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Paleo-environmental evolution of the Larnaca Salt Lakes (Cyprus) and the relationship to second millennium BC settlement

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ABSTRACT

New coring data provides a complete ^{14}C dated sequence covering the paleo-environmental evolution of the Larnaca Salt Lakes from c. 9000 BP onwards. This suggests the formation of a relatively confined lagoon after 4000 cal. BP. On the western shore of the main Aliki basin, overseas imports from the Late Bronze Age site of Dromolaxia-*Vyzakia* (Hala Sultan Tekke) reflect use of the Salt Lakes as a harbour during the second millennium BC. Coring and geomorphological mapping were employed to determine routes of navigation between this port and the open sea, with two main natural channels identified. A third potential communication in the form of an artificial cut, previously dated by Gifford (1978) to the Venetian period, is discussed with reference to changes in relative sea level along the island's south-east coast. Abandonment of settlement at Dromolaxia-*Vyzakia* in the early 12th century BC relates to the gradual isolation of the Salt Lakes lagoon from the surrounding marine environment through sedimentation. The timing of this event correlates with other known instances of population displacement throughout the eastern Mediterranean c. 1200 BC.

1. Introduction

The most prominent hydrological feature in Larnaca Bay is the Salt Lakes which cover an area of c. 57 km^2 (Fig. 1). Until recently the annual salt harvest provided Cyprus with one of its oldest and best known exports (Yon, 1992). Prior to formation of the Salt Lakes this area of coastline was connected to the sea, latterly in the form of a lagoon which gradually became isolated through sedimentation. In the second millennium BC this lagoon formed the largest sheltered anchorage on the island.

The main focus of Late Bronze Age occupation on the shore of the Salt Lakes was at Dromolaxia-*Vyzakia* (otherwise known as Hala Sultan Tekke). Excavated remains at the site primarily date to its final major phase of occupation between c.1190–1175 BC in Late Cypriot IIIA. The late Paul Åström, who led the Swedish Cyprus Expedition between 1971 and 2008, characterised this settlement as, "*an international harbour town … (with) Mycenaean jars and krators from mainland Greece, early vases and stirrup jars of oatmeal fabric from Crete, Grey ware from Troy, Canaanite jars from Cicilia, Syria and Palestine, elephant tusks and faience from the Near East and Egypt, and lapis lazuli from Badakstan in the north-east of Afghanistan*" (Åström, 1986, 8).

Dromolaxia-*Vyzakia* was also a likely point of departure for locally manufactured goods going overseas. Crushed murex shell heaps have been interpreted as evidence for purple cloth manufacture in the early 12th century BC (Åström, 1986, 11). Lead isotope analyses by Renson et al. (2007) on white slip and white painted wheelmade ceramics found at Dromolaxia-*Vyzakia* indicate that clay was sourced from the near vicinity, implying that the site was one of a number of manufacturing hubs for these major categories of Late Bronze Age Cypriot export (Artzy, 2001). In addition, the site appears to have been a regional centre for outlying rural settlements including Dromolaxia-*Trypes* (Åström, 1977).

A road running north from Dromolaxia-*Vyzakia* a short distance to the shore has been mapped using ground-penetrating radar survey (Fischer, 2011, 70; Fischer, 1980, 49). In common with other (proto-) harbours throughout the Bronze Age Mediterranean, shallow-draft vessels would presumably have been beached near to this location during loading, unloading and maintenance (for ancient depictions of this practice see Marriner et al., 2008, 1287; also Carayon, 2008; Sauvage, 2012; Tartaron, 2013).

Renewed excavations, ongoing as of 2010 under the directorship of Peter Fischer, have begun to investigate earlier occupation at Dromolaxia-*Vyzakia* in more detail. Preliminary results suggest two preceding architectural phases beginning c. 1600 BC in Middle Cypriot III–Late Cypriot I (see most recently Fischer and Bürge, 2013). The

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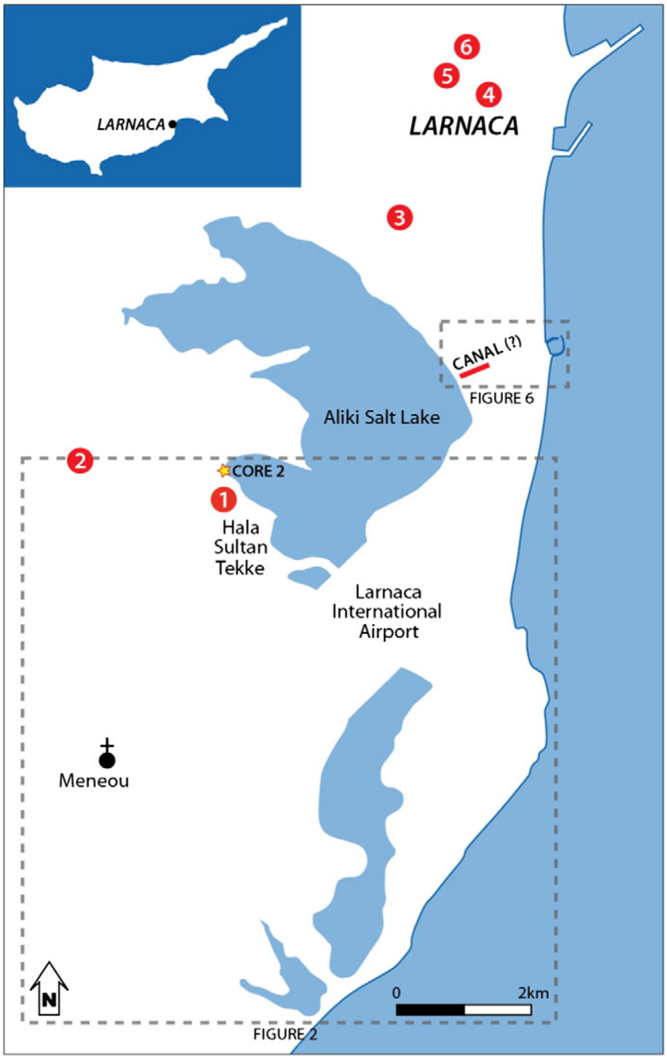

Fig. 1. The Larnaca Salt Lakes with principle sites and features mentioned in the text. 1.) Dromolaxia-*Vyzakia*; 2.) Dromolaxia-*Trypes*; 3.) Artemis Paralia; 4.) Kition-*Bamboula*; 5.) Kition-*Chrysopolitissa*; 6.) Kition-*Kathari*.

main settlement at Dromolaxia-*Vyzakia* was abandoned c. 1175 BC, with sporadic use of wells, indicated by ceramic debris, continuing into the early 11th century BC (Åström, 1998).

The geology and hydrology of the Salt Lakes were first systematically investigated by Bellamy (1900). Palaeography of the Larnaca lowlands received in-depth consideration by Gifford (1978), who produced a comprehensive regional history of human–environment interaction including the second millennium BC. Immediately to the north in the vicinity of ancient Kition, sedimentological and paleontological analysis of seventeen cores by Morhange et al. (2000) and Bony (2013) has been used to reconstruct shoreline changes over the past 4000 years. Geomorphological studies along the Gialias watershed by Devillers (2008) provide further comparanda from neighbouring areas of south-east Cyprus.

The purpose of this paper is to review recent research concerning the paleo-environmental evolution of the Larnaca Salt Lakes, and its relationship to settlement during the second millennium BC. These studies chiefly include previously unpublished results from coring and geomorphological mapping undertaken by Devillers and Morhange in 2002, together with proxy measurements for changes in relative Holocene sea-levels along the south-east coast of Cyprus by Dalongeville et al. (2000) and Morhange et al. (2000). Environmental data presented by Kaniewski et al. (2013) for the Salt Lakes region is considered with reference to eastern Mediterranean-wide climate trends and their possible social implications c. 1200 BC (the so-called 3.2 ka BP event).

2. Methods

Geomorphological mapping of the Salt Lakes region is based on coring data, supported by accompanying field survey, and remote sensing using Landsat and visible spectrum imagery (Fig. 2). Six mechanically drilled cores (LS1–4, 6–7) were retrieved in 2002 for the purposes of litho- and bio-stratigraphical analysis (Fig. 3). Core LS2 produced the greatest thickness of Holocene deposits, reaching the substrate at a depth of 18 m. Five radiocarbon ^{14}C dates were taken from this sequence for the period when the lagoon was open to the sea, and thus potentially in use as a harbour. This new data is compared with results from coring and survey previously undertaken by Gifford (1978). Geological identifications are based on Bagnall (1960).

3. Results

Core LS2 provides the most developed stratigraphical sequence, and is accordingly subject to more detailed analysis. It is also located furthest from the coast, meaning that marine influences observed in this core probably affected the majority of the surrounding Salt Lakes basin. Furthermore, because of the immediate proximity of LS2 to Dromolaxia-*Vyzakia*, it constitutes an important record of the changing geomorphological relationship between the ancient port and the open sea. As such, for the purposes of the present discussion, core LS2 can be viewed as broadly representative of its wider paleo-environmental context. The 18 m stratigraphic sequence covered by LS2 is divided into three main units (Fig. 4);

1) Base to 6 m depth, texture is silty clay interspersed with smaller amounts of sand due to detrital activity. The dark grey colour of the unit reflects the process of reduction. Manganese nodules and bedded sands show a hydrodynamic environment with subaqueous deposits. Fauna (identified by M. Bourcier, Centre d'Océanologie de Marseille-Endoume) also indicates a marine and/or lagoon environment in communication with the sea, with moderate contributions of freshwater and organic matter (Fig. 5). All radiocarbon dates are obtained from this unit (Table 1). These suggest a sedimentation period from c. 9000 BP to at least 4000 BP.
2) The middle unit between 6 and 4 m depth is richer in sand and is ocher coloured, likely due to oxidation. Some species of fauna (malacofaune, ostracods) are characteristic of freshening. Halite crystals are also present. Riverine influence from the adjacent Tremithos fluvial system appears to be apparent through freshwater input. These factors collectively favour a gradual closure of the Salt Lakes basin under the growing influence of alluvial silting, with the formation of a relatively confined lagoon after 4000 BP.
3) From 4 m deep, the top of the core is made up of beige silt and consolidated sand lying in parallel beds. A paleosoil with small brown clods is present at a depth of 3.8 m. Oxidation of clay through wetting and drying has left ocher marks. Anthropogenic deposits in the form of charcoals and ceramics are also present. This unit is alluvium (flood deposits), and represents the final phase of sedimentation leading to the emergence of the current landform through a process of aggradation.

Geomorphological mapping also highlights the underlying geological origin of the Larnaca Salt Lakes. As evidenced by the almost continuous presence of marly limestone along the current shoreline, the lagoon fits within a large Pliocene furrow. Numerous Quaternary alluvial fans on the western edge of this paleo-depression demonstrate the role of detrital erosion in the formation of the basin (Fig. 2). The present study does not provide evidence for significant shoreline progradation within the lagoon itself (for coastal progradation see below). It should

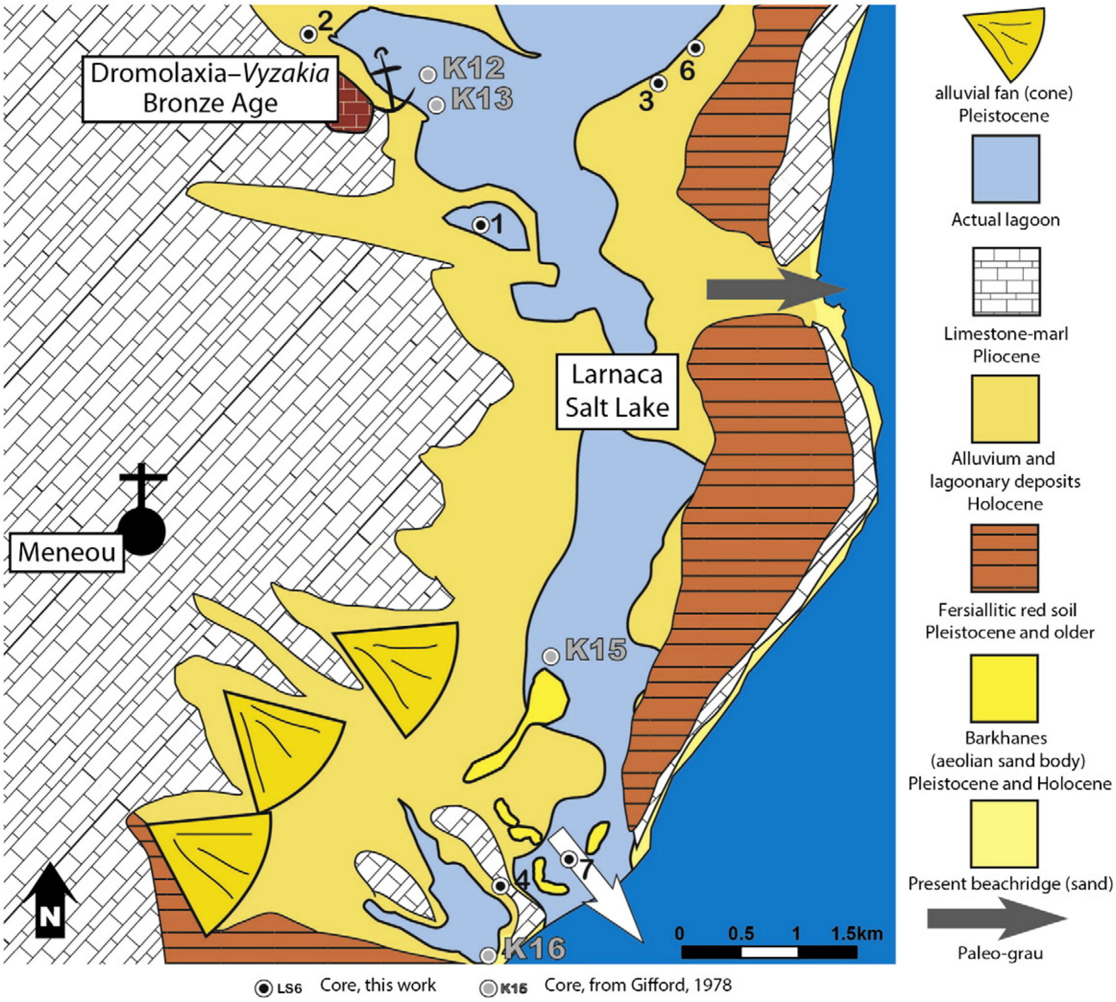

Fig. 2. Geomorphological outline of the Larnaca Salt Lakes region.

be noted, however, that the possible significance of fluvial deposition during antiquity is difficult to gauge, due to anthropogenic modification of the watershed in the form of diverting channels, which carry away much of the fresh water run-off (Fig. 6). These were constructed in the Venetian period, if not before, to increase salt production by making the lakes more saline (see Gifford, 1978, 49–54, 117–119, 168–169).

4. Discussion

4.1. Natural channels between the Salt Lakes lagoon and the open sea

A close relationship is apparent between the paleo-environmental evolution of the Larnaca Salt Lakes during their marine stage and the corresponding development of ancient settlement. The most significant implication of the new coring data is that siltation of the lagoon appears to have been underway during the period it was in use as a harbour. This implies that the Bronze Age inhabitants of Dromolaxia-*Vyzakia* would have been forced to contend with shifting channels suitable for navigation. Geomorphological mapping presents two main possible routes to the sea, between gaps in the marly limestone Pliocene outcrops along the eastern side of the lagoon (Fig. 2). A third potential anthropogenic channel is discussed in Section 4.2.

The Swedish Cyprus Expedition to Hala Sultan Tekke has previously proposed that the entrance to the lagoon was most likely at the southern end of the Salt Lakes, based on the immediate proximity of the modern coastline. Borings intended to investigate this hypothesis, undertaken in 1971 along the ridge at the presumed mouth of the embayment, proved to be inconclusive (Engvig and Åström, 1975, 6, 25). Coring for the present study (Figs. 2 & 3, core LS7) similarly showed the presence of highly concentrated marine shells overlying substrate to a depth of more than 4 m. Artefacts including Canaanite jars recovered close offshore through underwater survey confirm the presence of maritime traffic, and highlight the potential hazards of navigation in this area during the Late Bronze Age (McCaslin, 1978; Engvig and Åström, 1975).

The other possible northern candidate for a natural passage connecting the main Aliki basin with the sea is located immediately adjacent to and beneath the runway of Larnaca airport, meaning it was not possible to obtain coring data from between the two main sections of marly limestone Pliocene ridge which form the eastern boundary of the Salt Lakes. In the absence of evidence for significant shoreline progradation within the lagoon itself, it can be inferred that marine deposits were also most likely responsible for infilling of this northern paleo-channel.

Based on the assumption that sea-level was c. 3 m below its present level, combined with the relative depth of the main Aliki basin, the northern passage was favoured by Gifford (1978, 166-68) as a natural entrance for Late Bronze Age ships arriving and departing the lagoon. More recent ^{14}C dating by Dalongeville et al. (2000) of stepped beach deposits close to Cape Kiti, immediately southwest of the Salt Lakes, has conversely demonstrated that relative sea-levels (RSLs) were up to c. 1–1.5 m higher in the second millennium BC. While these RSL

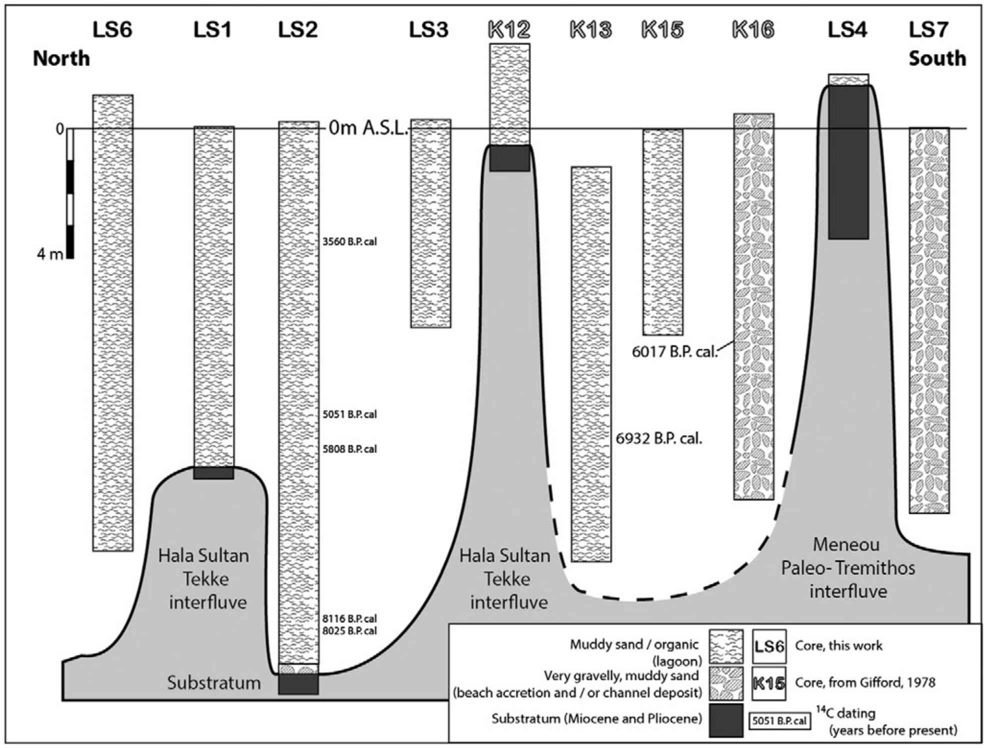

Fig. 3. Stratigraphic context of salt lake cores shown in Fig. 2.

markers along the most exposed section of the cape are most plausibly interpreted as ancient storm deposits, above the normal tidal range, they nonetheless suggest higher sea-levels when compared to the present mean. The subsequent decline in relative sea level appears to be based on a gradual process of tectonic uplift which stabilised c. 3000 BP (Dalongeville et al., 2000, 16–17, 19).

Immediately to the north of the Salt Lakes at Kition-*Bamboula*, ceramics dated on typological grounds to the 13th century BC have been excavated from a marine mud layer in strata 40 cm above present sea-level (Morhange et al., 2000, 223). This supports the hypothesis that shoreline change along the intermediate section of coastline adjoining the Salt Lakes between Larnaca/Kition and Cape Kiti was also driven by tectonic uplift during the period under review.

This phenomenon can be further associated with coastal progradation, leading to siltation of the two natural routes of communication between the Salt Lakes lagoon and the open sea. Relative proximity of the northern channel to the port at Dromolaxia-*Vyzakia* suggests that it may have been favoured as a route of communication under optimal sedimentary conditions. The more exposed aperture of the southern channel probably also made it more susceptible to clogging through longshore drift (Gifford, 1978, 35). Given the evidently dynamic nature of the lagoon environment during the second millennium BC, however, it is entirely plausible that both routes could have been used for navigation at different times.

4.2. Potential evidence for harbour engineering during the Late Bronze Age

A third possible candidate for a channel connecting the Salt Lakes lagoon with the open sea is an artificial cutting through the marly limestone Pliocene ridge at its narrowest point on the eastern side of the main Aliki basin (Fig. 6). This averages c. 40 m in width and is approximately 100 m in length. Its floor is excavated to within 0.5 m of current sea level. Gifford (1978, 49–50, 160–161) interpreted this feature as a Venetian period (1489–1571 AD) construction, designed to facilitate transportation of salt from the eastern shore of the lake to the coast for onwards transhipment. A short tramway for this purpose was also laid along the southern edge of the cut during the late 19th century. Gifford's main reason for considering earlier construction associated with the Bronze Age port at Dromolaxia-*Vyzakia* unlikely was the absence of indicators for higher sea-levels during the second millennium BC. This is now no longer the case with relative changes in sea level along the south-east coast of Cyprus documented by Dalongeville et al. (2000) and Morhange et al. (2000). These proxy measurements suggest that the base level of the cutting, if it is a Late Bronze Age construction, was potentially in excess of 1 m below the waterline.

In light of these new data, the present authors support the alternative hypothesis that the cutting represents a canal excavated during the later second millennium BC between the harbour lagoon and the open sea. The c. 40 m width and c. 8 m depth of the excavations, which would seem excessive to accommodate pack animals (e.g. donkeys) in train, offers circumstantial support to this revised interpretation (it should be noted that the same argument was used by Gifford to discount the possibility of a 19th century date for the cutting associated with the tramway). An alternative hydrological function related to salt production or pisciculture also seems unlikely based on the shape of the cut. The uniform depth of the channel suggests that it represents a finished construction, rather than a partially excavated feature aborted before completion.

Excavation of the canal would most probably have been a latter development in the life of the port, in response to siltation of natural route(s) of passage into the lagoon. Its proposed date of construction correlates with other examples of Middle to Late Bronze Age harbour engineering along the neighbouring Levantine coast (see Marriner et al., 2008, 1289; Brewer, 2009). Evidence of salt production from the 4th century BC onwards would seem to preclude an attempt in later antiquity at reviving the harbour, nor can the cut be directly associated with the Classical sanctuary of Artemis Paralia located a short distance to the north (Yon, 1992, 301–302; Nicolaou, 1976, 108–111).

As noted by Dalongeville et al. (2000, 13), carbonate rocks outcropping the Larnaca shoreline are generally too soft to preserve erosion

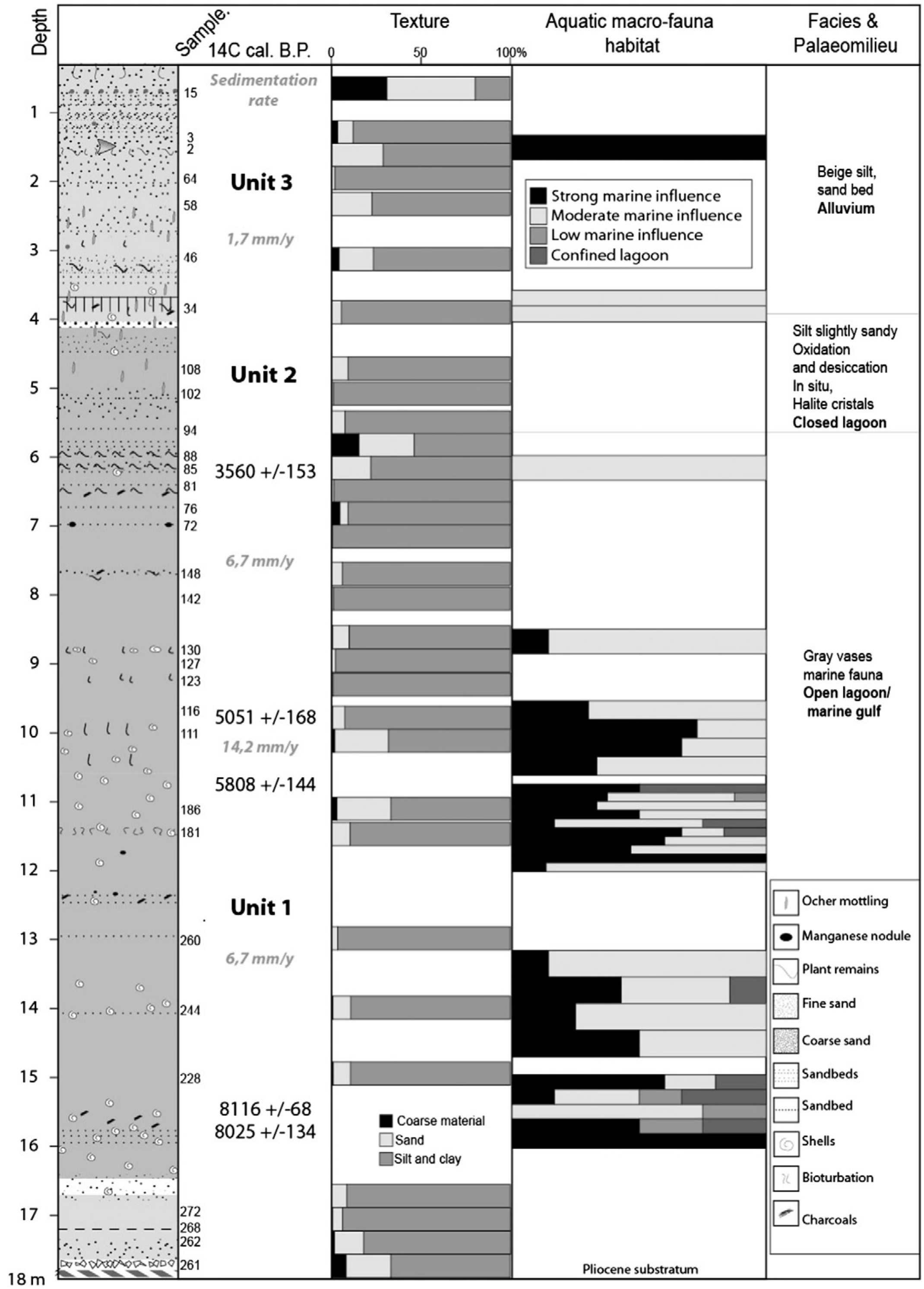

Fig. 4. Litho- and biofacies studies, dating, and paleoenvironmental interpretation of core LS2.

marks and stepped bioconstructions, which might otherwise indicate the depth of the channel in relation to the sea. Although shallow by later standards, the channel would, if submerged, have been deep enough to accommodate Late Bronze Age shipping. Simulations based on the 14th century BC Uluburun ship, which likely included Cypriot ports of call within its itinerary, suggest that the maximum draught of such a vessel fully laden with c. 20 tonnes of cargo was approximately 1.2 m (Lin, 2003, 207, 220).

Abandonment of the main settlement at Dromolaxia-*Vyzakia* during the early 12th century BC indicates that if the channel was constructed during the lifetime of the port, it was ultimately not successful in maintaining a viable route of communication with the sea. The continuing decline in relative sea levels towards the end of the second millennium BC documented by Dalongeville et al. (2000) suggests that the canal could have become too shallow to accommodate ocean going ships. Sediment infilling may have also reduced the space available for berths

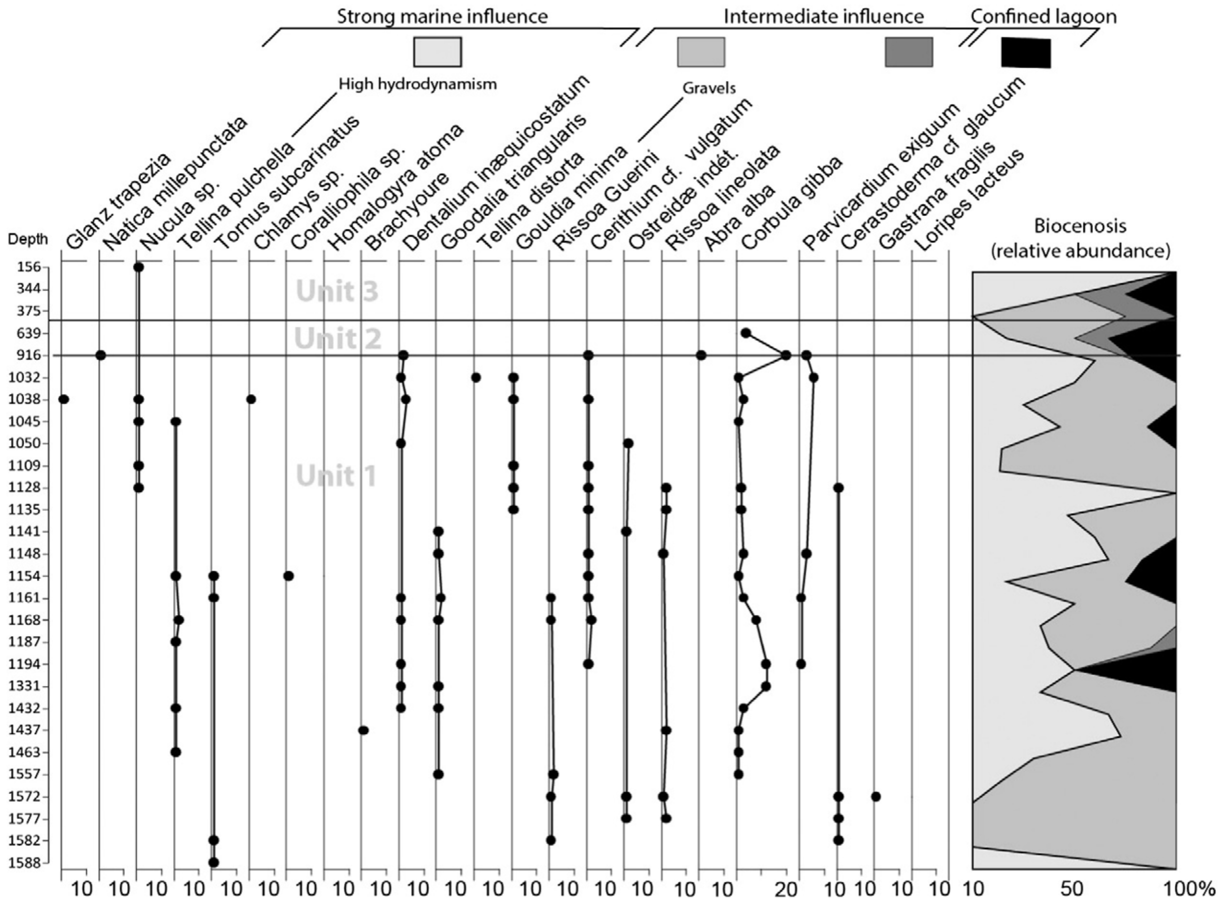

Fig. 5. Biological content of core LS2.

closer to the port. Technological limitations, combined with gradual tectonic uplift and associated marine sedimentation, may all have played a role in rendering the Salt Lakes lagoon impractical as an anchorage by the end of the Late Bronze Age.

4.3. Geomorphological and archaeological comparanda from south-east Cyprus

Development of the recent Holocene coastline at Larnaca (ancient Kition), immediately to the north of the Salt Lakes, has been examined in detail through core analysis by Morhange et al. (2000) and Bony (2013). During the period when the Salt Lakes were in use as a harbour, the shoreline at Kition was several hundred metres east of its present position, comprising a marine-back bay that was open but protected from the sea by a Posidonia bed. This feature had a major influence on subsequent coastal evolution by trapping sediment close offshore. From c. 2600 years BP onwards this led to the formation of a prograding

Table 1
List of dated samples from core LS2.

Lab. code	Sample	Material	13C (0/00)	Age (years BP)	Cal. age 2 sig.	Delta R
T17882A	LS2.220	Charcoal	−25.3	7335 ± 58	8116 ± 68	N/A
T17883A	LS2.112	*Parvicardium exiguum*	2.8	5118 ± 42	5051 ± 169	342/41
T17884A	LS2.84	*Corbula gibba*	1.5	3999 ± 39	3569 ± 153	342/41
T17885	LS2.68	*Nucula nucleus*	0.71	>24,800	N/A	342/41
T17886B	LS2.215	*Cerastoderma glaucum*	1.47	7895 ± 51	8025 ± 134	342/41
T17887A	LS2.190	*Corbula gibba*	1.73	5794 ± 44	5808 ± 144	342/41

coastal spit, eventually enclosing the Larnaca shoreline in a lagoon (Morhange et al., 2000, 221, 227; Bony, 2013). Excavation of shipsheds at Kition-*Bamboula*, together with an associated inscription, demonstrates that this sheltered anchorage functioned as a military harbour during the later first millennium BC (Yon, 1995).

Further to the north on the east coast of Cyprus, infilling of the Gialias River's basal plain during the latter half of the second millennium BC presents a parallel example of coastal progradation (Devillers, 2008, 141–168). As with Dromolaxia-*Vyzakia* loss of maritime access appears to have been the principle motivation behind site abandonment; progressive siltation of the Gialias Delta being at least partly responsible for the migration of the region's main population centre from Kalopsidha to Enkomi followed by Salamis between the 15th to 11th centuries BC. The political relationship between Late Bronze Age settlements in south-east Cyprus is discussed with reference to environmental change in Brown (2013).

Extensive anthropogenic modification of the Salt Lakes watershed makes it difficult to discern the possible contribution of detrital erosion to siltation of the lagoon during the later second millennium BC. At Kition sediment transported from the Tremithos drainage west of Larnaca only became a significant influence on shoreline evolution after 2600 BP (Morhange et al., 2000, 221). Infilling of the Gialias Delta presents stronger evidence for detrital activity in combination with coastal progradation, but this cannot be unequivocally attributed to anthropogenically-induced erosion (Devillers, 2008, 159–168). Pollen samples taken by Gifford (1978, 167) from manual coring north-east of the Aliki Salt Lake, and dated using radiocarbon to 1456 ± 120 BC, record significantly more oak than in later periods, suggesting that deforestation was probably not a major cause of sediment displacement during the Late Bronze Age.

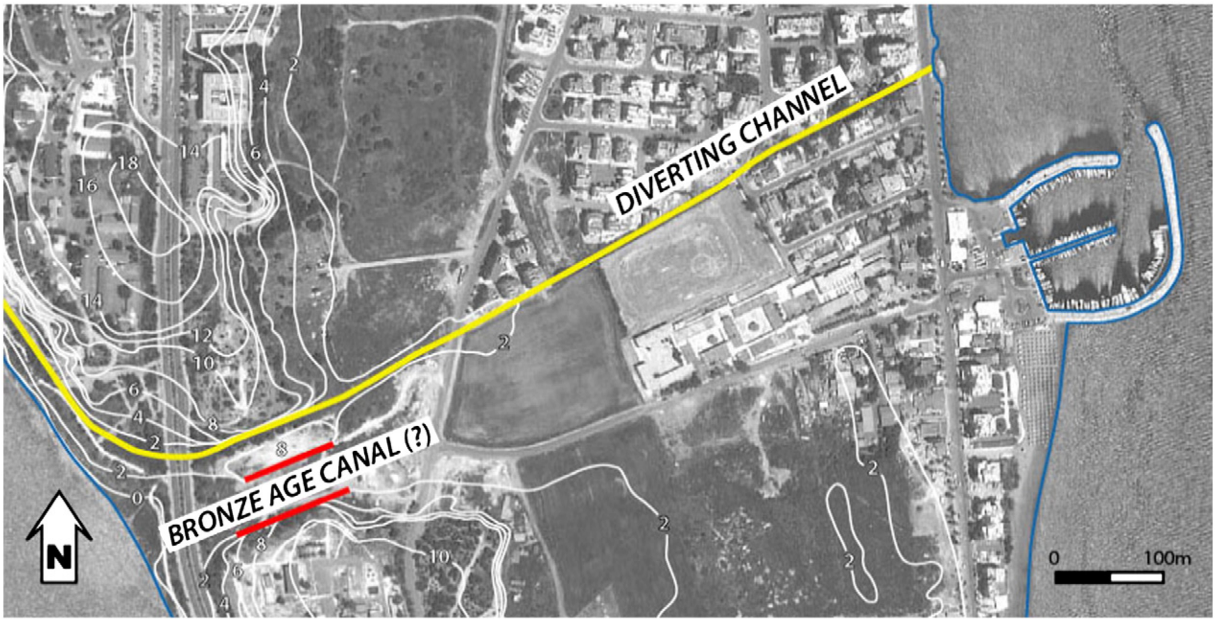

Fig. 6. Possible Late Bronze Age canal on eastern side of the Aliki Salt Lake (after Gifford, 1978, 50). All elevations metres above current sea level. Base map: Republic of Cyprus Department of Land and Surveys 1:5000 topographic series 1976. Background image: Google, DigitalGlobe 2012.

4.4. Environmental change and population displacement

Siltation of the Salt Lakes lagoon, preventing its use as an anchorage, provides a convincing explanation for the abandonment of the main settlement at Dromolaxia-*Vyzakia* during the early 12th century BC. Intensified occupation at Kition-*Chrysopolitissa*, together with the redevelopment of port facilities at nearby Kition-*Kathari* (Karageorghis and Demas, 1985) in Late Cypriot IIIA, may also in part reflect relocation of population from Dromolaxia-*Vyzakia* following the demise of their harbour.

Based on pollen data extracted from a core sampled in the Larnaca Salt Lake, it has been shown that the climate around Dromolaxia-*Vyzakia* became drier between c. 1200 and 850 cal. years BC (Kaniewski et al., 2013). This correlates with results of paleo-environmental studies from the Levant and adjacent regions which indicate a corresponding period of aridity associated with atmospheric cooling (Riehl et al., 2012, 120; Rohling et al., 2009; Langgut et al., 2013). In the absence of irrigation, which does not appear to have been intensively practised in Cyprus during the Late Bronze Age, this decline in precipitation levels would have made agriculture more precarious in some marginal areas.

Even if crop failure did contribute to the abandonment of Dromolaxia-*Vyzakia*, the continuity and growth of settlement at nearby Kition indicates that such pressures were either less severe, and/or could be effectively ameliorated through modified subsistence strategies. While the arrival of displaced populations from the Aegean c. 1200 BC has been proposed to explain developments at Kition (Karageorghis and Demas, 1985, 275–276), and further to the east at Pyla-*Kokkinokremos* (Karageorghis and Demas, 1984, 72–73), the evidence for and impact of 'Sea Peoples' or related groups along the south-east coast of Cyprus is still debated (Iacovou, 2013). For the Salt Lakes region, the present study arguably supports a primarily local model of settlement consolidation, in the face of increasingly adverse environmental pressures.

5. Conclusions

Preliminary paleo-environmental reconstruction for the Larnaca Salt Lakes region based on new coring data and geomorphological mapping has confirmed the existence of a coastal lagoon in the second millennium BC. Corresponding development of the Late Bronze Age settlement at Dromolaxia-*Vyzakia* on the western shore of this embayment supports its use as a harbour between c. 1600–1175 BC, when it would have constituted the largest sheltered anchorage in Cyprus. The subsequent abandonment of settlement at Dromolaxia-*Vyzakia* during the early 12th century BC also appears to correlate with isolation of the lagoon through sedimentation of one or more channels connecting it with the open sea. This was caused by coastal progradation, led by changes in relative sea level due to gradual tectonic uplift, and forms part of a long term island-wide trend towards shoreline regularization.

Identification of the artificial cutting on the north-east side of the Aliki Salt Lake as a Late Bronze Age canal remains speculative, pending further confirmation of Holocene relative sea-level changes along the south-east east coast of Cyprus, and/or independent dating of the feature itself. If confirmed, it would represent one of the earliest known examples of a navigation canal in the Mediterranean. A more accurate understanding of the spatial and temporal relationship between the cutting and its surroundings would, by extension, also permit further refinement of regional sea-level proxies.

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References

Artzy, M., 2001. White slip ware for export? The economics of production. In: Karageorghis, V. (Ed.), The White Slip Ware of Late Bronze Age Cyprus. Verlag der Osterreichischen Akademie der Wissenschaften, Wien, pp. 107–116.

Åström, P., 1977. Dromolaxia, locality "trypes". Report of the Department of Antiquities Cyprus, pp. 110–111.

Åström, P., 1986. Hala Sultan Tekke — an international harbour town of the Late Cypriote Bronze Age. Opuscula Atheniensia 16 (1), 7–17.

Åström, P., 1998. Hala Sultan Tekke 10: The Wells. Åström Editions, Jonsered.

Bagnall, P.S., 1960. The Geology and Mineral Resources of the Pano-Lefkara–Larnaca Area. Geological Survey Department of Cyprus, Nicosia.

Bellamy, C.Y., 1900. A description of the Salt Lake of Larnaca in the island of Cyprus. Q. J. Geol. Soc. 56, 745–759.

Bony, G. 2013. Natural constraints and potentials of some ancient harbours in the Mediterranean and Black Sea (Fréjus, Ampurias, Kition, Istanbul, Orgame). Unpublished PhD thesis, Univ. Aix-Marseille I.

Brewer, M., 2009. The origins of the phoenician cothon: development of the inland harbour in the Eastern and Central Mediterranean during the 2nd and 1st Millennia BC. In: Aygün, Ç.Ö. (Ed.), SOMA 2007. Proceedings of the XI Symposium on Mediterranean ArchaeologyBAR International Series. 1900. Archaeopress, Oxford, pp. 25–32.

Brown, M., 2013. Waterways and the political geography of South-East Cyprus in the second Millennium BC. Annual of the British School of Athens 108, pp. 121–136.

Carayon, N., 2008. Les ports phéniciens et puniques. Géomorphologie et infrastructures. Unpublished PhD thesis, Université Marc-Bloch, Strasbourg.

Dalongeville, R., Bernier, P., Prieur, A., Le Campion, T., 2000. Les variations récentes de la ligne de rivage du sud-est de Chypre/the early changes of southeastern Cyprus shorelines. Géomorphol. 6 (1), 13–19.

Devillers, B., 2008. Holocene morphogenesis and anthropisation of a semi-arid watershed, Gialias River, Cyprus. BAR International Series. 1775. Archaeopress, Oxford.

Engvig, O.T., Åström, P., 1975. Hala Sultan Tekke 2: The Cape Kiti Survey. Åström Editions, Göteborg.

Fischer, P.M., 1980. Applications of Technical Devices in Archaeology. Åström Editions, Göteborg.

Fischer, P.M., 2011. The new Swedish Cyprus expedition 2010: excavations at Dromolaxia Vizatzia/Hala Sultan Tekke. Preliminary results. Opuscula 4, 69–98.

Fischer, P.M., Bürge, T., 2013. The new Swedish Cyprus expedition 2012: excavations at Hala Sultan Tekke. Opuscula 6, 45–79.

Gifford, J.A., 1978. Paleography of archaeological sites of the Larnaca Lowlands, Southeastern Cyprus. Unpublished PhD thesis, University of Minnesota.

Iacovou, M., 2013. Aegean-style material culture in Late Cypriote III: minimal evidence, maximal interpretation. In: Killebrew, A.E., Lehmann, G. (Eds.), The Philistines and Other "Sea Peoples" in Text and Archaeology. Society of Biblical Literature, Atlanta, pp. 585–618.

Kaniewski, D., Van Campo, E., Guiot, J., Le Burel, S., Otto, T., Baeteman, C., 2013. Environmental roots of the Late Bronze Age crisis. PLoS ONE 8 (8), e71004. http://dx.doi.org/10.1371/journal.pone.0071004.

Karageorghis, V., Demas, M., 1984. Pyla-Kokkinokremos: A Late 13th-Century B.C. Fortified Settlement in Cyprus. Department of Antiquities, Cyprus, Nicosia.

Karageorghis, V., Demas, M., 1985. Excavations at Kition V: The Pre-Phoenician Levels. Areas I and II, 4 vols. Department of Antiquities, Cyprus, Nicosia.

Langgut, D., Finkelstein, I., Litt, T., 2013. Climate and the Late Bronze Collapse: New Evidence from the Southern Levant. Tel. Aviv. 40 (2), 149–175.

Lin, S-H., 2003. Lading of the Late Bronze Age Ship at Uluburun. Unpublished MA thesis. Texas A&M University.

Marriner, N., Morhange, C., Carayon, N., 2008. Ancient tyre and its harbours: 5000 years of human–environment interactions. J. Archaeol. Sci. 35 (5), 1281–1310.

McCaslin, D., 1978. The 1977 underwater report. In: Åström, P. (Ed.), Hala Sultan Tekke. 4. Åström Editions, Göteborg, pp. 97–172.

Morhange, C., Goiran, J.-P., Bourcier, M., Carbonel, P., Le Campion, J., Rouchy, J.-M., Yon, M., 2000. Recent Holocene paleo-environmental evolution and coastline changes of Kition, Larnaca, Cyprus, Mediterranean Sea. Mar. Geol. 170, 205–230.

Nicolaou, K., 1976. The Historical Topography of Kition. Åström Editions, Göteborg.

Renson, V., Coenaerts, J., Matielli, N., Åström, P., Nys, K., Claeys, P., 2007. Provenance determination of pottery from Hala Sultan Tekke using lead isotopic analysis: preliminary results. In: Åström, P., Nys, K. (Eds.), Hala Sultan Tekke 12. Stone Anchors, Faunal Remains and Pottery Provenance. Studies in Mediterranean Archaeology 45. Åström Editions, pp. 53–62.

Riehl, S., Pustovoytov, K., Dornauer, A., Sallaberger, W., 2012. Mid-to-late holocene agricultural system transformations in the northern fertile crescent: a review of the archaeobotanical, geoarchaeological, and philological evidence. In: Giosan, L., Fuller, D.Q., Nicoll, K., Flad, R., Clift, P.D. (Eds.), Climate Landscapes and Civilization. American Geophysical Union, Washington DC, pp. 115–136.

Rohling, E.J., Hayes, A., Mayewski, P.A., Kucera, M., 2009. Holocene climate variability in the Eastern Mediterranean, and the end of the Bronze Age. In: Bachhuber, C., Roberts, G. (Eds.), Forces of Transformation: The End of the Bronze Age in the Mediterranean. Oxbow, Oxford, pp. 2–5.

Sauvage, C., 2012. Routes maritimes et systèmes d'échange internationaux au Bronze Récent en Méditerranée Orientale. Maison de l'Orient et de la Méditerranée, Lyon.

Tartaron, T.F., 2013. Maritime Networks in the Mycenaean World. Cambridge University Press, Cambridge.

Yon, M., 1992. The goddess of the Salt-Lake. In: Ioannides, G.C. (Ed.), Studies in Honour of Vassos Karageorghis. Society of Cypriot Studies, Nicosia, pp. 301–306.

Yon, M., 1995. Kition et la mer à l'époque classique et hellénistique. In: Karageorghis, V., Michaelides, D. (Eds.), Cyprus and the Sea. University of Cyprus, Nicosia, pp. 119–130.