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Determination of ecological change using palinology in a coastal area between Istanbul and Tekirdağ

İstanbul-Tekirdağ arasındaki kıyı bölgesinde ekolojik değişimlerin palinolojik yöntemle belirlenmesi

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Abstract

This study is concerned with the changing ecological conditions in the coastal area between Tekirdağ and İstanbul. The pollen distribution in the area is dominated by non arboreal pollens (NAP).The increasing amount of spores, particularly Sphagnum in the lower zone 2 (between 40-60 cm) together with the existence of *Plantago* and *Rumex* in the lower zone indicate to reflect the human impact and the subsequent effect of secondary vegetation .

Keywords: Pollen analysis, vegetation, climatology, human impact, ecology.

Introduction

The study area is located in the northern coast of the Sea of Marmara, lies between the highly populated Istanbul and Tekirdağ (Figure 1). The settlement history of the study area dates back to very ancient times. The earliest settlement in the study area was established in 12000 BP.

Throughout the history it has been an attractive place for settlement, in terms of economical, political and cultural activities and consequently, the population has continuously increased. Present population of the Istanbul is over ten millions. It is one of the biggest cities and an important trading centre of Turkey.

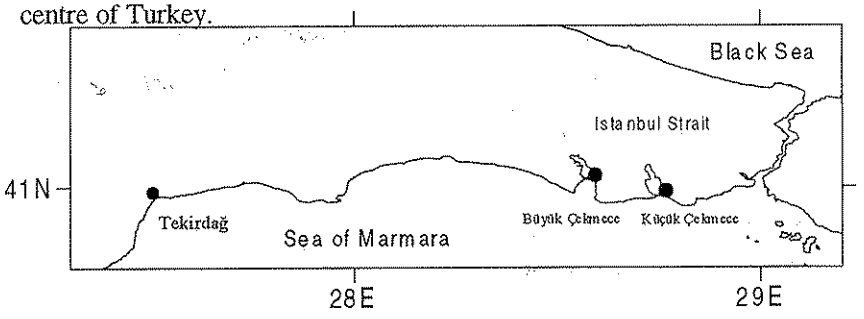


Figure 1. Map of the coring locations.

The study area can be defined as extensively defrost, with a small exception of Hacıveli Common in the west of Çevrimkaya village.
The climate of the region is dry-semi arid, defined by "Thorntwaite Classification", second degree mesotermal excess of water in winter, being closer to the maritime conditions.

The geological formations in the study area are composed of metamorphic rocks (the basement) and units of Paleozic (Middle-Upper Devonien and Carboniferous), Tertiary (Middle Eocene-Lutetian, Continental Oligocene, Marine Oligocene with lignite, Sarmatian-Ponsian, Marine Miocene, Undifferentiated Continental Miocene), and Quaternary (Undifferentiated Continental Quaternary, Holocene new Aluvium) aged (Figure 2).

These units outcrops in north of Büyük Çekmece Lake (Karasurier of basement of valley). Holocene, new Alluvium (Qy) is represented by stream sediments consisting of gravel, sand, clay and soil. These units outcrops in basement of valleys. Plateau surface is the most common geomorphologic unit, in the area. This plateau surface is cracked partly by rivers along the tectonic lineaments (Figure.2).

The most important parameter which is effective in today's geomorphologic appearance in study area is different rocks resistance which causes various erosion.

In the study area, beaches, cliffs, spits, lagoons and mass movement forms are the main geomorphologic features along the coast between Tekirdağ and İstanbul (Figure 3). The aim of this study was to reconstruct the vegetation and the ecological conditions in the coastal area, lying on the Tekirdağ and Istanbul.

Materials and Methods

A total of three core samples were collected from Tekirdağ, B. Çekmece and K.Çekmece using a "Dachnowsky sampler " (Figure 1). The drilling device Dachnowsky sampler had a chamber length of 25 cm and 3.6 cm diameter with a core line 100 cm length.

The core sample collected from Tekirdağ (Şerefli Dere estuary in a marshy meadow at the shore) has a length of 70 cm, overlying on a gravely layer which could not be penetrated. The core samples collected from K. Çekmece and B. Çekmece had lengths of 55 cm and 60 cm, respectively due to penetration limits of the deeper. The coring had to be stopped because the sediment became too hard.

Samples were prepared according to the standard method (Erdtman, 1954) and bromoform treatment (Moore *et al.*; 1991). Pre-treatment procedure consisted of adding cold 10% HCl in excess (i.e. until all obvious reaction ceases, followed by hydrofluoric acid (HF) and then KOH digestion. Finally, staining with safranine and mounting glycerine jelly were performed. Sample from B. Çekmece was performed with bromoform treatment in order to correlate two methods. For bromoform treatment method, samples were washed with 96% alcohol, and resuspended into glacial acetic acid to dehydrate the organic material. Acetolysis mixture (acetic anhydride mixed with concentrated sulphuric acid by a volume of 9:1) was then added to the sample solution and put in a boiling water bath for 3 min. The procedure was followed by centrifuging and decantation of the supernatant to obtain the sample pellet. Sample pellets were washed with distilled water and 96% alcohol and added few drops of 10% KOH–two drops 5% aqueous safranine solution-distilled water mixture. This solution was placed in boiling water bath for 3-5 min. Before washing with 96% alcohol and added 1 ml tertiary butyl alcohol, adding silicone oil and left for 24 h. The samples were put in fume cupboard. To evaporate the volatile component Comparison of the two methods shows no significant differences between the samples. However the bromoform treatment method gave much cleaner samples for microscopic analysis

Two main pollen zones were recognised from the palynological analysis. In general, the pollen contents were low in all the cores. Surface samples including the top 20cm of the cores were characterised by containing low tree pollen (AP) values and consequently high herb-pollen values (NAP) mainly Chenopodiaceae and Xanthium (Figure 4a). Chenopodiaceae indicates the prevailing to steppic condition. The lowering of the AP values may have been caused by increasing human activity in the area. This is supported by the existence of primary or secondary anthropogenic indicators such as *Rumex* and *Plantago* sp. in this zone (Bottema *et al* ; 1991) (Figure 5a).

Pinus brutia Ten. presents the highest value (44.6%) in AP, among the other arboreal group pollens are *Quercus* sp and *Castanea sativa* Mill values between 19.2 and 18.4, *Platanus orientalis* L. is the less abundant pollen (Figure 5b). These pollen distribution pattern of surface samples reflects the composition of present-day pollen precipitation.

The lower zone is presented the layer below the surface zone and extents to 40 cm. It can be divided into two sub-zones 1 and 2, based on pollen distribution. In the lower zone 1; AP contents are high (Figure 4b) and presented by Pinus (60.9%) and Quercus and lesser amount of Tilia, Castanea, Platanus. The content of *Carpinus orientalis* Mill and *Alnus glutinosa* L are low in this zone (Figure 5d). The appearance of Tilia, reflects the prevailing moist conditions. *Alnus glutinosa* L. is very common in the Black Sea coastal forest area at Turkey and it grows in wet lands very well. *Carpinus orientalis* Mill grows in lesser wet area and association with *Quercus* (Saatçioğlu, 1976).

The lower zone 2 is dominated by Sphagnum and fungal spores, also contains lesser amount of pollens (Figure 5c). The abundance of spores in this zone indicate that hydrological conditions were relatively more wet compared to other zones (Van Gell,1976; Van Geell *et al*; 1980;1981; Moore *et al.*; 1991; Bottema *et al.*; 1991).

There are farming indicators such as Plantago and Vitis all of the sample. Chenopodiaceae is a typical taxon for open vegetation .

The palynological evidences in this area indicate that the changes in climatic conditions were not sharp. There are no climatic signal is determined, however all observed changes were overridden by the effects of human impact and subsequently secondary vegetation were formed. The vegetation history study in the north west of Turkey by Bottema et al. 1993-1994, indicates that the first appearances of herbs pollens, such as *Plantago lanceolata* L.and other plantain species, *Polygonum aviculare* L.type-,*Sangui sorba minor* L./*Poterium, Artemisia* L. and *Rumex* L.have occurred at 4000 years BP. These pollens and *Pteridium* spores are produced by plants that benefit from grazing. In Greek, *Platanus* has first appeared around 3000 BP

(Bottema,1982). In this study, although age determination could not be obtained due to lack of organic deposits and short core samples, a regional correlation can be considered with those previous studies. The further studies in longer core will provide us more detail information about vegetation and climatical changes in this area.

Conclusion

The composition of the present-day pollen precipitation in the area between Tekirdağ and Istanbul is established in this study. The pollen distribution suggests that a gradual changes in the climatic conditions have occurred in the area. The increasing amount of Sphagnum and fungal spores together with the existence of *Tilia, Castanea* and *Platanus* in the lower zone indicates a significant change in hydrological conditions, from wet to dry. These changes were caused by increasing human activity as indicated by the formation secondary vegetation in the area.

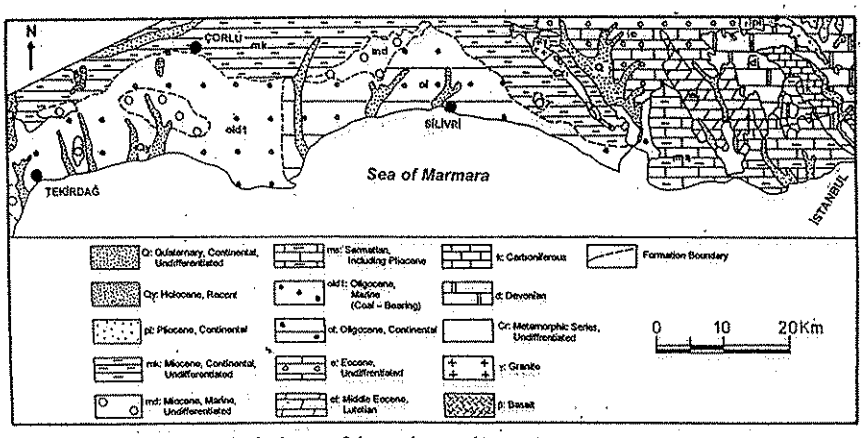


Figure 2: Geological map of the study area (According to MTA 1987)

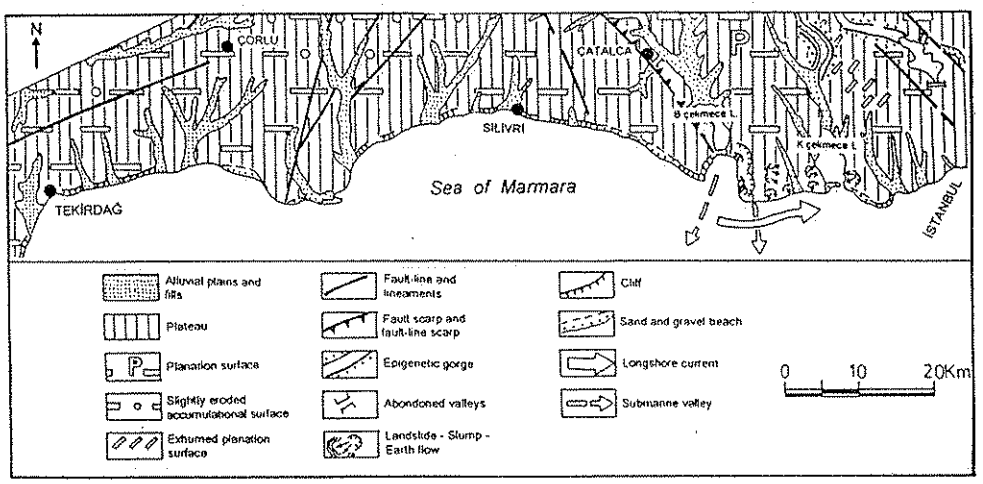
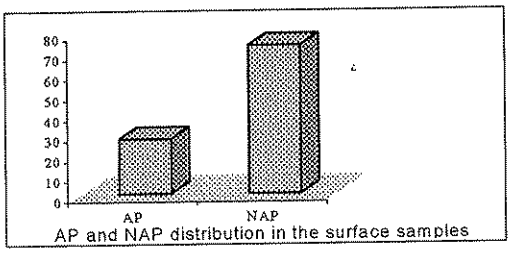


Figure 3: Geomorphological map of the study area (According to Erinç at al; 1984)



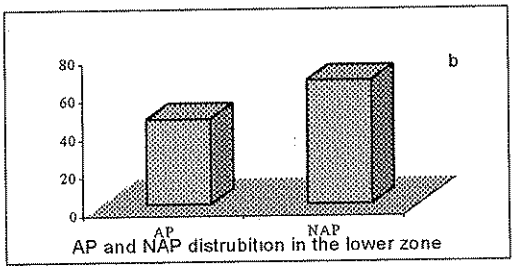
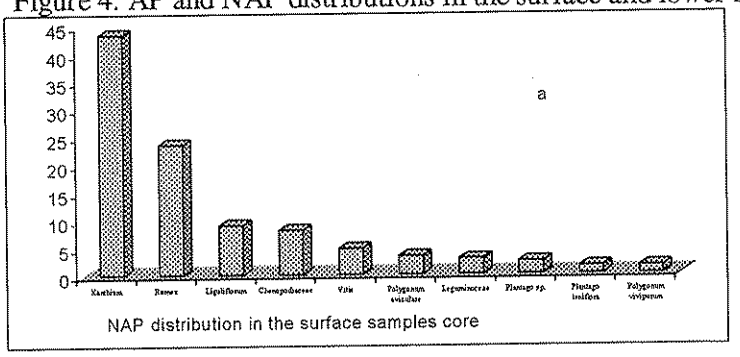
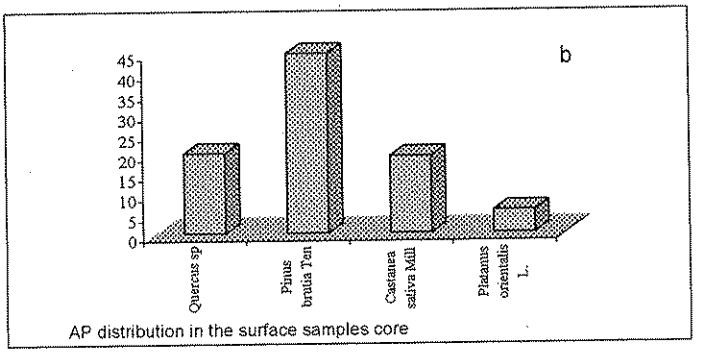


Figure 4. AP and NAP distributions in the surface and lower zones





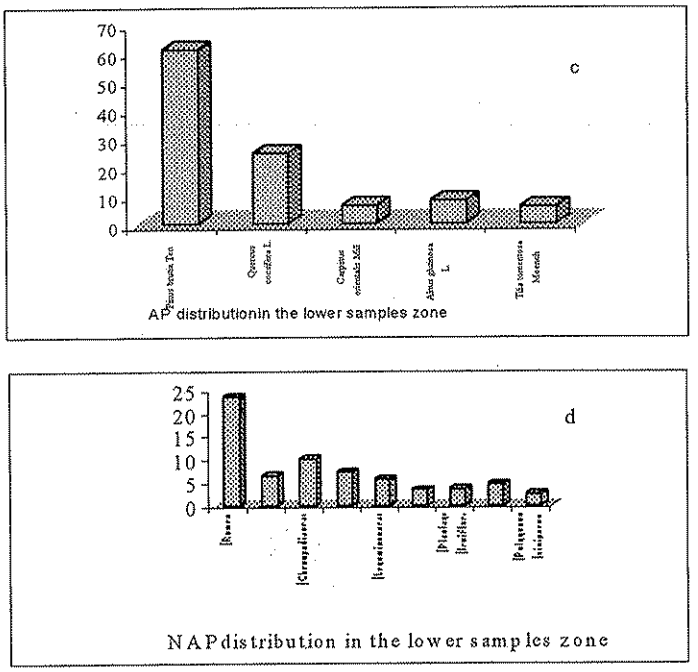


Figure 5. Pollen distributions in the various zones of the core samples

Özet

Bu çalışma İstanbul ve Tekirdağ arasındaki kıyı bölgesinde ekolojik değişimlerin palinolojik yöntemlerle belirlenmesi amacıyla yürütülmüştür. NAP bütün korlarda yoğunluk göstermektedir. Özellikle Sphagnum ve fungal sporların alt zonda artış götermesi ile birlikte Plantago ve Rumex gibi insan etkisini açıkça ortaya koyan türlerin varlığı; bölgede insan etkisi soncunda ikincil bir vejetasyonun oluştuğunu göstermektedir.

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