

## Environmental changes in the Jebleh plain (Syria) Geophysical, Geomorphological, Palynological, Archaeological and Historical Research<sup>1</sup>

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Une approche interdisciplinaire a permis de retracer les changements environnementaux de la région de Tell Tweini. Les textes de l'Âge du Bronze provenant de la ville d'Ugarit, XIV<sup>e</sup>/XIII<sup>e</sup> s. av. J.-C., mentionnent Gibala/Tweini parmi les villes portuaires, mais de nos jours, le tell est recouvert par des terres de culture. La prospection géophysique n'a révélé les vestiges d'aucune structure sous la plaine située immédiatement au nord de Tweini et une étude géomorphologique a confirmé que la plaine consistait en une accumulation de couches de sédiments. Une recherche palynologique a permis de répartir ces sédiments en trois catégories selon leur origine : marine, péri-marine et fluviale. À l'aide des analyses de pollen et des méthodes de datation relative, on a pu reconstituer pour l'Âge du Bronze le mouvement d'une incursion maritime allant jusqu'au pied de Tell Tweini. Une étude comparative montre que d'autres sites levantins présentent des évolutions similaires, qui sont à mettre en relation avec le niveau fluctuant de la mer.

### Situation

Tell Tweini,<sup>2</sup> the site of the ancient Gibala/Gabala, is located on the east coast of the Mediterranean Sea some 30 kilometres south of the harbour town of Lattakia and just outside the limits of the modern town of Jebleh (35° 35' N, 35° 31' E).

- 1 The Jebleh/Tell Tweini Project is a part of the Belgian Programme on Interuniversity Poles of Attraction, inaugurated by the Belgian State Prime Minister's Office for Science Policy Programming (IAP VI/34) and is primarily financed by the Research Fund K.U.Leuven and the Flemish Fund for Scientific Research.
- 2 J. BRETSCHNEIDER, T.F. CUNNINGHAM and K. VAN LERBERGHE, « Gibala. The First Two Excavations 1999 and 2000 », *UF*, 31, 1999, p. 75-131 and J. BRETSCHNEIDER, M. AL-MAQDISSI, K. VANSTEENHUYSE, J. DRIESSEN and K. VAN LERBERGHE, « Tell Tweini, Ancient Gabala, in the Bronze Age », *Ägypten und Levante*, XIV, 2004, p. 215-230.

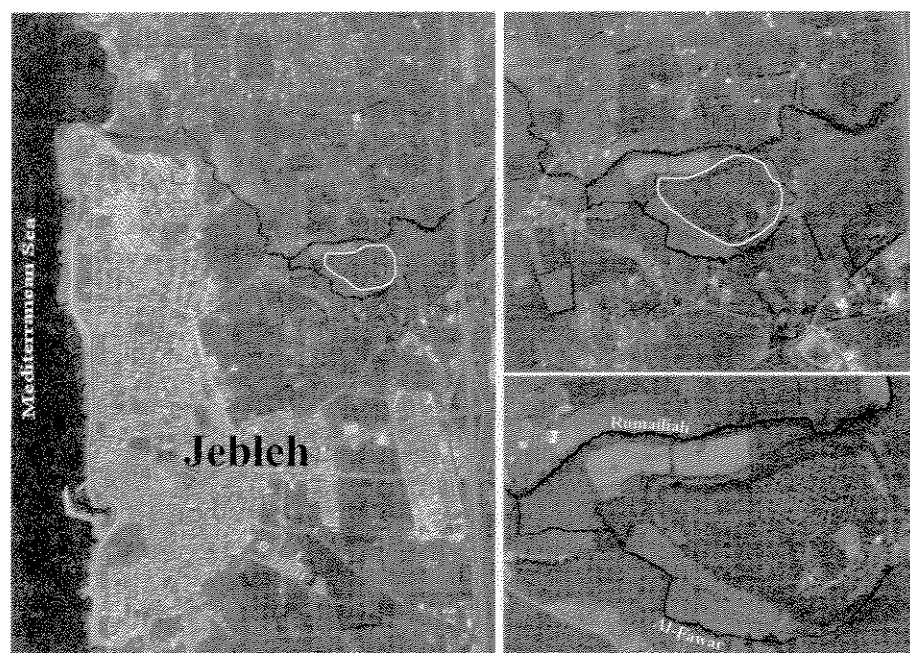


Fig. 1. Satellite image of the Jebleh plain with Tell Tweini (white) and the Rumailiah (N) and Al Fawar (S) rivers (based on Google Earth™, 2003)

The tell lies 1.7 km from the sea at the junction of two rivers, the Rumailiah and the smaller Al-Fawar. The rivers surround the tell, with the Al-Fawar running just to the east of it (Fig. 1).<sup>3</sup> The tell measures 400m (E-W) by 290m (N-S), it rises 10 to 15m above the surrounding fields and reaches a maximum height of 30m above sea level. According to the current state of the archaeological research (2006), the site was occupied from at least the late Early Bronze Age, although bedrock has not been reached. The youngest archaeological structures date to the Byzantine era.

### The plains surrounding Tell Tweini

During the 2004 archaeological season a geophysical survey was conducted at Tell Tweini. Its main purpose was the investigation of the complete surface of the tell in order to plan subsurface features. At the northern margin of the survey area, a plain just beyond the tell was investigated (Fig. 2). This plain lay some 10m lower than the tell. In contrast to the results of the remote sensing work on the tell, no subsurface anomalies or structures were found on this lower plain. This led to several hypotheses, some of them involving the deposit of sediments by the nearby Rumailiah river. If this ground to the north had indeed been urbanised, thick river sediments might still obscure any geophysical result. According to

3. P.J. RIIS, I. THUESEN, J. LUND and T. RIIS, *Topographical Studies in the Gaba Plain*, Copenhagen, 2004, p. 27, 68-69 and map on p. 116.

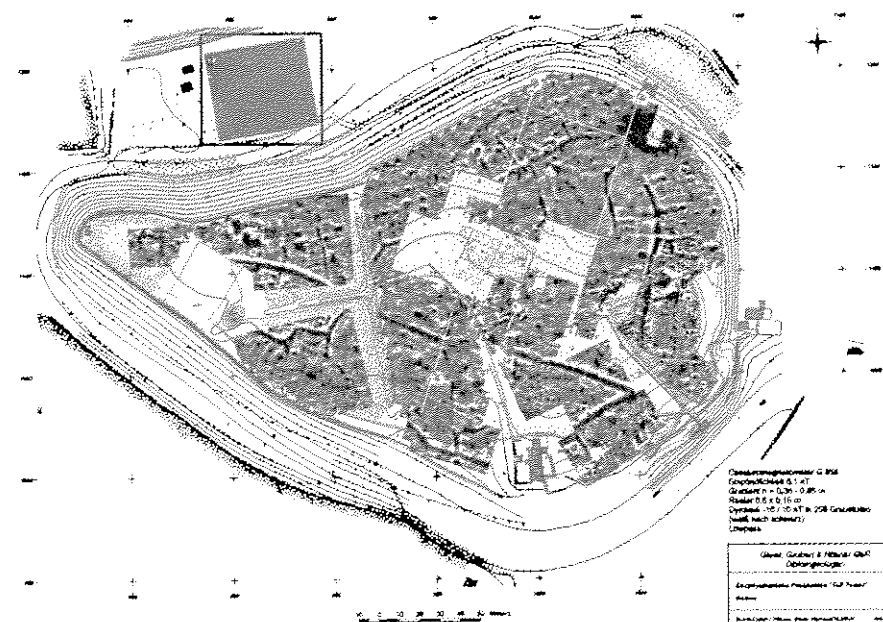


Fig. 2. Topographic map with the results of the geophysical survey. In rectangular the negative results on the plain north of the tell

local people interviewed, the Rumailiah was navigable as recently as the early part of the twentieth century AD. Today the course of the river is incised some 4m into the plain just north of Tell Tweini.

Triggered by a brief geomorphological investigation surrounding Tell Tweini conducted by E. Paulissen in the autumn of 2003, two cores were taken from both the Rumailiah and Al-Fawar river valleys in May 2004. Tell Tweini Core 2 of the Rumailiah valley reveals that the valley consists of thick Late Holocene sediment packets. Based on sedimentological and palynological research, the core was subdivided into three units of different origin: marine, peri-marine and fluvial. At a depth of 8m (the deepest point reached), a concentration of ceramics was found. They were too fragmented to allow identification and dating, but they indicate serious environmental changes in the river valleys surrounding Tell Tweini. Sediment to a depth of 8m has been deposited above a former occupation level. Herein lies the solution to the results of the geophysical survey of the northern plain, the same area where the Core 2 sample was taken. No structures could be detected as some 8m of marine, peri-marine and fluvial sediment were deposited through the ages.

In the lower unit of Core 2 high concentrations of dinoflagellate cysts are attested. Dinoflagellate cysts are one of the chief constituents of phytoplankton floating in the top of the Mediterranean Sea water column (about 5m). They prove that the sediment deposit in which they occur has a marine origin. These high amounts of dinoflagellate cysts in the deposited sediments can only originate in

open sea. As this core sample is located some 1.7km from the current seashore, open sea must have incised this far inland via the present Rumailiah valley. A second core, located in the smaller Al-Fawar valley, adjacent to that of the Rumailiah, affirms that open sea was at that time also present to the south of Tell Tweini.

A pollen analysis of the marine deposits dates the sea incursion to the Bronze Age.<sup>4</sup> This is supported by the archaeological artefacts found in the cores, especially in the upper fluvial deposits. The relative dating of several body fragments of the ceramics confirmed the palynological sequence. Those sherds which can be attributed with certainty to the Iron Age came from the fluvial deposits in the core sample. Ceramics with Bronze Age characteristics were found in the lower marine and peri-marine deposits.<sup>5</sup>

### Impact of environmental changes

The geophysical, geomorphological, palynological and archaeological studies reveal that Tell Tweini was a sea port during the Bronze Age (at the current state of research further subdivision of this period is not possible). Both the north and south side of the tell could be reached by an estuary that followed the valleys of the Rumailiah and Al-Fawar rivers and connected the tell with the Mediterranean Sea (Fig. 3). Historical sources from Ugarit, suggest there was a harbour at Gibala (Gibālā).<sup>6</sup> According to geographical lists, Gibala must be located at the coast. In an administrative text from Ugarit, RS 19.42, Gibala is mentioned in a list of harbour cities along with Mahadu (port of Ugarit), Tyrus, Arwad, Ashqelon and Akko. The new information not only confirms the possibility that Tell Tweini is the ancient city of Gibala, but even opens the perspective of a harbour district near the banks of the former estuary.

Having a port located at an estuary has several key benefits. Strategically the port is fairly easy to protect. In comparison to a coastal port, the banks of an estuary stretch over a larger area surface. Installations on these banks and boats anchored in the estuary are protected well from storms, whereas most harbour installations at the sea coast need additional protective measurements against these frequent natural forces. Well-protected natural bays and estuaries are the most likely places for the development of harbours and flourishing cities.

The Bronze Age estuary must have boosted the economic importance of Tell Tweini, which is reflected in the archaeological remains unearthed during the recent excavation seasons. Its central geographical position in the Jebel plain, on the banks of this estuary, gave it a strategic and political role in the region. When

4. Research conducted by D. Kaniewski and S. Van Simaeys, main reference material from G. WILLCOX, «Charcoal Analysis and Holocene Vegetation History in Southern Syria», *Quaternary Science Reviews*, 18, 1999, p. 711-716 and Y. YASUDA, H. KITAGAWA and T. NAKAGAWA, «The Earliest Record of Major Anthropogenic Deforestation in the Ghab Valley, Northwest Syria: A Palynological Study», *Quaternary International*, 73/74, 2000, p. 127-136.

5. K. Vansteenhuyse, the ceramologist of the excavation team of Tweini, made these conclusions.

6. W. VAN SOLDT, *The Topography of the City-State of Ugarit*, Münster, 2005, p. 64-71 and 88-92.

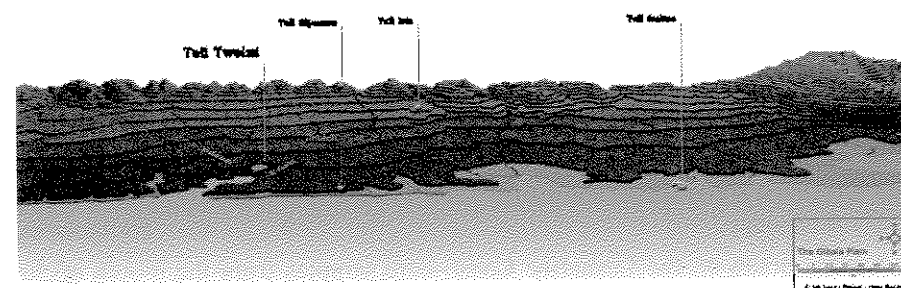


Fig. 3. Sea incursion at Tell Tweini and around Tell Sūkās, after hypothetical 5m rise of relative sea level

the estuary aggradated, it may still have been navigable, but the key benefits were lost. In the Late Iron Age, habitation and urbanisation shifted from Tell Tweini towards the sea coast. Several Byzantine installations are found on Tell Tweini, but the administrative, political and religious centre since the Persian era is ancient Gabala, located at a small natural bay-harbour on a limestone formation near the shores of the Mediterranean Sea; the location of the modern town of Jebel.

### Parallels at the north-eastern coast of the Mediterranean Sea

Environmental changes, such as relative fluctuations of sea levels, have influenced urban centres all over the northern Levantine Coast. At Tell Sūkās, 7km south of Tell Tweini, the Southern Harbour district, close to the sea shore, revealed a layer which was archaeologically sterile.<sup>7</sup> It lay just beneath an occupation layer which, according to its excavators, contained pottery of the Late Bronze or Early Iron Age.<sup>8</sup> The layer was believed to be the result of marine sedimentation. Immediately under this sterile layer, pottery sherds were dated to the late Early Bronze Age. The marine-deposit layer at Tell Sūkās can thus be roughly situated during the Middle Bronze and early Late Bronze Age. The Southern Harbour district of the settlement was inhabited during the Early Bronze Age. It was then abandoned due to maritime forces, and reused when the sea level regressed during the Late Bronze Age. Taking into account that the sterile layer was found at a depth of 4.10m-3.5m, sea level must have been a minimum of approximately 5m above present sea level to allow the sedimentation. If the contours of the tell are followed at this height, Sūkās was almost completely disconnected from the mainland during the Middle Bronze and early Late Bronze Age (Fig. 3).<sup>9</sup>

At Tell Tabbat al-Hammām, 80km south of Tell Tweini on the shores of the Mediterranean, several soundings in the late 1930s revealed a sterile layer of approximately 1.5m.<sup>10</sup> Beneath this layer some Early Bronze Age and mostly

7. P.J. RIIS, *Sūkās VI: The Graeco-Phoenician Cemetery and Sanctuary at the Southern Harbour*, Copenhagen, 1979, pl. 1.

8. P.J. RIIS, J. JENSEN, M.-L. BUHL and B. OTZEN, *Sūkās X: The Bronze and Early Iron Age Remains at the Southern Harbour*, Copenhagen, 1996, p. 22-23.

9. The contour lines on Fig. 3 of the Sūkās region are based on Riis *et al.*, 1996, p. 5.

10. R.J. BRAIDWOOD, «Report on Two Sondages on the Coast of Syria, South of Tartous», *Syria*, 21, 1940, p. 191-203 and fig. 21.

Chalcolithic and even Neolithic pottery was found, laying directly on bedrock. Above the sterile layer Iron Age structures and artefacts were attested. Overall the survey at Tabbat al-Hammām gave only an extremely low amount of Bronze Age material, and it seems the sea level was sufficiently high during the Bronze Age to restrict any permanent habitation.

After examining the remains on the beaches of Ras el-Bassit, 50km north of Tell Tweini, it appears the relative sea level in 1600 BC was approximately 2m higher than today.<sup>11</sup>

Further south on the Levantine Coast, core samples from the mouth of the Qassuba river valley, just south of the foot of Byblos, suggests this was a large open estuary in antiquity. Now a trickling creek filled in with 4 to 5m of sediment, this must once have been a bay, an ideal anchorage for ships.<sup>12</sup> The deposition of marine strata is dated as 2340 ± 80 years BP. This date is presumably too late and so was questioned by the authors of the study on the samples.<sup>13</sup>

At Sidon and Tyros a deposit of sterile sand is found just above late Early Bronze Age installations. At Sidon this deposit (0.7m to 1.5m in depth) is disturbed by Middle Bronze Age graves, and at Tyros (0.90m to 1.40m in depth) by early Late Bronze Age graves.<sup>14</sup> The top of the Tyros sterile layer is from 3.5m to 3.9m above present sea level. Its excavators suggest the deposit of the sand is the result of aeolian processes during an abandonment of the island.<sup>15</sup> Until now the reason the sterile layer of sea sand was deposited at Sidon has not been established by its excavators. The search of the ancient ports of Sidon proved a progradation of the shoreline took place throughout the Bronze Age.<sup>16</sup>

A most interesting parallel in relation to the situation studied at Tell Tweini is Kinet Höyük, a tell today located some 500m inland of the Gulf of Iskenderun. Geomorphological research in the surroundings of the tell concluded that Kinet Höyük had two harbours in antiquity.<sup>17</sup> The one to the north was in a natural bay and the one to the south of the tell was on the banks of an estuary of the Deliçay river. On the East Terrace of the tell, a Middle Bronze Age II building

was excavated. It was sealed off by a 0.4 to 1.2m sterile layer of silt, waterborne gravel and concentrations of seashells.<sup>18</sup> This must represent the highest level of the sea in the estuary. Since the aggradation of both the estuary and natural bay was severe, the course of the Deliçay shifted some 2.5km to the south and the tell itself is today surrounded by gardens. Like Tell Tweini, Kinet Höyük was reached by an estuary during the Bronze Age.

## Conclusions

All over the north-eastern Mediterranean, palaeoenvironmental shifts influenced coastal urbanisation and accessibility of urban centres. At some places these changes had far-reaching consequences. The Jebel plain delivers two clear cases. Depending on the changing relative sea level, the ground surrounding Tell Sūkās was urbanised or not. At certain eras, it is even possible that the tell was accessible only by sea, or during low tide. Gibala, an ideally positioned seaport during the Bronze Age, gradually lost its access to the Mediterranean Sea and was eventually abandoned during the Persian era. The parallels between Kinet Höyük, Ras el-Bassit, Tell Tweini, Tell Sūkās and Tell Tabbat al-Hammām are striking. All give clear evidence that relative sea level was higher during the Bronze Age, with the result that marine deposits overlay older occupation levels. The foundation of Mahadu, the port of Ugarit, in the Late Bronze Age,<sup>19</sup> is probably the result of this same process of aggradation subsequent to a sea incursion reaching Ras Shamra earlier during the Bronze Age.

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