GEOARCHAEOLOGY OF BYBLOS, TYRE, SIDON AND BEIRUT

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Abstract: Recent geoarchaeological work at Byblos, Tyre, Sidon and Beirut has looked to marry geoscience techniques (coring, geomorphological mapping, bio-sedimentological studies) with archaeology, to better understand where, when and how the cities' ancient harbours have evolved. Not only have these data contributed to a historical and archaeological reinterpretation of Lebanon's harbour environments, but they have also provided new insights into seaport systems and infrastructure for the wider Canaan, Phoenician and Punic spheres. In this paper, we summarise the geoarchaeological results from these four sites, placing particular emphasis on previously unpublished archaeological data.

Keywords: Ancient Ports; Phoenicia; Geomorphology; Tyre; Sidon; Byblos; Beirut.

Byblos

Six cores were undertaken at Byblos (Fig. 1), two in the northern harbour and four in the bay of El-Skhiny.[1] The elucidated chronostratigraphy has shed new light on a number of questions posed by H. Frost during the 1960-70s.[2] New work has demonstrated that the ancient city of Byblos possessed two harbours: the present port, just to the north of the tell in a creek that favoured the beaching of small vessels, and the bay of El-Skhiny, south of the tell, open to the influence of the wind and swell and bordered by a sandy beach. The islet of Jeziret el-Jasmine, in the northern angle of the bay, faces the mouth of wadi Qassouba and affords greater protection to this area of the bay.

No rapid shift in sedimentological *facies* is attested in the northern or southern bays' sedimentary records, demonstrating that these basins were probably never endowed with artificial harbourworks, such as moles, destined to protect the waterbody. Indeed, the chronostratigraphy demonstrates that the northern port was also relatively exposed to swell and wind dynamics during antiquity. The southern bay was open to offshore influences and only its northern flank was relatively sheltered from high-energy sea states. Relative to present, the coastline lay further inland during antiquity and progradation of the coastline, through sediment supply from local wadis, began around 1300-1200 years BP. Today, the topography has been significantly disturbed due to the illegal extraction of sand allied with the construction of numerous tourist amenities.

From a geomorphological perspective, the ancient harbour system of Byblos comprises two harbours separated either side of the archaeological tell: to the north an exposed pocket beach and, to the south, a large marine bay (~550-m wide) with a small offshore islet.

Byblos was the most important harbour of the Levantine coastline during the Bronze Age and its spatial organisation is typical of this period, namely a series of simple juxta-

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[1] Stefaniuk *et al.* 2005.
[2] Frost 1973b; Frost – Morhange 2000.

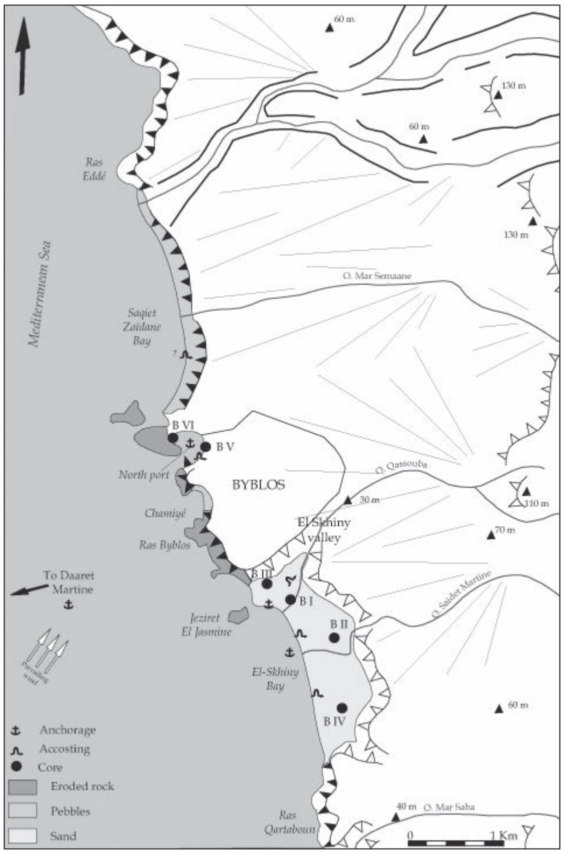

FIG. 1. Simplified geomorphology of the Byblos coast (CARAYON 2008).

posed harbours.[3] This model is also attested at Batroun, Tell Sukas, and Akzib. The use of these harbours was totally dependent upon the meteorological conditions, whilst the absence of artificial infrastructures meant that larger vessels could not shore-up at the waterfront. The northern creek was, as it is today, too small for large vessels to access. Instead, the latter anchored offshore in the southern bay when weather permitted whilst lighter vessels assured the transit with the continent.

Despite its unfavourable harbour context, Byblos was able to play an important role in the eastern Mediterranean's Bronze Age trade network, particularly the trade of cedar with Egypt, described in the 11th century BC in the account of Wenamon.[4] In this text, an Egyptian envoy, Wenamon, arrived in Byblos looking to buy cedar wood. He installed his tent in the harbour where he met the Giblite king and negotiated the merchandise. It is recounted that the wood was cut in the mountain and stocked on a beach outside the city until the boats loaded and exported them to Egypt. It is hypothesized that Wenamon set anchor in the northern harbour and that the stocking and charging of the logs took place on the beaches of El-Skhiny.[5]

TYRE

25 cores were undertaken at Tyre (FIG. 2), centred on four geographical areas: (1) the northern harbour; (2) the "southern" harbour; (3) the tombolo; and (4) the coastline of Palaeo-Tyre.[6] In addition, underwater archaeological surveys in the area known as the "southern harbour" were also undertaken.[7] The results of this underwater study have looked to reconcile some unresolved questions relating to the work of E. Renan,[8] A. Poidebard[9] and H. Frost.[10]

The ancient configuration of the northern port has been reconstructed. The basin was approximately 50% larger in antiquity than today, diminishing in size due to the infilling of a natural semi-protected bay, accelerated by harbour infrastructure (e.g. enveloping moles). A rapid shift in sediment *facies* from an exposed to a confined environment, dated to the Hellenistic period, translates this structure. Underwater surveys undertaken by a team from the University of Perpignan (programme ARESMAR) have relocated remains of a late construction today submerged underwater, consistent with the ancient mole of Tyre's northern harbour.[11] It is important to note that no harbourworks dating from the

[3] CARAYON 2008.
[4] SCHIPPER 2005. [5] FROST 2002.
[6] MARRINER 2009; MARRINER – MORHANGE – CARAYON 2008.
[7] EL AMOURI *et al.* 2005.
[8] RENAN 1864. [9] POIDEBARD 1939.
[10] FROST 1971.
[11] CASTELLVI *et al.* 2007.

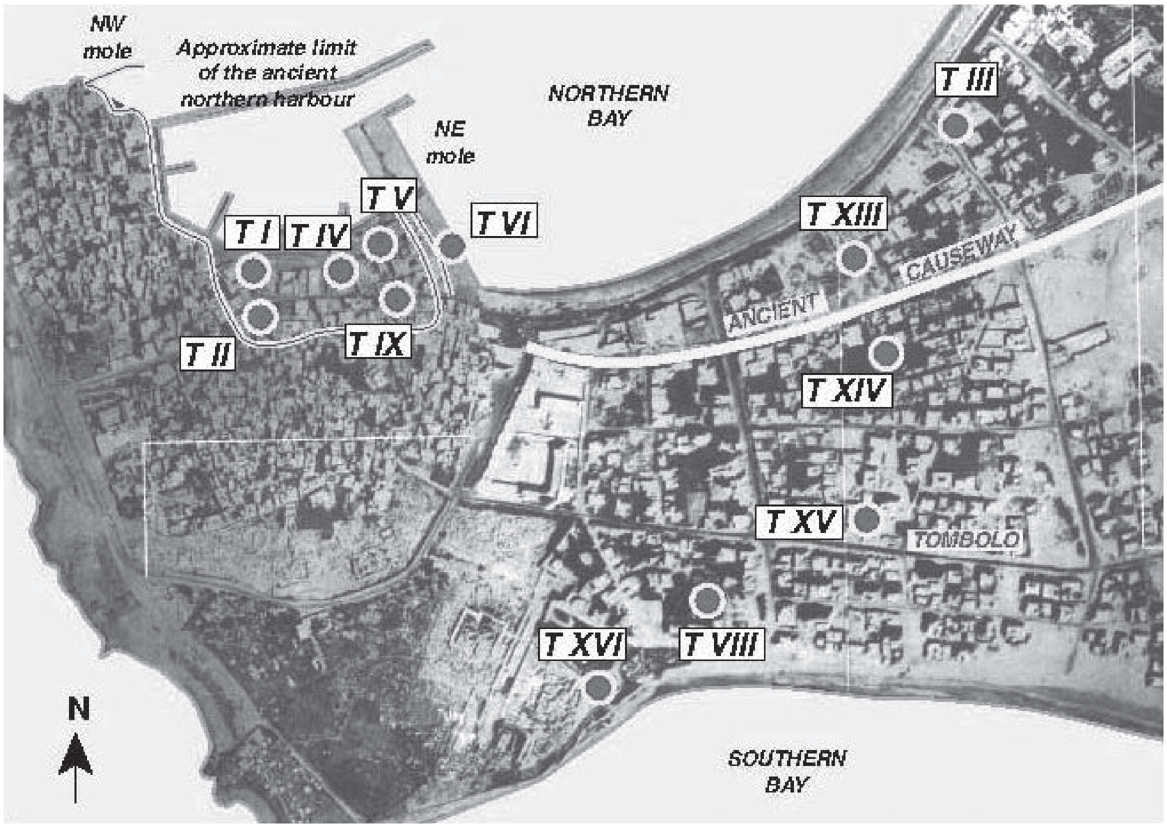

Fig. 2. Location of cores and reconstructed limits of Tyre's ancient northern harbour (Marriner 2009).

Phoenician period have been evidenced. The relative absence of sediment from this period also evokes considerable dredging operations that would have removed sediment archives dating from the Phoenician period.

Work undertaken in the southern harbour has clearly shown that the drowned area, called the "southern harbour" or "Egyptian harbour" after the work of Poidebard, was not a harbour complex. The presence of numerous land-based structures (walls, quarries) suggests that this area corresponds to an urban quarter of the ancient city, protected from the sea by an important mole today submerged underwater (Fig. 3). These remains appear to correspond to the last phase of occupation of a polderized area that has yet to be dated (perhaps the infilling work attributed to Hiram 1st in the ancient literature).[12] The southern harbour, mentioned by the Graeco-Latin sources relating to the siege of Tyre by Alexander, must therefore lie elsewhere. Two sediment cores were extracted further west (TVIII and TXVI; Fig. 2), in proximity to the so-called *Tour des Algériens* where E. Renan located the famous southern harbour, at the foot of the Phoenician city wall. The sediments reveal a relatively open marine environment, inconsistent with the descriptions of a protected harbour evoked by literary sources.

A number of cores were also taken on the coastline directly facing the island of Tyre, where the ancient city of Ushu-Palaeotyre lay. The results attest to a prograding sandy coastline with a natural shallow sand bank between the offshore island city and the continent by the time of Alexander the Great. A sublittoral lagoon around the Tyre el-Bass

[12] For example Ios. Fla., *C. Ap.*, I 112-113; 116-118.

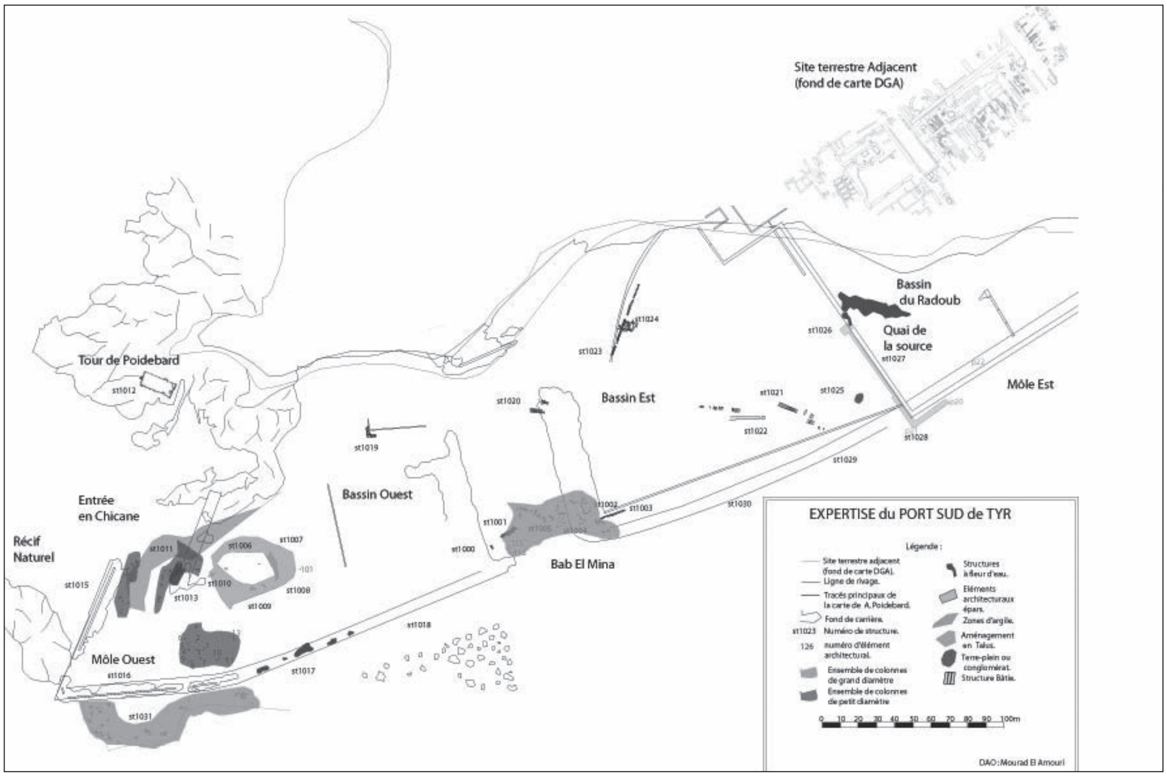

Fig. 3. Plan of archaeological structures on the south part of the Tyrian peninsula (El Amouri *et al*. 2005).

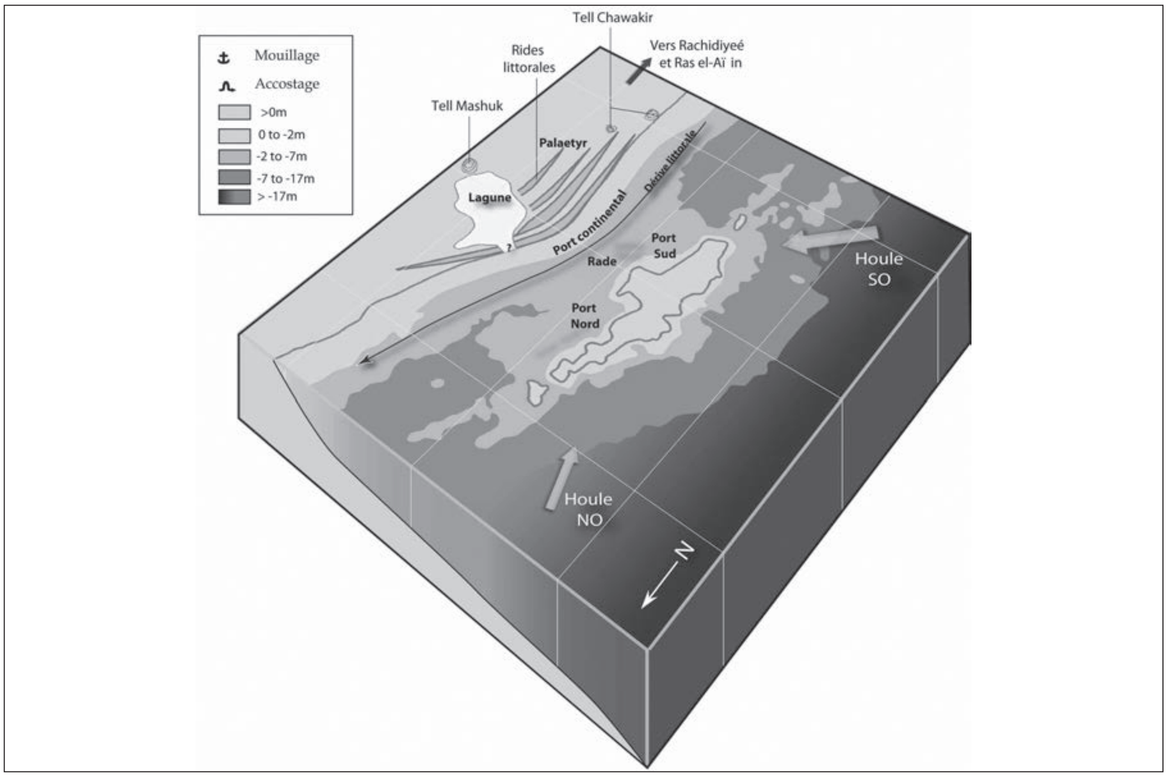

Fig. 4. Reconstructed limits of the ancient island of Tyre in 3000 BP (Marriner 2009).

area has also been elucidated (Fig. 4). This could help to explain the important surface area attributed to Palaeotyre in Pliny the Elder's descriptions (*Nat.*, V, 17).

In sum, Tyre's port system during Phoenician times comprised a vast outer harbour that exploited the long aeolianite ridge exposed during this period and upon which the ancient city lay. These outer harbours operated in tandem with: (1) the northern harbour comprising a semi-protected natural bay (a mole confined the ancient basin at least from the Hellenistic period onwards, possibly earlier); (2) a southern harbour whose precise location and geomorphological disposition have yet to be precisely determined; and (3) the beaches of Palaeotyre and its sheltered lagoon. Similar spatial configurations are attested at Arwad (Fig. 5), Cadix, Jezirat Fara'un (Red Sea) and at Cerro del Villar, and represent a unique specificity of the Phoenician model.[13]

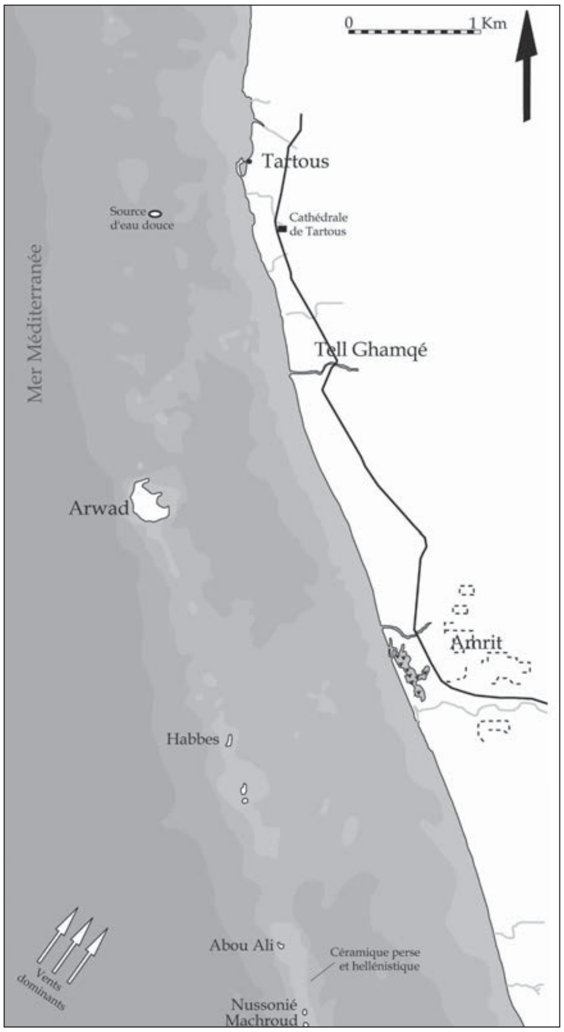

Fig. 5. Simplified map of the Arwad reef, Syria (Carayon 2008).

Sidon

At Sidon, 15 cores were undertaken in collaboration with the British Museum, ten around the northern harbour and four around the *crique ronde*.[14] Topographic measurements were also made on the island of Zire.[15] As at Tyre, the results of the geoarchaeoogical study of Sidon's harbours complement the pioneering work of A. Poidebard, J. Lauffray[16] and H. Frost.[17]

The sediment record attests to a progradation of Sidon's coastline since the Bronze Age. The northern harbour and the *crique ronde* were approximately 30% larger during antiquity (Fig. 6). Up until the Middle Bronze Age, the northern harbour's sediment record attests to a sublittoral marine environment subject to offshore marine dynamics, partially protected by the semi-transgressed aeolianite ridge. After the Middle Bronze, three distinctive phases of harbour confinement have been elucidated. The first, around 1700-1450 BC, is concomitant with the apogee of the Middle Bronze Age town according to excavations at the American College site. It appears to correspond to the earliest artificial modification of the aeolianite ridge. The second phase was dated to the Roman period and corresponds to a well-protected basin, subject to rapid silting. The remains studied by Poidebard and Lauffray appear to correspond to this second phase. The third phase

[13] Carayon 2008.

[14] Marriner – Morhange – Doumet-Serhal 2006; Marriner 2009; Morhange *et al.* 2003.

[15] Carayon 2003.

[16] Poidebard – Lauffray 1951.

[17] Frost 1973a and Frost 1999.

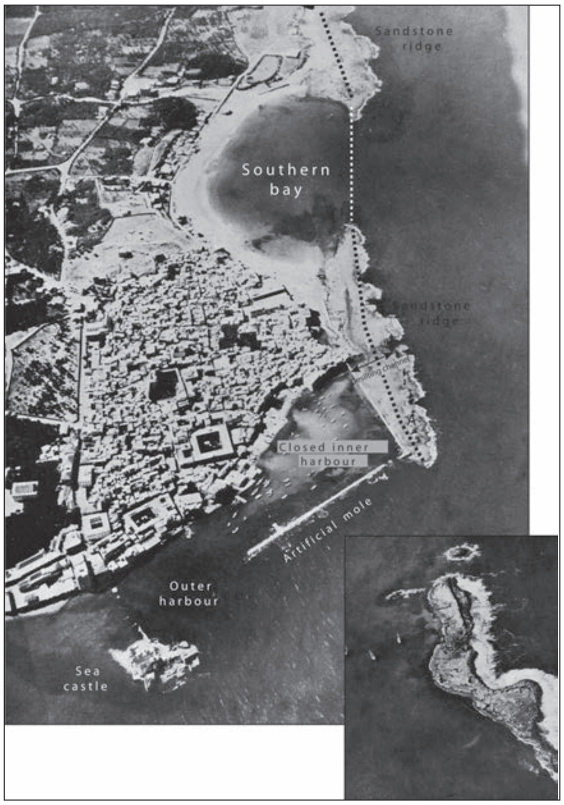

Fig. 6. Sidon and Zire during the 1940s (Poidebard – Lauffray 1951).

dates to the modern and contemporary periods and is consistent with a harbour environment open to an offshore marine influence. It appears to correspond to a decline in the management of harbour structures characterised by a more poorly confined basin.

The study of Zire has detailed the island's use as a sandstone quarry and outer harbour (Fig. 7). A prominent "sea wall" has been fashioned into part of the quarry, in addition to an artificial quay and two jetties built during Persian times. An erosion notch is attested on the front of the quarry face, translating an uplift of the island, probably of tectonic origin, dated to the first centuries AD.

During the Canaan and Phoenician periods, Sidon's geomorphology was characterised by a partially drowned aeolianite ridge sheltering two harbour complexes: (1) the northern harbour and (2) the insular harbour of Zire that formed an outer harbour operating in tandem with the continental port. To the south, wide sandy beaches bordered the *crique ronde*, which was open to the influence of the marine swell and winds. Nevertheless, it would have been possible for small boats to anchor in this bay during clement weather. During the Iron Age, the exploitation of a partially drowned ridge system to form harbours is a common trait in Canaan and Punico-Phoenician sites,[18] for instance at Bronze Age Tel Dor, Cap Hermaion near Leptis Magna and Oea (present-day Tripoli in

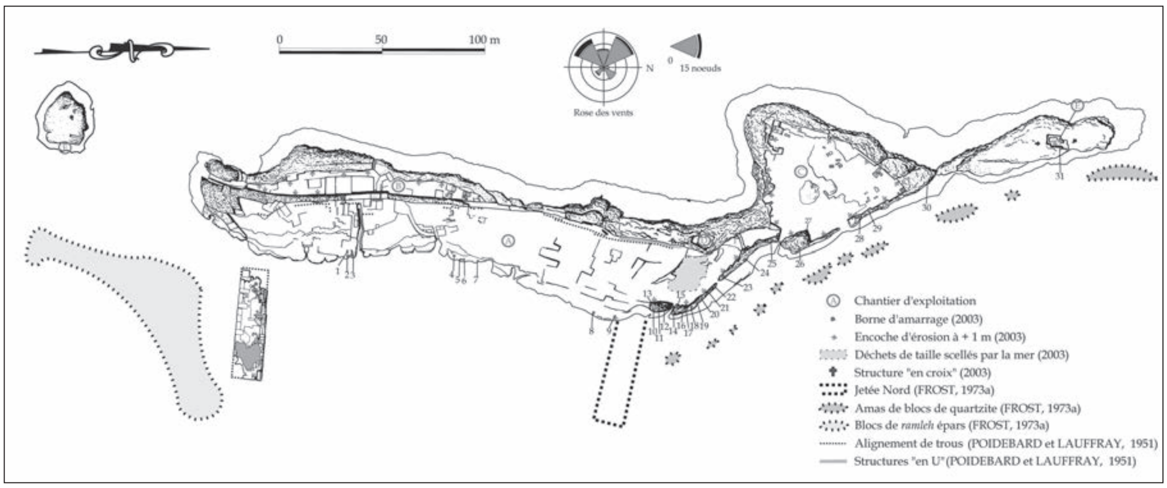

Fig. 7. Zire island (Carayon 2003).

[18] Carayon 2008.

Fig. 8. View of the seawall in Batroun (N. Carayon).

Libya). In a similar vein, the use of quarry sea walls *sensu* Zire is also attested at Batroun (Fig. 8) and at Tripoli (Lebanon), Arwad (Syria), R'mel (near Bizerte in Tunisia) or Guardia s'Arena (near Sulcis in Sardinia).

Beirut

25 cores were undertaken around the ancient harbour of Beirut,[19] in collaboration with the excavations of the Beirut Central Distrit (BCD). The results enabled the ancient location, nature and geomorphological configuration of Beirut's ancient harbours to be described, and the origin and nature of the coastal progradation to be more clearly understood (Fig. 9). Excavation of harbourworks from a number of different periods (Persian, Hellenistic, Roman, Byzantine and Ottoman)[20] have complemented this study and demonstrate that Beirut's ancient coastline has been subject to considerable modifications, both natural and artificial.

The Canaanite and Phoenician harbour of Beirut was composed of two separate basins, separated by a modest promontory upon which the ancient city was founded. To the west, the tell was flanked by a wadi creek. This creek was protected from the sea by Ras Beirut, in addition to a number of other ridge outcrops still visible during the Ottoman period (Fig. 10). To the east of the tell, a second more open creek served as a fair-weather harbour.

Over the centuries, due to urban growth and significant sediment inputs from urban runoff and the Ras Beirut, the two basins were gradually infilled. The mouth of the wadi, attested at excavation sites Bey 27 and Bey 69, served as a natural anchorage during the

[19] Marriner 2009; Marriner – Morhange – Saghieh-Beydoun 2008; Francou 2002.

[20] Elayi – Sayegh 2000.

Fig. 9. Location of core sites (Marriner 2009) and archaeological data in Beirut (Elayi – Sayegh 2000).

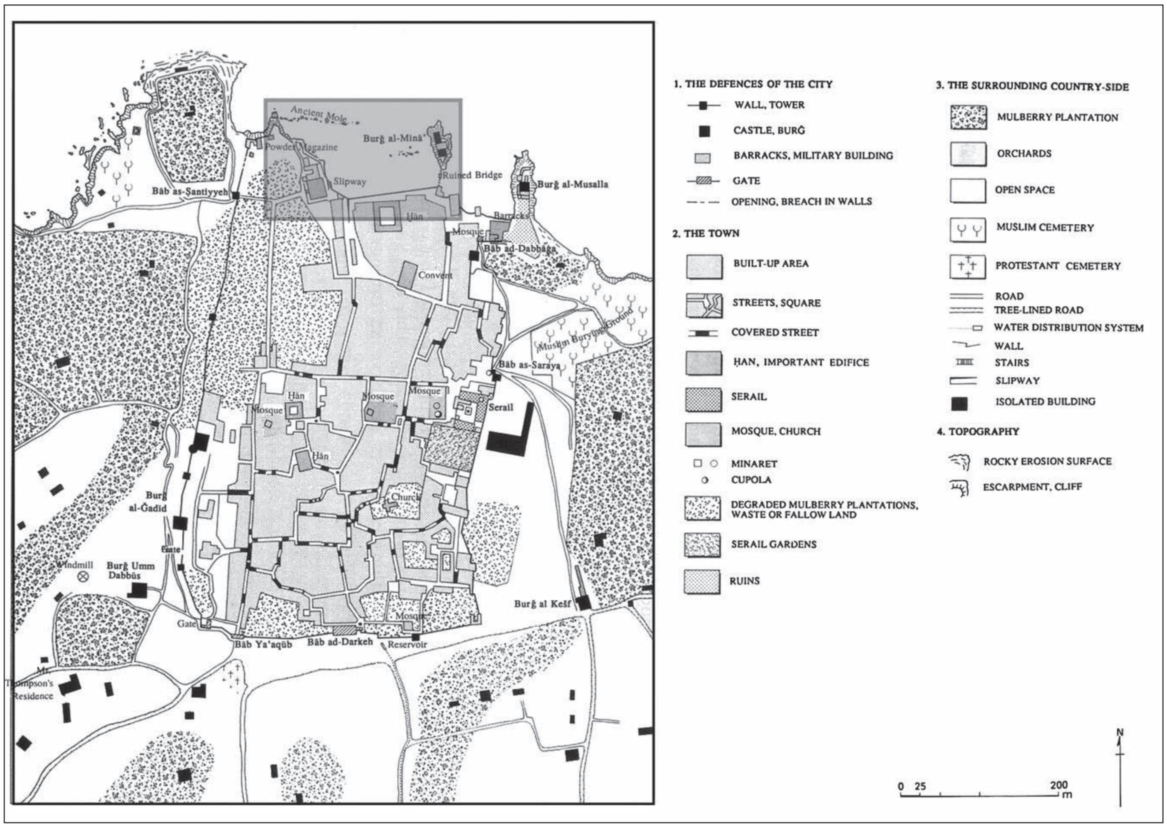

Fig. 10. Davie's proposed location for Beirut's ancient harbour (Davie 1987).

Middle and Late Bronze Ages. During the Iron Age, an artificialisation of the ancient harbour is clearly attested in the coastal stratigraphy, although Roman and Byzantine

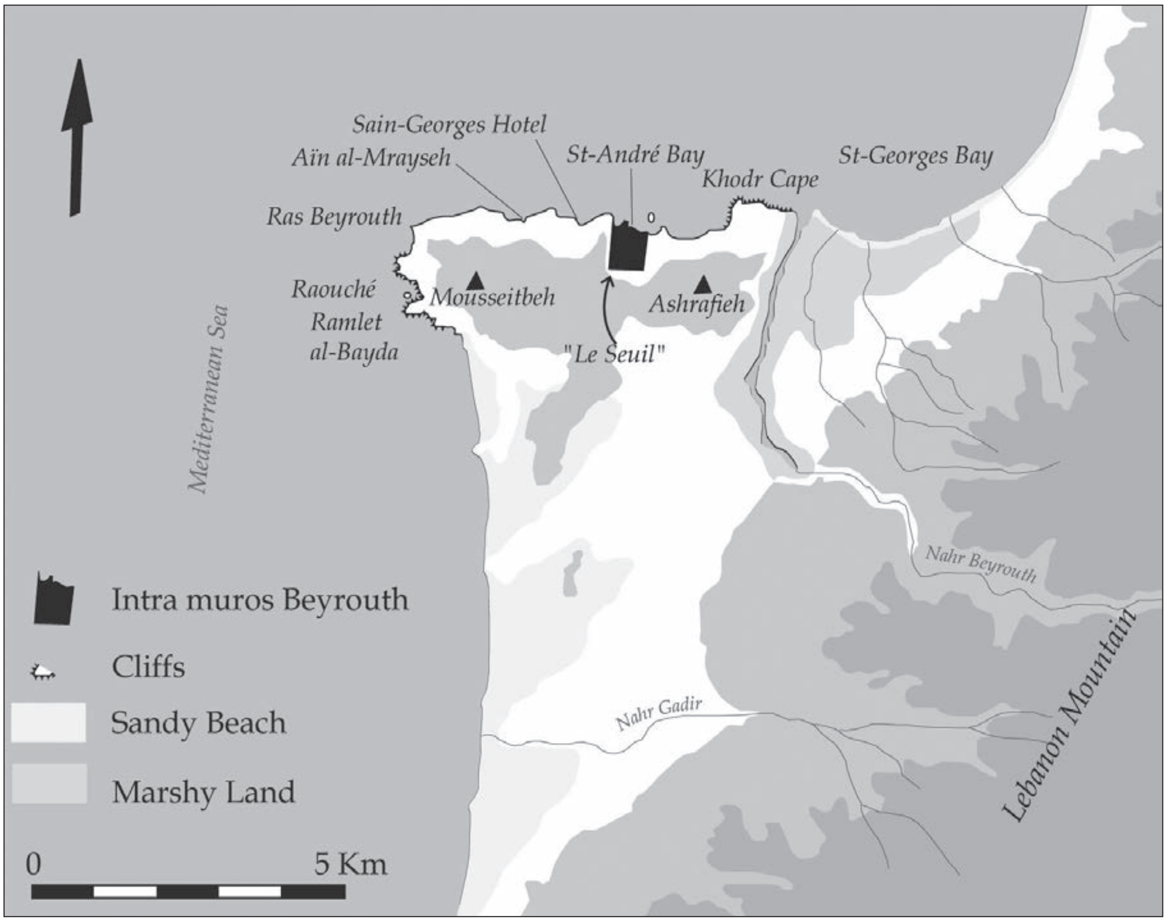

Fig. 11. Simplified geomorphology of the Ras Beirut (Carayon 2008).

dredging practices, already elucidated at Tyre, have considerably disturbed the sediment record.

The geomorphological configuration of ancient Beirut is typical of other Canaan harbours, namely a promontory accommodating the ancient city overlooking two natural harbours.[21] This same configuration is observed at Byblos and Sidon, and was reproduced elsewhere in the Mediterranean by the Phoenicians. This type of settlement is attested, for instance, at Nora (Sardinia) or at Lilibeo (present-day Marsala in Sicily). One important characteristic of the harbour of Beirut is the presence of a relatively large anchorage area sheltered by the Ras Beirut (Fig. 11). The vessels waiting to unload their cargo at the quayside could anchor in proximity to the coastline. Even today, this physical trait remains a significant natural advantage of the city. Sheltered flanks are a recurrent theme in Phoenician and Punic harbours. This is the case, for instance, at Tyre, Sidon and Carthage, although this is not true for Byblos. This might be a possible explanation for the decline of the latter city's harbour activities during the Iron Age.

The geomorphological study of the ancient harbours of Byblos, Tyre, Sidon and Beirut has allowed a more precise topography of these ancient harbour systems to be elucidated. The multidisciplinary nature of these analyses has yielded fresh geomorphological insights into a number of difficult his-

[21] Carayon 2008.

torical and archaeological questions. The significant changes in the coastline and the continued occupation of these sites since the Bronze Age makes a traditional archaeological approach problematic, rendering a precise interpretation of historical sources particularly difficult.

The geoarchaeological approach adopted in Lebanon is set within the wider context of ancient harbour geoarchaeology at the scale of the Mediterranean that includes work at Caesarea,[22] Kition,[23] Alexandria,[24] Marseilles,[25] etc. Investigation of the four Lebanese harbours has been particularly important with regards to the Canaanite, Phoenician and Punic periods. The study of these Phoenician harbour complexes has provided the basis for a typological classification of Phoenician harbours at the scale of the entire civilization.[26]

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