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Human settlement and coastal change in Gaza since the Bronze Age

*Gaza : évolution des environnements et occupation de l'espace
depuis l'âge du Bronze*

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Abstract - Gaza has been characterized by important coastal changes since the Bronze Age. Around 6000 years ago, the coast comprised small estuaries at the outlets of the main wadis. During the Bronze Age, this indented coast spawned important maritime settlements such as Tell es-Sakan and Tell al-'Ajjul at the outlet of Wadi Ghazzeah, which probably served as a natural harbour. During the same period, the rate of sea level rise slowed, leading to the formation of the Nile delta and small local deltas along the coasts of the Sinai and Palestine. From the first millennium BC, the coast was regularised by infilling of the estuaries and settlements. The harbour sites became landlocked. In response, new cities, such as Anthedon, were founded on a Quaternary ridge along the present coastline. Our research project is to test and date this «model of sedimentological evolution» –abandonment of estuarine sites and re-settlement on the coastal ridge– and to compare the fluvial and coastal environmental histories to the long-term dynamics of human settlement.

Résumé - La région de Gaza se caractérise par une métamorphose des paysages littoraux depuis l'âge du Bronze. Il y a environ 6000 ans, la côte présentait de rares estuaires au débouché des principaux wadis. La côte était indentée et des villes portuaires importantes ont vu le jour à l'âge du Bronze au débouché de Wadi Ghazzeah, qui devait servir de port naturel. À la même période, se produit une décélération très importante de la vitesse de montée du niveau de la mer, d'où l'édification du delta du Nil et de petits deltas locaux ainsi que le remaniement des sables par le vent et la dérive littorale le long des côtes du Sinai. À partir du premier millénaire avant J.-C., la côte est donc régularisée par colmatage des estuaires et les sites portuaires anciens se retrouvent à plusieurs kilomètres à l'intérieur des terres. De nouvelles cités sont alors fondées sur le littoral. Notre projet est de tester ce «modèle d'évolution sédimentologique» d'abandon des sites estuariens et d'installation sur la ride dunaire littorale.

Introduction

In partnership with the Direction of the Palestinian Antiquity department, we are looking to begin geomorphological and geoarchaeological research on Gaza's coastline, a littoral strip ca. 38 kilometres long between Israel and Egypt. The Gaza strip has long been

ignored by archaeologists even though, paradoxically, it prefigured Alexandria as the pre-Hellenistic maritime window of Petra and Arabia. In effect, Gaza lies at the crossroads between the terminus of Arabian and Asian land-based trading routes and the Mediterranean. Wadi Ghazzeah was also the historical frontier between the Egyptian empire to the south and the Canaan region to the north.

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Two main factors, ideological and political, explain why Gaza has often been left aside by archaeological research (HUMBERT, 2000). First, this area was considered as laying outside the field of Biblical archaeology and the history of ancient Israel. During the British occupation, only the famous egyptologist F. PETRIE partially excavated a few Bronze Age sites, such as Tell al-'Ajjul (Fig. 1). From 1935, the troubles in Palestine, the Second World war, and later the war of 1948 with its waves of refugees, all explain the absence of any real archaeological activity. Between 1948 and 1967, this area was then left by the archaeological authorities of Egypt, too preoccupied with their Pharaonic sites. From 1967 to 1994, the Gaza strip was administrated by the Israeli army. This occupation did not give rise to excavations of any real ampler, other than on Tell Deir el-Balah (University of Tel-Aviv under the direction of T. DOTHAN) and Tell Ruqueish, a Bronze Age port to the south of the wadi Ghazze (University of Ben Gourion, Bersheeba, under the direction of E. OREN, fig. 1). The Antiquities Service of the Israeli army also started elaborating archaeological maps, mainly to the south of Wadi Ghazze. The north of the Gaza strip was not studied in detail, even though it is a zone under pressure from rapid urbanisation, to the detriment of the historical sites. Finally, since 1995, there has been an unprecedented

development of archaeological activity, with the opening of numerous expeditions working in close collaboration with the Palestinian Antiquities Service. These include the Palestino-Swedish project in Tell al-'Ajjul, under the direction of M. SADEQ and P. M. FISCHER, the excavation of Tell es-Sakan by the Franco-Palestinian team of M. SADEQ and P. DE MIROSCHEJJI, and the work of M. SADEQ and J.-B. HUMBERT's Franco-Palestinian team along the coast of Blakhiya-Anthedon.

1. Research aims

From a geomorphological perspective, this research will seek to elucidate the history of coastal evolution over the past 6000 years, when the rate of sea-level rise significantly slowed (FLEMING *et al.*, 1998; SIVAN *et al.*, 2001). It is also important to estimate the impacts of this change on the coastal morphology and in particular the onset of local delta formation in the outlets of the main water courses (STANLEY & WARNE, 1994). These base-level fluvial inputs led to a progressive regularisation of the coastline. In effect, Gaza's coastline occupies a marginal position relative to the Nile delta, at more than 150 km to the east of the Damietta branch. The long-shore drift, which transports a sandy sediment load, partially explains the regularisation of the coastline (Fig. 2). It is also important to estimate the respective sediment inputs of the Nile and local wadis (STANLEY *et al.*, 1997; SANDLER and HERUT, 2000), to explain the infilling of the estuaries, confined by coastal bars and bordering dunes. From a geoarchaeological perspective, it is important to link the human settlement data, notably the location of harbour sites, with a mapping of potential natural or artificial anchorage havens.

2. Current knowledge and the history of research. From tectonic catastrophism to sedimentary impacts

In the 1980s, NEEV *et al.* (1987) published a multi-disciplinary, hyper-mobilist and determinist synthesis of the Israeli, Palestinian and Sinai coastlines. The crises, declines and periods of destruction of coastal sites were systematically interrelated with natural catastrophes. Three main phases of multi-metric tectonic activity were identified during: the Late Bronze Age, the Early Byzantine period (around the 5th century AD) and the Early Mamelouk period (15th century AD). At the site of Deir el-Balah, these authors believe in an Iron Age oscillation of around 20 m. The central argument is the presence of a shelly layer of *Glycymeris* which caps the archaeological remains. The sediments were not studied in detail and the possibility of a shelly deposit linked to human activities is not evoked.



FIG. 1 - SIMPLIFIED MAP OF THE GAZA STRIP. POSITION OF THE ARCHAEOLOGICAL SITES (after MIROSCHEJJI & SADEK, 2000)
Carte simplifiée du nord de la bande de Gaza. Localisation des sites

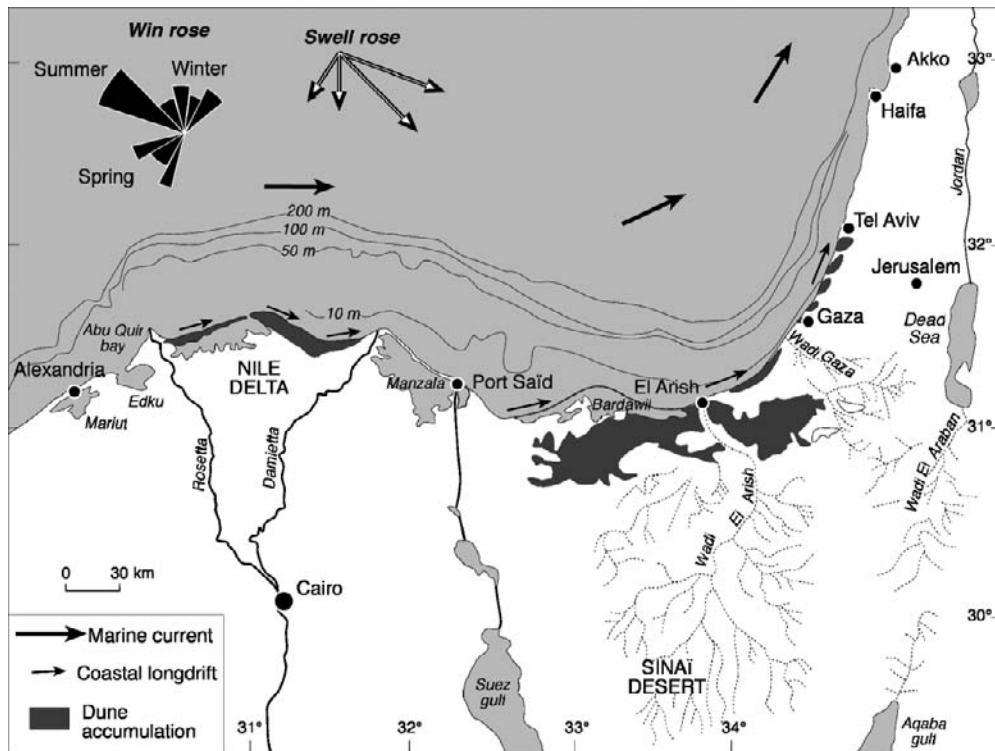


FIG. 2 - TRANSPORT OF NILE SANDS BY THE DOMINANT SWELL
(after STANLEY, 2002) - Transport des sables du Nil sous l'influence des houles

Around the same period, the archaeologist A. RABAN (1987, 1990, 1995) insisted more on the importance of coastline mobility, especially the rapid infilling of estuaries. Raban demonstrated the importance of estuarine sites along the presently rectilinear coast of Gaza and Israel, which would have been the only environments sheltered enough to harbour boats. This natural but temporary protection, was threatened by the regularisation of the coast during antiquity. A. RABAN (1987) approximately dates these geomorphological changes to before 2000 years BC. These earlier works have since been taken up by E. MARCUS (2002). J.D. STANLEY (2002) also insisted upon continental sediment inputs from wadis and dunes, as well as the littoral long-shore drift, in explaining coastline regularisation. A change in research interests therefore resulted: from a tectonic forcing we passed to a sedimentological postulate, with relative sea-level change in the Levant being largely elucidated upon (GALILI & NIR, 1993; SIVAN *et al.*, 2001). The Neolithic well of Atlit-Yam, at the base of Mont-Carmel, is dated 8000 years BP. It lies at a depth of -16 m (GALILI & NIR, 1993). Around 4000 years ago sea level lay at ca. -2 m (SIVAN *et al.*, 2001). These data therefore attest to a classic geomorphological evolution, characterised by a maximum marine ingressions ca. 6000 years BP, rapidly counteracted by fluvial inputs at the origin of coastal progradation. For example, such geomorphological dynamics characterise rias on the Turkish Ionian coast (BRÜCKNER, 1997; KRAFT *et al.*, 2003). In the eastern Nile region, the disconnection of the Pelusian branch and the formation of the Damietta branch led to Peluse harbour being infilled and isolated from the sea around the 9th century AD (GOODFRIEND & STANLEY,

1999).

3. Archaeological sites

This coastal metamorphosis explains the formation, over a few thousand years, of a long, quasi-continuous arched beach between the Nile delta and Gaza. The beach is limited by the presence of a fossil Pleistocene dune, which is often capped by active dune systems and occasionally incised by wadis. In this context, how is the migration of archaeological sites in the palaeo-estuaries to be explained. Is it a function of infilling of the outlets by important fluvial, dune and marine sediment inputs ?

The site of Taur Ikhebeineh, dated to the Chalcolithic period, lies nearly 3 km inland and probably corresponds to the upriver palaeo-estuary of Wadi Ghazze. This site has revealed ancient relations with Egypt. A future coring expedition would allow us to understand the environment and its relationship with the open sea.

The site of Tell es-Sakan also corresponds to an Egyptian foundation. The tell, which covers over 5 hectares, is dated to the Early Bronze Age (3500-2350 BC). The site was protected by an active dune system and was only accidentally discovered in 1998, during construction work (MIROSCHEJJI *et al.*, 2001). Tell es-Sakan appears to be the immediate predecessor to Tell al-'Ajjul, as indicates the geographical proximity of the two sites (300 m) and their chronological succession (MIROSCHEJJI, 2000 ; MIROSCHEJJI et SADEQ, 2000). Tell es-Sakan lies quite far from Wadi Ghazze's present bed. It is feasible that its harbour is located in a palaeo-channel, experiencing a mobility of its downriver course

due to important dune sediment input.

Tell al-'Ajjul dates from the Middle and Late Bronze Age. Archaeological excavations conducted by F. PETRIE have shown that the tell's apogee corresponds to the Middle Bronze II. The tell dominates Wadi Ghazze's contemporary bed, that probably still presented an estuarine-type landscape. The site lies further inland than Tell es-Sakan. Given this evidence, it appears that one of the principal factors in determining urban location was not that of proximity to the sea, but rather the site's propinquity to the navigable fluvial outlet.

On the left bank, at the summit of the most easterly sandstone ridge, Tell es-Sanam guards the estuary's entry. For the most part, the site has been levelled for agricultural purposes. Iron Age pottery shards have been found there.

During the Iron Age, this urban pattern seems to have continued to the south on Tell Ruqeish, a site with a small bay today silted-up, and in Anthedon-Blakhiyah, 3 km to the west of the old Bronze Age tell, in the centre of modern Gaza. These two sites manifest identical geomorphological organisations. They both lie in immediate proximity to the contemporary beach, at the summit of the Quaternary sandstone ridge, and constitute two elements in a series of ancient harbours which punctuate the Levantine coast between the Sinai and Mont Carmel. They had found the ancient harbour in an infilled

settlement patterns.

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