A Pollen Diagram From a River Sediment in Central Anatolia

Orta Anadolu'da Bir Nehir Tortuluna Ait Polen Çizelgesi

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Anahtar Sözcükler: Polen, Tortul, Burgu, Aşıklı, Orta Anadolu

Aşıklı Höyük, Orta Anadolu'da, Aksaray İli'nin 25 km. güneydoğusunda yer alan çanak çömleksiz Neolitik bir yerleşmedir. 1991 kazı yılı sırasında, höyüğün kuzey yamacında, yerleşim yerinin hemen altında, kumlu kilden oluşan bir dere çökelti tabakası kazılmıştır. Yerleşmeden önceki bir tarihe ait olan bu tabaka bitki kalıntıları açısından incelenmiştir. Yerleşmenin uyarlanmış en eski 14 $_{C}$ tarihlemesi İ.Ö.7952 olarak saptanmıştır.

Düşük AP değerler gösteren ve Erken Holosen ot bitki örtüsünün görüldüğü bu bitki tohumlarının kayıtları güney-batı Türkiye'deki, örneğin Beyşehir Gölü, Söğüt ve Akgöl/Konya gibi göl çökeltilerinden toplanan bitki kalıntılarıyla bazı benzerlikler göstermektedir.

Melendiz nehrinin su tablosundaki yerel değişiklikler Liguliflorae ve Chenopodiaceae bitkilerinin yüzdelerindeki dönüşümü hareketlendirdiği izlenimini vermektedir. Bitki kalıntıları çökelme sırasında bozkır koşullarının var olduğunu göstermekte ve Orta Anadolu'nun Son Buzul yahut İlk Holosen Devre ait bitki örtüsünün küçük bir parçasını yansıtmaktadır.

Introduction

Since 1989 excavations have been carried out under the direction of Professor U. Esin at the Pre-Pottery Neolithic site of Aşıklı Höyük (Esin, 1996). The site is situated near the village of Kızılkaya, 25 km. south- east of Aksaray in Central Anatolia. Aşıklı Höyük lies in a bend of the river Melendiz. Upriver, strong meanders can be observed in a fairly broad valley. At the western flank of the dwelling mound a few metres of deposit have been exposed by the river.

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In 1990 and 1991 the author flotated samples for palaeobotanical remains, which revealed large amounts of *Celtis* seed (Turkish: çitlembik), but otherwise the samples turned out to be rather poor in botanical remains. In 1991, the base of the occupation was reached at the northern flank. Underneath, a sediment consisting of clay was uncovered. The sediment was cored (Fig. 1) with a Dachnowsky sampler, because of the scarce palynological information on the area a number of samples were processed (Fig. 2).

Geography and Climate of the Site

Aşıklı Höyük (coord. 38 21'N, 34 13'E) is situated at an elevation of 1119,45 m. at the transition of the xero-euxinian steppe forest and the timberless Central Anatolian steppe west of Aksaray. The site lies in an undulating plain that is at some distance surrounded by mountains.In the south mountain ranges of the volcanic Hasan and Melendiz Dağı are found. In the north and east the area is bordered by the Ekecik and Erdas Dağı, respectively.

The average annual precipitation is 300 - 400 mm. of which the bulk falls during the winter and spring. The average temperature for July is in the range of 20°-24° and for January in the range of 0-4° C.

Modern Vegetation

According to Zohary (1973) the primary vegetation of the xero-euxinian sector is a steppe forest (Querco-Artemisietea santonicum), in which the trees are dominated by oak species such as *Quercus cerris*, Q. *pubescens* and Q. *robur*. The ground flora is dominated by *Artemisia santonicum* (= A. *fragrans*). Selective felling of trees and grazing turned the steppe forest into a striking landscape, the so-called 'wild orchards' in which fruit-bearing trees and shrubs such as *Pyrus, Crataegus, Amygdalus* and *Cotoneaster* dominate. Zohary states that intensive grazing gave rise to mixed xeromorphic formations of tragacanthic species such as *Astragalus* and dwarf shrubs. Plant communities in which *Astragalus* dominates occur in the vicinity of the site.

In the fields around Aşıklı Höyük the author recorded solitary trees and shrubs of *Pyrus elaeagnifolia, Crataegus laciniata*, C. *orientalis* and *Rosa* species. Apricots (*Prunus armeniaca*) are widely planted for the fruits.

Deciduous oak species are rare in the vicinity of Aşıklı Höyük. One specimen of pedunculate oak (Q.*robur*) has been recorded at Kutluaya, c. 0.5 km. from Aşıklı Höyük. another specimen was found in a garden in Doğantarla, at c. 2 km. distance from Aşıklı Höyük. A few specimens of this species were growing in the village of Demirci, c. 7 km. north of Aşıklı Höyük. Open oak forests, mainly consisting of Turkey oak (*Quercus cerris*), occur at the piedmont and the slopes at lower altitudes of the Hasandağ near Helvadere, c. 20 km. south of Aşıklı Höyük. Interesting are the oak species recorded in hedgerows surrounding the sun-bakened arable fields north of Helvadere. Here *Quercus cerris*, Q. *infectoria* ssp. *boissieri*, Q. *ithaburensis* ssp. *macrolepis*, Q. *pubescens* and (probably) Q. *macranthera* alternate with fruit-bearing species such as *Prunus divaricata*, P. *spinosa*, *Colutea arborescens*, *Cotoneaster nummularia*, *Pyrus eleagnifolius* and *Juglans regia* (!).

The large-scale cultivation of cereals and other agricultural crops has no doubt contributed to the reduction of the arborescent vegetation south and east of the Mamasın Barajı.

Lithology

The upper 20 cm. of the sediment was devoid of pollen. The part of the sediment containing pollen is represented in the diagram. Gravel prevented deeper cooring;

0 - 35 cm.	sandy
35 -115 cm.	sandy clay

Dating of the Core

Because of the low organic content, the core is not suitable for radiocarbon dating. The river sediment is located just below the settlement deposits of the trenches 4G and 4H on the northern flank of the site. The earliest calibrated 14 $_{C}$ date of the occupation deposit is 7952 BC and accordingly is the minimum age of the river deposit.

The Pollen Diagram

Non-arboreal pollen make up the bulk of the pollen sum. Arboreal pollen do not exceed 20%, except in spectrum 9, where Salix attains 30%.

It seems reasonable to conclude that both *Elaeagnus* and *Salix* are of local origin. In Turkey they are often found in the river landscape. The fluctuating curves, too, suggest stands of these shrubs along the Melendiz. *Juglans, Alnus* and *Populus* may have grown elsewhere along the river. Betula and Quercus cerris -type may come from higher elevations in the surrounding mountains.

Nowadays *Betula* forms the upper tree line of the Erciyaş Dağı, about 100 km. east of Aşıklı Höyük. Davis (1965-1985) mentions volcanic slopes as a favourite habitat of birches. For this reason it is possible that at the time of deposition birches were present on the slopes of the Hasan Dağı.

As mentioned before, deciduous *Quercus* species are relatively common components of the present-day anthropogenic steppe of Inner Anatolia.

Corylus avellana has a scattered distribution in the Pontic and Taurus mountain ranges. Its presence in the pollen diagram is probably due to long-distance transport. Nowadays *Juniperus* species (e.g. *excelsa*, J. *foetidissima*) are common in the mountainous areas of Inner Anatolia, but for instance *Juniperus oxycedrus* also forms part of the steppe forest.

The relatively high share of Pinus in the Aşıklı Höyük diagram must be ascribed to long-distance transport. In the pollen diagrams of southwestern Turkey, pine is not an important component of the Late Glacial and Early Holocene vegetation.

A peculiar phenomenon, difficult to explain, is the presence of *Olea* together with *Quercus calliprinos*-type. Both species belong to the Mediterranean vegetation and do not occur in Inner Anatolia. Their presence must be attributed to long-distance transport from coastal areas.

The absence of *Celtis* pollen is remarkable, though the pollen of this species is not very well dispersed. A surface sample of the Ihlara gorge yielded 1.9 % *Celtis* pollen. Not far from the sampling location a few specimens of *Celtis tournefortii* were recorded. The stony seeds of this tree were found in almost all flotation samples. In some occupation levels, layers consisting solely of *Celtis* stones were observed. The absence of *Celtis* pollen could mean that the shrub did not grow in the vicinity of the site at the time of deposition, but spread later in the area.

With the exception of *Elaeagnus* and *Salix*, the low values for the arboreal species suggest that they did not grow in the vicinity of the site. The non-arboreal pollen make up 80-90% of the total pollen sum, with Chenopodiaceae and Liguliflorae figuring as main groups. The curves of these groups show a clearly negative correlation. The high values of Liguliflorae and other Compositae have been discussed in Bottema and Woldring (1984(1986)). In southwestern Turkey, the high values of some groups of Compositae have been correlated with deforestation. In this context Bottema and Woldring described a special phenomenon, which they observed in a crater lake in Thessaly, Greece. While coring, their attention was drawn to some harvesting machines, above which a column of dust was lifted up by thermals. At the same moment a settling of chaff, pieces of straw etc., was observed in the lake around the coring site. It is explained that such air flows are caused by the difference in temperature between the air above the sun-baked fields and the much cooler air above the body of water. Such events can of course only occur in the months with the highest temperatures (July and August), the flowering time of many Compositae. In this way such types may well become over-represented in the pollen rain. On the basis of this explanation we may also conclude that the area around Aşıklı Höyük must have been largely devoid of trees at the time of deposition.

Do the spectra with low values for Liguliflorae at the same time imply that the cooling effect of water had disappeared? In this case the formerly flooded places would become exposed and for instance Chenopodiaceae could settle on the mud flat. According to Davis (1965-1985), *Chenopodium botrys* actually is the only Chenopodiaceae of river banks in Central Anatolia. The present author recorded this species near the coring site. The Chenopodiaceae pollen found in the Aşıklı core is matched by that of *Chenopodium botrys* in the reference collection of the Biologisch-Archaeologisch Instituut. The values of Chenopodiaceae in the pollen diagram could easily have been produced by this species.

Finally, a few remarks will be made on the remaining pollen types. Contrary to the fluctuating curves of Chenopodiaceae and Liguliflorae, a number of Compositae (*Artemisia, Cirsium* - type, *Centaurea solstitialis*-type and others) together with *Brassica*-type, *Cyperaceae, Gramineae* and *Cerelia*-type, show more regular curves. It is probable that these types represent the then-existing steppe vegetation. An exception is made for Cyperaceae, because this curve shows some similarity to that of the local *Elaeagnus*. Cyperaceae may have grown in marshy habitats along the river. *Cyperus fuscus* is a common species in the river bed near the site.

At present the most common wormwood of the Inner Anatolian steppe is *Artemisia santonicum*, a species which is advantaged by grazing. Some other species, growing in steppe habitats, also are considered. *Artemisia herba-alba* has a more eastern and local distribution in Turkey. *Artemisia vulgaris* too, does not occur in Central Anatolia. A species with identical pollen grains is *Artemisia scoparia*. This species is mentioned by Zohary (1973) for volcanic tuff in the Konya plain.

The *Cerelia*-type (pollen size > 40 µm) in Turkey includes several grasses, for instance *Aegilops, Hordeum, Stipa* and *Bromus*. Many species of these genera are common elements of the steppe vegetation. The corresponding curves of *Gramineae* and *Cerealia*-type suggest that the *Cerealia* formed part of the ground flora and do not indicate any form of agriculture.

Comparison With the Pollen Diagram of Akgöl in the Konya/Ereğli Basin

As for a possible time-correlation of the Aşıklı Höyük diagram, it seems justified to place it before 7952 BP.

A pollen diagram of Akgöl, situated near Ereğli in the eastern part of Konya plain, starts around 13,000 BP. Like Aşıklı, Akgöl is situated at the fringe of the xero-euxinian steppe forest and the timberless steppe conditions, with low values for arboreal pollen, while the values for non-arboreal pollen make up more than 90% of the total pollen sum. The arboreal pollen are mainly produced by Quercus *cerris*-type. Further *Qurcus calliprinos*-type, *Juniperus* and *Betula* are represented, chiefly in the subzones 1B-1D. In the arboreal assemblage of the Aşıklı diagram these pollen types are likewise found in low values, again with the highest values for *Q. cerris*-type. The non-arboreal pollen types in subzone 1B-1D are dominated by *Artemisia, Gramineae* and *Chenopodiaceae*.. The values of chenopodiaceus pollen in the Akgöl diagram originate from halophytic vegetations. As in Akgöl (subzone 1B-1D), *Artemisia* and *Gramineae* play a substantial part in the steppe vegetation around Aşıklı Höyük.

So far, the assemblage of the pollen types mentioned above, shows some conformity with the subzones 1B-1D of the Akgöl diagram. However, it must be admitted that other curves in the diagrams differ considerably. In subzones 1B-1D of the Akgöl diagram, values for *Pinus, Noaea* -type,*Centaurea solstitialis* -type and *Cerealia*-type are strikingly lower than those of their counterparts in the Aşıklı diagram. The discrepant values of these pollen types preclude a clearly defined dating of the pollen diagram.

Conclusion

The pollen diagram of Aşıklı Höyük covers an early phase in the vegetation history of Central Anatolia. The regional vegetation is poorly represented,may be due to a rapid sedimentation rate. *Salix, Elaeagnus*,Chenopodiaceae and Liguliflorae are in some way or another overrepresented in the pollen rain.

The low share of regional tree pollen (AP) in the pollen rain justifies the conclusion that the Aşıklı Höyük diagram reflects a probably short part of the Late Glacial or Early Holocene vegetation history of Central Anatolia.

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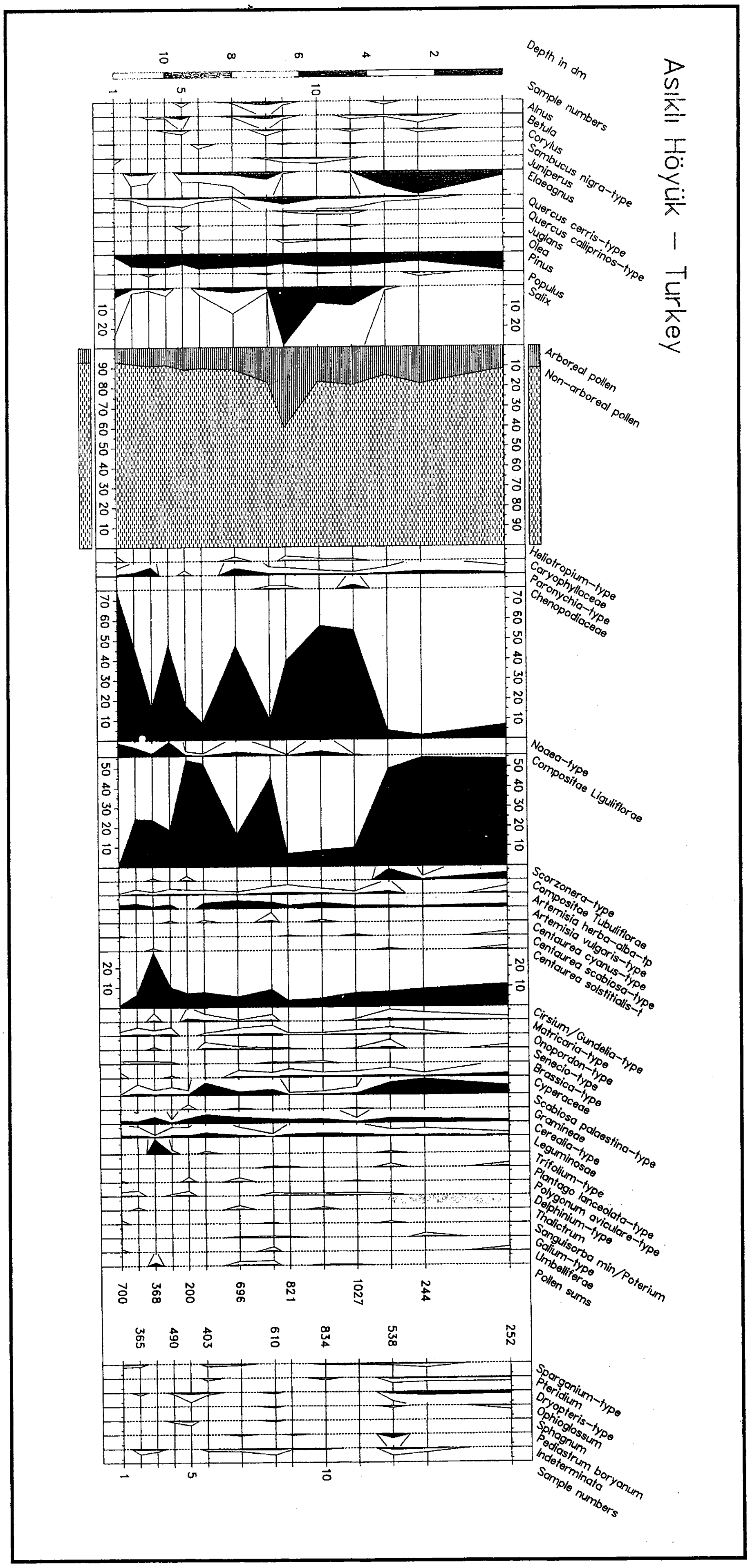
Table 1. Not included in the pollen diagram of Aşıklı Höyük are:

Spectrum 1: *Phillyrea* 0.1, *Vitis* 0.1,*Humulus/Cannabis* 0.1, *Xanthium* 0.1,*Convolvulus* 0.1 *Euphorbia* 0.1 *Hypecoum* 0.1;
Spectrum 2: Plantaginaceae 0.5;
Spectrum 3: *Anchusa/Pulmonaria*-type 0.3, *Cerinthe*-type 0.3,
Centaurea 0.3,*Plantago coronopus* -type 0.3,*Myriophllum*
spicatum/verticillatum 0.5;
Spectrum 4:*Platanus* 0.2,,*Symphytum*-type 0.2, *Evax* 0.2, Plantaginaceae 0.2;
Spectrum 5:*Hedera* 0.5,*Sorbus* -type 0.5, Cruciferae 0.5, Ericaceae 0.5, *Rumex acetosa*-type 0.5;
Spectrum 6:*Crataegus*-type 0.2,,*Bidens*-type 0.2, *Centaurea* 0.5,
Linum 0.2,*Plantago* tenuiflora-type 0.2, *Rumex patienia* -type 0.2,
Aquilegia -type 0.2, *Ranunculus repens*-type 0.2,Rosaceae 0.2,
Zygophyllum 0.7,*Equisetum* 0.2;
Spectrum 7: *Cedrus* 0.1, *Convolvulus* 0.1, Cruciferae 0.1,*Matthiola* 0.1,*Cuscuta* 0.1,*Allium* 0.1,*Scrophularia/Verbascum*-type 0.1;
Spectrum 8: *Ostrya/Carpinus orientalis* 0.2,*Abies* 0.2,*Cedrus* 0.3,*Ulmus*0.2, *Spinacia*-type 0.2,*Bidens* type 0.3,*Cuscuta* 0.2,
Ericaceae 0.2,*Lotus*-type 0.2,*Onobrychis* -type 0.2,*Polygonum cognatum*-type 0.3,*Polygonum persicaria* -type 0.2,*Bunium*-type 0.2
Spectrum 9: *Fagus* 0.1,*Morus* 0.1,*Fraxinus excelsior* 0.1,*Platanus* 0.1,
Crataegus-type 0.1, *Bryonia* 0.1,*Thymus/Mentha* -type 0.1,
Glacium 0.4, *Consolida* 0.2, *Hyoscyamus* 0.2, *Eryngium* -type 0.1;
Spectrum 10: *Juniperus sabina* 0.5,*Taxus* 0.1,*Echium* -type 0.1, *Ononis* -type 0.1,*Vicia*-type 0.1, *Hypecoum* 0.1,*Papaver* 0.1, *Aquilegia*-type 0.1, *Hyoscyamus* 0.1;
Spectrum 11: *Pistacia* 0.1,*Tilia* 0.1,*Ulmus* 0.1,*Arctium*-type/*Jurinea* 0.1, *Cousinia* 0.1,*Filago*-type 0.1, *Plantago tenuiflora*-type 0.2,
Consolida 0.2;
Spectrum 12: *Ostrya/Carpinus orientalis* 0.1,*Spinacia* -type 0.2,
Arctium -type/*Jurinea* 0.2,*Capsella*-type 0.7, *Rumex acetosa*-type
0.4, Polypodiaceae 0.2;
Spectrum 13: *Juniperus sabina* 0.4,*Abies* 0.4.



Aşıklı Höyük - Turkey

Figure 1: Drilling for pollen sampling at Aşıklı

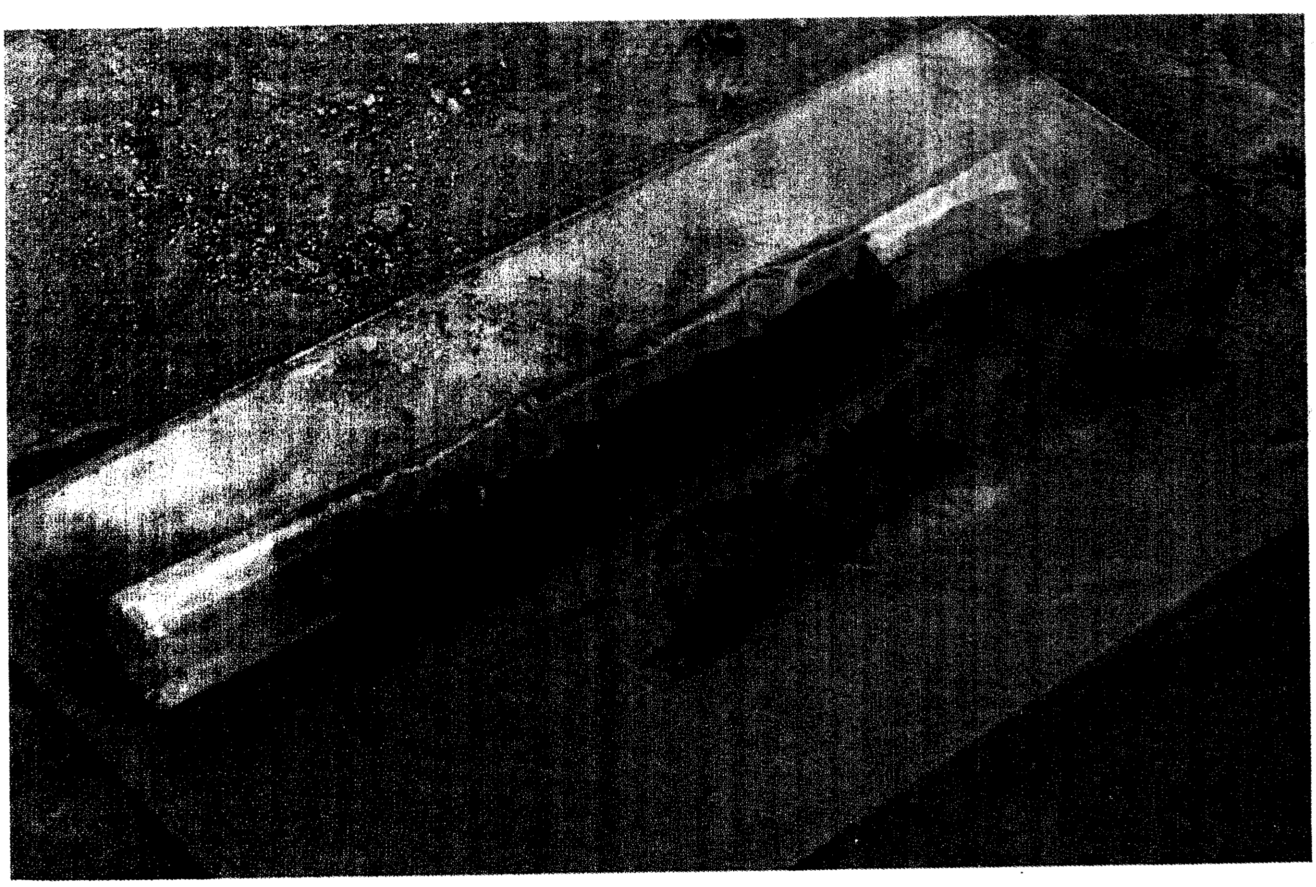


Figure 2: Pollen core sample consolidated by wrapping with plastic

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