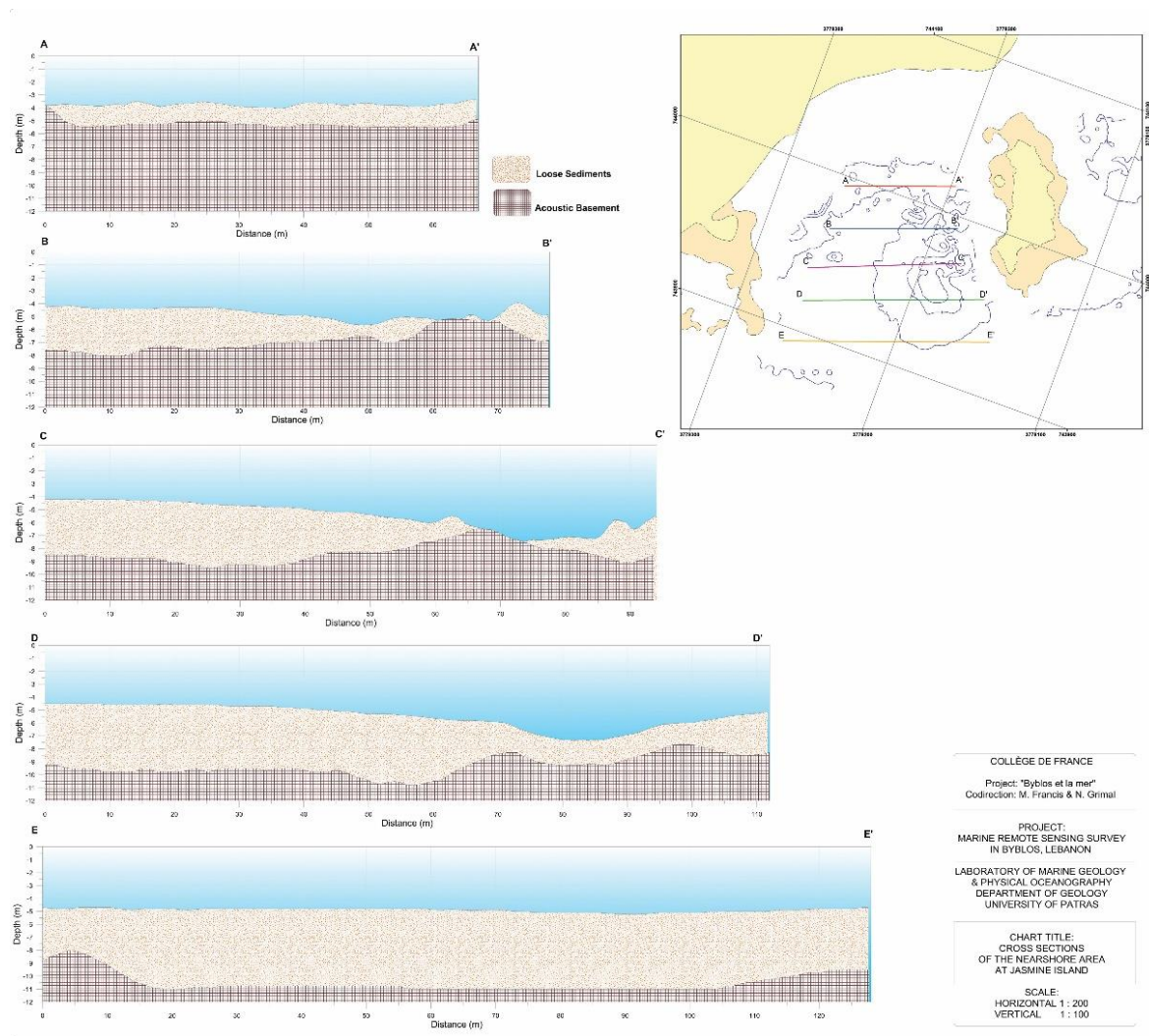


Figure 4. Cross-sections of the near-shore area in the Jouret Osman Bay, showing a 5m thick layer of loose sediments (light grey) covering a deeper seabed (dark grey), (©Byblos & the Sea, 2014, G. Papatheodorou).

The inner harbor basin of Byblos buried under the Armenian Orphanage land has been landfilled by a silting process that led to a seaward progression of the shoreline of about a 100m at present day, totally integrating the paleo-shoreline into the urban tissue (Fig.5-6). Today, the 5m of loose sediments covering the deeper sea-bed in the Jouret Osman Bay (in front of the Armenian Orphanage lot) are the outcome of this same landfill process. If the abandonment of harbor structures played an important part in the silting process of this southern coastal area, modern landfill such as Durand's archaeological excavation dumps thrown over the cliffs onto this area since the 1920ies, modern construction works of the Armenian Orphanage, as well as the building of a coastal route in the 1970ies have also majorly contributed to the masking and transformation of the original landscapes and seascapes of southern Byblos.

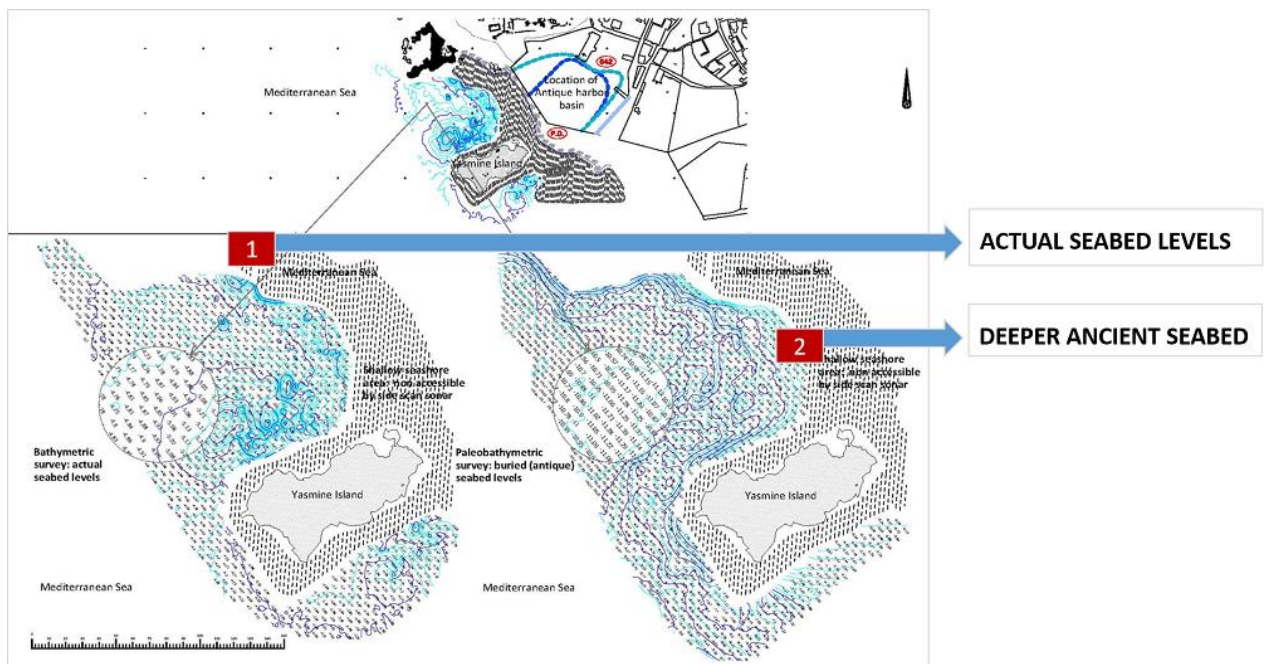


Figure 5. Comparative plan showing actual bathymetric seabed levels (left/1) and buried paleo-bathymetric levels (right/2) of the same spot in Jouret Osman Bay (©Byblos & the Sea, 2015, Martine Francis-Allouche after George Papatheodorou).

The level of the buried sea-bed matches perfectly the one of the silted-in harbor basin which has been detected under the Armenian Orphanage lot by both the Geophysical survey and the Auger coring survey on land in 2013 and 2014 respectively (Fig.6). In conclusion, the multidisciplinary research program *Byblos & the Sea* has proven the existence of a large basin laying at the southern foot of the promontory of Byblos. It extended inland, deep into the Qassouba Valley which is occupied today by the Armenian Orphanage lot and it had the proper depth for the safe mooring of boats, - possibly the commercial harbor of the Acropolis of Byblos.

Marine survey 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

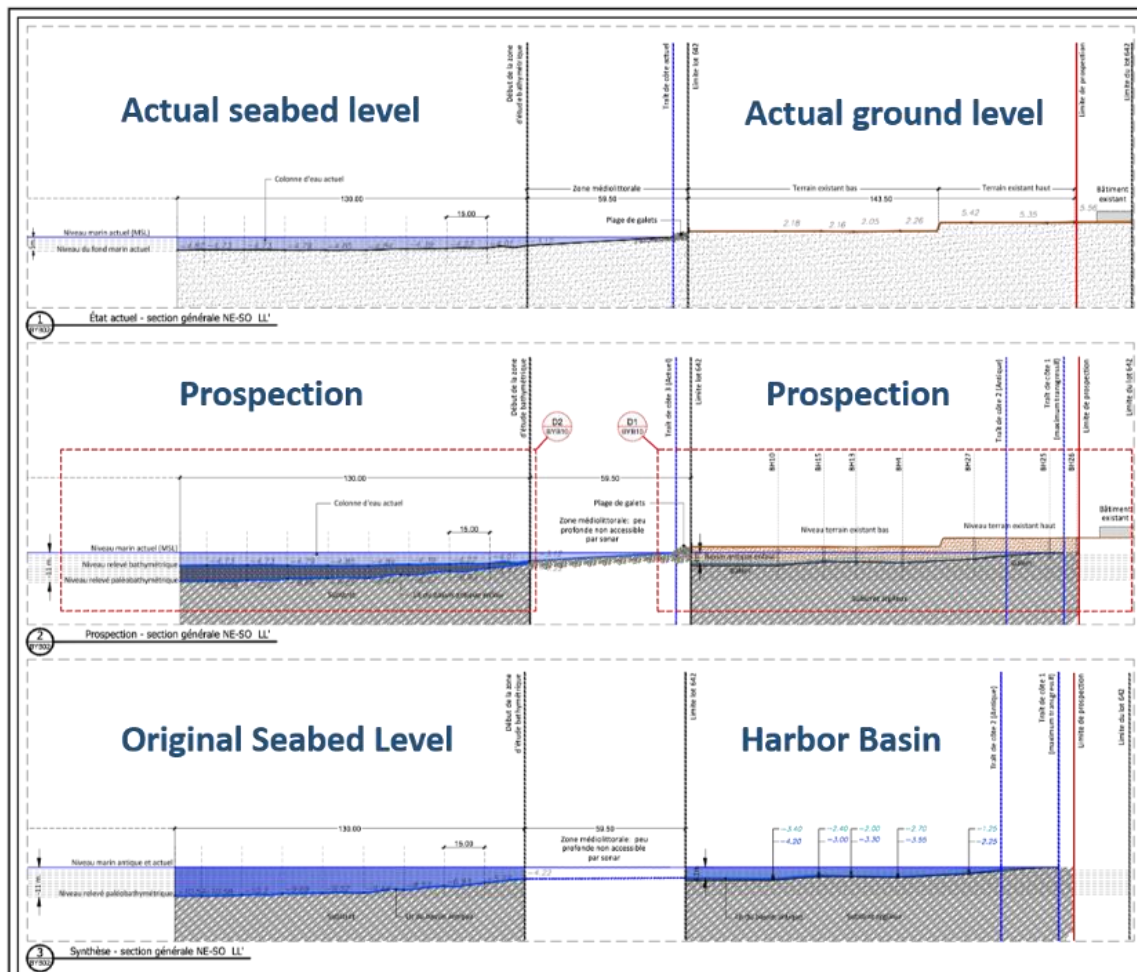


Figure 6. Showing a NE-SO General Section, reconstituting the water depth of the antique basin, buried under the Armenian Orphanage lot, and further, extending into the sea beneath the Bay of Jouret Osman.

From top to bottom:

- Actual configuration
- The geoarchaeological prospection works
- The Antique configuration of the basin

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