Figure 1: Block-lifting charred timbers using plaster and tissue support. Kaman-Kalehöyük, Turkey.
Credit: Takayuki Oshima

Resim 1: Yanmış ağaç kökülerinin ağıç ve kağıt malzeme ile desteklenerek blok halinde kalınlanması.
Kaman-Kalehöyük, Türkiye. Fotoğraf: Takayuki Oshima
Introduction
Wooden artifacts and structures have been found at numerous excavations in Turkey including the Hittite site of Acerb deployments, the Phrygian site of Gordium and the Urartian site of Ayanis. Archaeological wood and plant materials such as basketry and reed matting can be recovered from burial sites (dry or wet) and above-ground locations such as tombs and other structures.

Description
Wood and plant materials are composed primarily of cellulose fibers that form the cell walls; hemicellulose, which coats the cellulose fibers; and lignin, a cementing agent. One of the most characteristic features of cellulose is its ability to attract and bind water molecules. This mechanism accounts for the shrinkage and swelling of wood in response to dry or humid environmental conditions.

The structure of wood is complex. The initial growth phase in the trunk consists of a central pith and the surrounding heartwood region. As the tree matures, layers of sapwood form, consisting of living cells that transport sap within the trunk. The outer bark protects the vulnerable layer of inner bark beneath, the region responsible for the dispersal of nutrients throughout the tree. The growth layers or annual rings apparent in cross section are used by dendrochronologists to calculate the age of a particular tree and to date wooden objects. The structure of (non-wood) plant materials varies with the species but is generally much simpler. The stems of plants such as rushes contain no lignin but are strengthened by the presence of silica.

Deterioration & Preservation Conditions
The factors most likely to have caused decay in archaeological wood include exposure to water as well as bacterial, fungal and insect attack. Cracking, splitting and warping are the initial indicators of deterioration. On a microscopic level, gradual loss of the cellular components occurs as a result of fungal attack or slow leaching by groundwater.

In environments favorable to preservation, wooden objects may survive intact, whereas in unfavorable burial conditions, soil stains may be the only evidence of the prior existence of wooden structures. The grain pattern and shape of completely decayed wooden artifacts may sometimes be preserved as pseudomorphs on corroded metal artifacts. Wood that has been exposed to fire may survive in a carbonized state. Once converted to charcoal, it is chemically stable and provides a reliable source of samples for carbon-14 dating.

Plant materials are less likely to survive than wooden ones. Basketry may be preserved if carbonized or if in either desiccated or completely waterlogged environments. The prior existence of reed matting may sometimes be deduced from impressions in other materials such as pottery and plaster.

Giriş
Acremiöyük, Gordium ve Ayas'a başla olma olmak üzere Türkiye'de gerçekleştirilen tek çok arkeolojik kazada ahşap objeler ve mimari yapılarla ait parçalar ele geçmektedir. Arkeolojik ahşap ve hasır örgü benzeri bitkisel malzemeler (kuru veya i̇sik halde) görüntü alanlarında ve mezar odaları gibi toprak üstünde yer alan kalıntılar içinde bulunabilmektedir.

Ahşap Buluntuların Tanımı
Ahşap ve bitkisel malzemeler temelde hücre duvarlarını oluşturan selülozu fotosentezle herniselik hücre duvarları oluşturan hemisellülözden ve bağlılığı gösteren olan ligninden oluşmaktadır. Selülozu en karakteristik özellikleri burası molekülerini kendine çekmesi ve bunlarla birleşmesidir. Bu nedenle ahşap, kuru ve nemli ortam koşullarında köktürme ve şişme şeklinde işleyen bir mekanizmaya sahiptir.


Bozulma ve Korunma Koşulları
Arkeolojik ahşapın bozulmasının yol açan etkenler arasında İslamın kısır baktını, muntar ve bıçak salaminın aşırısı ve padişahın kıyafetleri ile ilgili brakmak ve bozulmasının en belirgin işareti olabilir. Mikroskopik düzeyde incelemeyi hücresel bileşenlerin aşınması olarak yok olsunun, muntar salının veya toprak alta indiksi nedeniyle aşırlı gelisen bir çözümlmeye yol açığı anlaşılmaktadır.

Korunmayı sağlayan ortam koşullarında ahşap objeler parçalanmadan kalabilyen, uygun olmayan gömülü şartlarında ahşap objelerin varlığına işaret eden yeşil işaret toprakta hırtakatları izlerdir. Dokusuz izler ile tamanın çürümiş ahşap objelerin formları kimi zaman metal objeler üzerinde "pseudo-mort" (yalanç) oluşmaları biçiminde korunabilmektedir. Yangın veya yakılmakın maruz kalan ahşap ise karbonize olarak kalabilmektedir. Olun könümüne dönüştüğlenmiş sonra ise, kınıyasal açılan stabil halde olup, Karbon-14 tarihimini için güvenirlik oranları almanın mümkün bir kaynak teşkil eder.

Excavation & Lifting
In hot climates, it is best to excavate wood during the early morning or in the evening to avoid the heat of the day. As soon as a wooden artifact is uncovered, it should be photographed to provide a permanent record of its condition. Periodic misting with water and covering with plastic sheeting will prevent damp or wet wood or plant materials from drying out when immediate excavation cannot take place. Samples for carbon-14 dating must be handled carefully at all times to avoid contamination from modern sources of carbon, such as adhesives, fungicides or cigarette ash.

Even though it may appear robust, archaeological wood usually requires support during lifting. Careful undercutting of the soil with a trowel or metal blade of appropriate shape is often sufficient to free an object from its soil matrix. The object can then be placed in a container of appropriate size.

In some cases, it may be necessary to remove the surrounding soil to a depth of several centimeters to create a pedestal for the object. A wooden board or stiff plastic sheet can then be slipped underneath. The artifact should be secured to the underlying support for transportation. Tying with twill tape and wrapping in plastic sheeting is suggested. More elaborate measures such as block lifting with surrounding soil, providing support with expanding polyurethane foam, and encasing with plaster jackets may be necessary to remove complex objects or architectural features. These methods should be carried out under the direction of a conservator.

Kazı, Kaldırma ve Taşıma İşlemleri

Sağlan hiç görünümemekle birlikte arkeolojik aşırı kaldırdı ve taşıma işlemleri sırasında destek gerektirir. Aşırı obje içinde bulunduğunu toprak kütlesinden ayırmak için uygun formla bir metal kesici atet veya kireğin özenle kullanılması yeterli olacaktır. Destekleyen toprakla birlikte kesilerek çıkarılıp obje daha sonra uygun büyüklükte bir kutu içine yerleştirilir.

Bazı durumlarda, obje taşıyacak bir kaide oluşturmak üzere buluntuyı çevreleyen toprağı birkaç santimetre derinliğinde kazarak açmak gerekメリット. Daha sonra ise buluntuyu yerinden kalırmakta kullanılabilecek sert bir pano yardımıyla (suna, saç veya sert plastik) işlem tamamlanacaktır. Nakil esnasında ise altta taşıyıcı destekten obje ile sağlan ve givielen bir bağlantı bulunugundan emin olunmalıdır; destek ile obje birarada plastik
Cleaning, Stabilization & Repair

If wood is damp or wet when excavated, it should be kept in this condition until reaching the conservation laboratory where it can be dried under controlled conditions. To prevent irreversible damage to the cellular structure through fungal growth or loss of moisture, individual pieces should be gently wrapped and kept in a cool, shaded environment after excavation. Artifacts of small or medium size may be transported from the field to the laboratory in an insulated cooler. Refrigeration is recommended until drying or consolidation is performed by a conservator.

The application of fungicides to eliminate fungal growth was a common practice in the past, but is no longer recommended because fungicides interfere with dating and analysis, are difficult to remove, and pose potential health risks during future handling of the materials.

Damp wood may require consolidation with a water-based consolidant such as Acrysol WS-24, an acrylic colloidal dispersion. Dry wooden artifacts may be consolidated with solvent-based resins such as Paraoid B-72 (in a combined acetone/ethanol solvent system) by dripping, brushing, or spraying on the surface. The concentration of the solution will vary depending on the condition of the wood - 20%-30% for very degraded objects and 5%-10% for those that exhibit only surface deterioration. Consolidation with organic resins excludes future carbon-14 dating however, and is only carried out when the artifact is too fragile to move. It is difficult to achieve sufficient penetration of solvent-based resins in the
field, particularly in hot climates. Excavated wooden objects are shaded during treatment and covered with plastic sheeting to slow solvent evaporation.

If repairs are required, concentrated solutions of synthetic resins can be used. Wooden fragments in a dry state may be joined with adhesives prepared by the conservator such as Paraloid B-72 in acetone or Butvar B-98 in ethanol. Concentrated solutions of acrylic or polyvinyl acetate emulsions are suitable for repairing damp or waterlogged wood. If unconsolidated wood is to be repaired, the break edges should first be strengthened by the application of a weaker solution (generally 5%-10%) of the resin chosen as the adhesive.

Storage
Dry wooden artifacts and plant materials should be kept in a stable, dark environment (20°C and 40%-50%-relative humidity is preferable). It is particularly important to avoid relative humidity fluctuations that can cause cracking, warping and eventual disintegration of the wood. Boxes made from acid-free cardboard or stable plastics such as polyethylene are suitable for the storage of small objects. Artifacts of irregular shape may require individually designed supports, employing materials such as polyethylene foam and acid-free tissue. Larger objects may be stored on metal shelving units padded with thin polyethylene foam and draped with plastic sheeting to exclude dust and pollutants.

Further Reading


Author
Since 1990, Krysalis Spirydowicz has been the Senior Conservator for the Gordion Furniture Project. She is the Coordinator of Graduate Studies and Professor of Artifact Conservation for the Art Conservation Program at Queen’s University, Kingston, Canada.

ahşap objelerin bu işlem sırasında güneyen korunması ve çözücü buharlaşmasını yavaslatmak amacı ile plastik örtülerle örtülmesi yerinde olaktır.

Eğer onune gerekli ise, yaşantıcı olarak sentetik reçinelerin yoğun çözeltleri kullanılabilir. Kuru haldeki ahşap objeler konservatör tarafından hazırlanacak Paraloid B-72 (aseton ile) veya Butvar B-98 (ethanol ile) birleştirilebilir (Koob, Spirydowicz). Yoğunluğu yüksek akıllık çözeltleri veya polivinil asetat emülsiyonları ise nemli veya suda doymış ahşap buluntuların onarılmasında kullanılabilir. Eğer ahşap sağlamlaştırılmadan onarılacak ise, kırık kenar yüzeyleri yaşantıcı olarak seçilen reçine ile hazırlanmış bir çözelti ile (%5-10 oranlarında) sağlamlaştırılabilir.

Depolama

Kaynakça


Özgeçmiş
Archaeological Sites in Turkey with Active Conservation Programs

Field Notes is a series of essays written by professional conservators and archaeologists. They are intended for archaeologists, conservators and students as resource guides for the stabilization and preservation of excavated materials and archaeological sites.

For additional copies of Field Notes, or more information about the series, please contact: Japanese Institute of Anatolian Archaeology, Resit Galip Cad. 63/1, Gaziosmanpaşa, Ankara, TURKEY, Tel: 90-312-437-7007, FAX: 90-312-446-6838.

Kaz Notları profesyonel konservatör ve arkeologlar tarafından yazılmış olan bir makaleler dizisidir. Arkeologlar, konservatörler ve öğrenciler için kazı buluntuları ve arkeolojik ören yerlerinin stabilizasyonu ve korunması ile ilgili kaynak rehberi olarak hazırlanmıştır.