

The palynological analysis of surface samples from the Western Rough Clica (Alanya, Gazipaşa)

Dağlık Klikya (Alanya_Gazipaşa) yüzey örneklerinde pollen analizleri

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Abstract

In this paper palynological examination of surface samples from western Rough Clica is discussed. The localities of obtained surface samples are represented by three lagoonal areas in the Hacimusa, the Bıçkıcı and Delice River basins. Distribution of the pollen grains in Bıçkıcı and Delice Rivers differs from that which occurs in the Hacimusa River. Arboreal pollens are represented by *Juniperus oxycedrus* L. and *Pinus* in Hacimusa river as the highest value; whereas, *Juglans* reaches the highest values in Bıçkıcı and Delice Rivers.

According to our preliminary evidence, two different vegetation types are in the study area. Eu- Mediterranean vegetation contains xerophytic shrubs and evergreen vegetation (*Pinus brutia*, *Quercus coccifera* and *Erica*, *Artemisia*) and Oro-Mediterranean vegetation includes deciduous forest (*Pinus nigra*, *Q. Cerris*, *Juniperus*, *Cedrus*).

Keywords: Human impact, paleoecology, pollen analysis, surface sample, vegetation

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Introduction

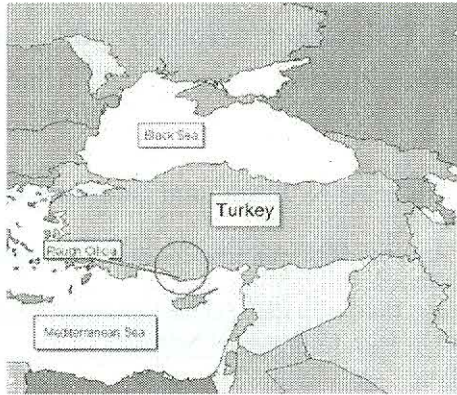


Figure 1. Location of study area

The history of human settlement in southwest Turkey has been studied as a series of archaeological and historical field surveys and excavations. For this region, including western Rough Cilicia (Figure 1), the reconstruction of vegetation and human - induced landscape change is primarily based upon pollen analysis and other paleoecological methods. While archaeological data, including those from excavation and field survey, can sometimes be biased by differential site destruction and modern looting of burials, palaeoecological data tend to be continuous and do not suffer from the chance destruction of archaeological remains.

In the general vicinity of the Eastern Mediterranean basin surface-sample studies have been published for northern Greece (Bottema 1974), southeastern Turkey (van Zeist *et al*, 1968-1970), and western Iran (Wright *et al* 1967).

Surface samples consisting of patches of moss were obtained in more or less natural, semi-natural and seriously degraded vegetations. It should be stressed that various vegetation types may have been overlooked.

In pollen diagrams from southwest Turkey a period of increased anthropogenic activity has been identified; this period is called the Beysehir occupation phase, after a pollen record from the site of Beysehir where it is most clearly expressed (van Zeist *et al.*, 1975; Bottema *et al.*, 1986; Bottema and Woldring, 1990; Eastwood *et al.*, 1998). This occupation phase shows evidence of forest clearance, crop cultivation (e.g. cereals and weeds) and arboriculture (e.g. walnut, olives, manna and vines). It was evidently a widespread phenomenon, since it is strongly recorded in pollen diagrams from Beysehir to Gölcük near the Aegean coast. Radiocarbon dating of the Beysehir occupation phase suggest it began around 3200 14C BP (Cal.~ 1450 BC) and continued, until around 1500 14 C BP (Cal.~ AD 600). The end of the BO phase was characterized by the re growth of woodlands with pine becoming the dominant forest tree, although pine often appears mixed with oak (van Zeist *et al.*, 1975; Bottema *et al.*, 1994; Eastwood *et al.*, 1998).

Although the best documented example of the Beysehir occupation phase occurred at Lake Beysehir 100 km. Northwest of the Rough Clica study area, its pattern has been recognized at many sites in the Eastern Mediterranean, especially SW Turkey.

This paper summarizes the results of the pollen analysis of the surface samples carried out in western Rough Clica. This area lies on the south Mediterranean coast near modern Alanya and Gazipaşa (Antalya province) Turkey. In this region the Taurus Mountains come within 30 km. of the coast and fall steeply to the sea

Present Vegetation

Distribution of major vegetation three units in the study area (van Zeist *et al.*, 1975; Atalay, 1994) in below.

Eu-Mediterranean Vegetations

The trees and shrubs of the Eu-Mediterranean vegetation consist mainly of evergreen species. This vegetation belt extends along the coastal area at elevations ranging from sea level to c. 800 m. In the lowest altitudes of the coastal area, that is, below 300 m., *Quercus coccifera* L., *Pistacia lentusculus* L., *Spartium junceum* L., *Juniperus oxycedrus* L., *Olea europea* L., thrive naturally. In elevations between 300-800 m. Forests consist mainly of *Pinus brutia* L., although *Quercus coccifera* L. is also a very common shrub (Zohary, 1973; van Zeist *et al.*, 1975; Atalay, 1994).

Oro-Mediterranean Vegetations

Oro-Mediterranean vegetations extend from the upper limit of the Euro-Mediterranean vegetation belt to the upper forest "tree line," that is, between 800 and c. 2000 m. elevation. In the lower part of the Oro-Mediterranean vegetation belt, between 800 and 1200 m, deciduous and coniferous forests occur. Below an altitude of 1000 m the coniferous forests consists primarily of *Pinus brutia* L., whereas, above 1000 m. altitude, *Pinus nigra* L. prevails. Where warm exposures exist, however, *Pinus brutia* L. forests can and do occur at elevations exceeding 1200 m. The dominant tree in the deciduous forests is *Quercus cerris* L. At the lower altitudes *Quercus coccifera* L. frequently occurs as the shrub layer of *Pinus brutia* L. forests; whereas, *Quercus cerris* tends to form a more or less dense undergrowth in higher altitude *Pinus nigra* L. forests.

In the uppermost forest zone, extending generally between 1200 and 2000 m, coniferous forests are found. The main constituents of these forests vegetations are *Pinus nigra* L. (up to 1800 m), *Cedrus libani* L., *Abies cilicica* L. and *Juniperus excelsa* L. These trees occur as nearly pure stands as well as in mixed forests. Western Taurus range, extensive at these altitudes *Cedrus-Abies* forests have been confirmed by Zohary (1973). As these high altitude forests degenerate, a mixed *Juniperus excelsa* L.-*Quercus coccifera* L. shrub vegetation tends to colonize this area successfully (Zohary, 1973; van Zeist *et al.*, 1975; Atalay, 1994).

Alpine Vegetation

The majority of the vegetations above the upper tree line consists of top-lawns (pelouses). The majority of the vegetations that occur above the "tree line" consist of top-lawns (pelouses écorchées). The appearance of these vegetations is characterized by the presence of spiny, cushion - shaped species, such as *Astragalus angustifolius*, *Astragalus microcephalus*. However, unarmed species, in particular Labitae, Scrophulariaceae, Boraginaceae and Gramineae, are generally predominant (Zohary, 1973; van Zeist *et al.*, 1975; Atalay, 1994).

Material and Methods

During the 2001 and 2002 seasons of the Rough Cilicia Archaeological Survey Project, geophysical trenches were cut in river basins of the Gazipaşa countryside in order to obtain pollen and macrobotanical samples to determine the history of regional vegetation patterns.

Pollen was concentrated from 0.4 to 1.1 liter subsamples to which exotic *Lycopodium* spores (c. 12.000 grains per tablet) were added (Stockmar 1971). The sediment samples for pollen analysis (~1 cm³ fresh material) were collected as samples and treated using standard palynological techniques (Erdtman, 1954; Moore *et al.*, 1991). This method includes HCl, HF, and KOH digestion, before staining with safranin and mounting with glycerine jelly. The pollen percentages are based on the pollen sum of arboreal (AP) and non-arboreal pollen (NAP), excluding spores.

Results And Discussions

The surface samples were collected at three lagoonal areas in the Bıçkıcı, the Delice, and the Hacımusa Rivers, to which two samples were added from ancient lagoonal locations of the Delice and Hacımusa rivers (these lagoons are now dry farmland). A mortar sample was also obtained from the walls of the Selinus "kiosk" or medieval Selçuk hunting lodge. Building components of this kiosk are believed to survive from a Roman era cenotaph dedicated to the Emperor Trajan, who died at Selinus in 118 AD.

Distribution of the arboreal pollen in Bıçkıcı and Delice Rivers differs from that which occurs in the Hacımusa River. Arboreal pollens are represented by *Juniperus oxycedrus* L. (%22) and *Pinus* (%26) in Hacımusa river as the highest value (figure 2) ; whereas, *Juglans* reaches the highest values in Bıçkıcı and Delice Rivers (figure 4 and 6). Since *Juglans* is extensively cultivated in this region (Zohary, 1973) it is described as an anthropogenic indicator which clearly demonstrates human impact on the paleoenvironment (Bottema *et al.* 1994). At present *Juniperus* is a very common shrub in deforested, grazing terrain throughout southwest Turkey (van Zeist *et al.*, 1975).

In the Hacımusa River basin *Pinus* occurs as the dominant tree pollen (%26) in AP, with *Juniperus oxycedrus* L. and *Pistacia* counted in large numbers. *Chenopodiaceae* occurs in the highest values in NAP (figure 3). At the Delice and Bıçkıcı River basins *Juglans*, *Juniperus oxycedrus* L. and *Quercus* obtain the highest values in AP. *Chenopodiaceae* are the most

