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The environs of Elaia's ancient open harbour – a reconstruction based on microfaunal evidence

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ABSTRACT

During Hellenistic and Roman times, Elaia, the harbour city of ancient Pergamum, was an important place of trading and traffic. Intense mercantile and military activities are documented by literary sources and archaeological evidences. Geomagnetic and geoelectric investigations detected building structures close to the ancient coastline, which are interpreted as ship sheds. The aim of this study was to reconstruct the coastal evolution, particularly with regard to harbour-related facilities. For that purpose, a 10 m long sediment core was drilled in the area of the ancient open harbour immediately in front of the supposed ship sheds. It was studied with the tools of micropalaeontology, geophysics, sedimentology and geochemistry. To improve the reconstruction of the palaeoenvironmental conditions, reference samples of modern environments of the area were analysed. As indicated by marine ostracod and foraminifer taxa, the sediment core shows (from bottom to top) that the initially fully marine conditions changed to a more restricted fauna indicative for a more sheltered bay with brackish waters. This layer dates to Hellenistic times. It can, however, be shown that the siltation process had produced a lagoon system already several hundred years BC. The Elaia embayment was first used as a natural harbour. It was equipped with breakwaters in the Hellenistic period. The progressive siltation caused the abandonment of the harbour in Late Roman Times.

1. Introduction

For more than a decade, many multidisciplinary studies have focused on the utilisation of ancient harbours and harbour related facilities along the Mediterranean coasts. Some investigations deal with the function and history of ancient harbour settlements in general: the harbours of Tyre, Lebanon (Marriner and Morhange, 2007; Marriner et al., 2008, 2010; Morhange et al., 2012), Carthage, Tunisia (Gifford et al., 1992), Pergamum (Elaia), Turkey (Brückner et al., 2013; Seeliger et al., 2013), Ephesus, Turkey (Brückner, 1997, 2005; Stock et al., 2013), Corinth (Lechaion), Greece (Hadler et al., 2013), Marseille (Morhange et al., 2003), Rome, Italy (Goiran et al., 2010), Ostia, Italy (Goiran et al., 2014) – to mention a few. Others describe special harbour or economy facilities like fish tanks and ship sheds in relation to the palaeo-sea level in detail. Antonioli et al. (2007) and Auriemma and Solinas (2009) provide a general overview how archaeological remains may be correlated and interpreted in relation to palaeo-sea level on the basis of different sites along the Mediterranean coast (see also Seeliger et al., 2013, 2014).

Due to the exact dating by archaeological criteria and their well-documented position in respect to former sea level, ancient fish tanks may act as a good indicator for sea-level fluctuations. Morhange et al. (2013) use Roman fish tanks in combination with biological markers to state a relative rise in sea level of 40 ± 10 cm since those days for the region of Fréjus, southeastern France. Similar work is published, e.g., by Evelpidou et al. (2012) for the Tyrrhenian Coast of Italy, by Mourtzas (2012) for the Greek island of Crete, and by Florido et al. (2011) for the Istrian and Dalmatian coast, Italy and Croatia. Ship sheds in contrast to fish tanks cannot

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bear direct witness of former sea level because they have been built above the marine sphere but in close vicinity to it. Vött and Brückner (2006) as well as Vött (2007) summarise the research concerning the use and abandonment of ship sheds in ancient Oiniadai (NW Greece) used in Hellenistic and Roman times.

Following this tradition, our paper presents sedimentological and microfaunistical results of sediment core ELA 58 immediately seawards of the supposed Hellenistic ship sheds in the outer harbour region of Pergamum's harbour city Elaia (Figs. 1 and 2). Archaeological, geophysical and geoarchaeological fieldwork at Elaia started in 2006 (Pirson, 2007, 2008a, 2009, 2010, 2011; Brückner et al., 2013; Seeliger et al., 2012, 2013, 2014; Pint et al., 2013). While most of the archaeological structures and facilities of Elaia's harbour such as the closed harbour basin and a submerged Late Roman saline have already been described and dated (Pirson, 2007, 2008a; Seeliger et al., 2012, 2013, 2014; Pint et al., 2013), the hypothesis about the Hellenistic ship sheds of Elaia has not been proved so far. These structures, visible only in the geomagnetic and geoelectric measurements, are located immediately to the east of the closed harbour basin. The analysis of core ELA 58 is essential for the further interpretation of the structures as ship sheds as a sufficient water depth in Hellenistic times is required – only then oared warships could have been pulled in for shelter.

Microfossil analyses are an important tool to reconstruct palaeoenvironmental conditions. This has been successfully demonstrated in geoarchaeological contexts at, e.g., Ras Ibn Hani, Ephesus, Miletos, Tyre, Rome and the Nile delta, just to mention some of it (Handl et al., 1999, Brückner, 2005; Marriner et al., 2008; Goiran et al., 2010; Mazzini et al., 2011; Marriner et al., 2012; Flaux et al., 2013; Stock et al., 2013). General issues like the evolution of coasts, lagoons and lakes as well as special aspects like the usage of harbours and the navigability of waterways can be solved by the aid of microfossil analyses. Inferring environmental information like salinity, temperature and water depth, it is possible to reconstruct habitat changes in space and time. Therefore it is necessary to identify species and their ecological preferences and tolerances using an actualistic approach.

Our study aims at (i) reconstructing the palaeoenvironments of the ship sheds using micropalaeontological and sedimentological proxies, and (ii) establishing a chronology of the environmental changes over the millennia.

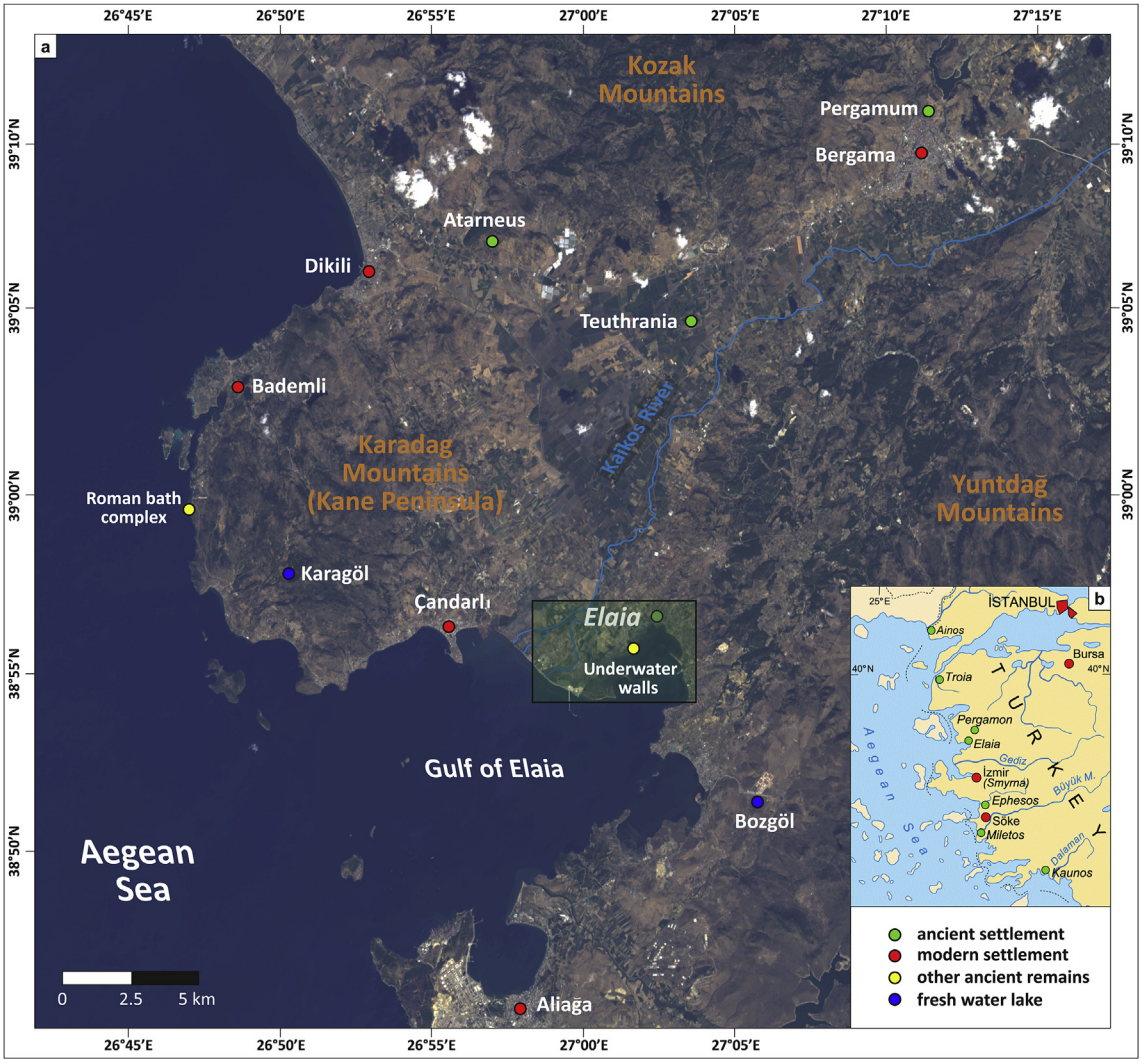

Fig. 1. Area of research at the Aegean coast of Turkey. (a) Overview based on Landsat 8 (acquired September 23, 2013; composition based on bands 4, 3, 1) with locations mentioned in the text. (b) General map of western Turkey with a selection of ancient and modern settlements.