The palynological analysis of surface samples from the Western Rough Clicia (Alanya, Gazipaşa)
Dağlık Klikti (Alanya_Gazipaşa) yüzey örneklerinde pollen analizleri

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Abstract
In this paper palynological examination of surface samples from western Rough Clicia is discussed. The localities of obtained surface samples are represented by three lagoon areas in the Hacimusa, the Buğkıcı and Delice River basins. Distribution of the pollen grains in Buğkıcı 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 Buğkıcı 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 Oros-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 palaeoecological 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 Clicia 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 Clicia. 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 lentiscus* 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 Eu-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 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 écorchéées). 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 Labiatae, Scrophulariaceae, Boriganaceae 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 Gazipasa 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 safranine 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 Bğkici, the Delice, and the Hacmusua Rivers, to which two samples were added from ancient lagoonal locations of the Delice and Hacmusua 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 Bğkıci and Delice Rivers differs from that which occurs in the Hacmusua River. Arboreal pollens are represented by Juniperus oxycedrus L. (%22) and Pinus (%26) in Hacmusua river as the highest value (figure 2); whereas, Juglans reaches the highest values in Bğkıci 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 at al., 1975).

In the Hacmusua 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 Bğkıci River basins Juglans, Juniperus oxycedrus L. and Quercus obtain the highest values in AP. Chenopodiaceae are the most
common pollen grains (between %70 and 92) there as well (figure 5 and 7). The samples from the two ancient lagoons exhibit low arboreal pollen (AP) values (%36-24) and consequently high herb pollen values (NAP). Chenopodiaceae present the highest value (between %83and %92) among the other nonarboreal group pollens, which consist of Plantago, Gramineae, Ephedra and Artemisia.

Chenopodiaceae indicate a prevailing steppic condition (Bottema, 1994). The lowering of the AP values (36%) may have been caused by increasing human activity in this area. This conclusion is supported as well by the existence of primary or secondary anthropogenic indicators such as Plantago sp in the samples.

Pollen counts obtained from mortar samples differ from those obtained from the geophysical trenches in the study area. The mortar samples are characterised by high values of AP (%90) which consist mainly of Juniperus (%30) and Pinus (%30). According to Zohary, these species are common along slopes of the Mediterranean coast. Juniperus occurs frequently together with broad-leaved maquis shrubs and very frequently also with Pinus brutia L. But it is also associated with summer-green forests especially where affected by man, and it also thrives in subalpine Cedrus and Abies forests.

According to our preliminary evidence, the study area contains two different vegetation types.

1. Eu-Mediterranean vegetation: Mainly evergreen vegetation, and xerophytic shrubs (Pinus brutia, Quercus and Erica, Artemisia)

2. Oro-Mediterranean vegetation: Deciduous forest as well as coniferous forests occur (Pinus brutia, Q. Cerris, Juniperus, Cedrus)

The reconstruction of the natural vegetation in southern Turkey is seriously handicapped by the fact that human settlement has exercised a destructive influence on vegetation over an extended period of time. Therefore, we need to obtain and examine more numerous samples for pollen analysis.
Figure 2. AP distribution in Hacimusa (%)

Figure 3. NAP distribution in Hacimusa (%)

Figure 4. AP distribution in Bıçkıçöl (%)
Figure 5. NAP distribution in Biçikci (%)

Figure 6. AP distribution in Delice (%)

Figure 7. NAP distribution in Delice (%)

58
Conclusion
The results of analysis of surface samples obtained from the Rough Cilicia Survey Region indicate a pattern of degraded vegetations. *Plantago* is obtained for areas with serious grazing experience; whereas, *Juniperus oxycedrus* L., *Q. coccifera* L. and *Chenopodiaceae*, *Plantago* characterize the effect of human impact on natural forests and their replacement by secondary vegetation.

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Özet

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