

# ANCIENT EUROPE

8000 B.C.—A.D. 1000

ENCYCLOPEDIA OF THE BARBARIAN WORLD

VOLUME I  
THE MESOLITHIC TO COPPER AGE  
(c. 8000–2000 B.C.)

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## TRADE AND EXCHANGE

Ancient trade is a major focus of archaeological research, as its study may reveal not only economic aspects of ancient societies but also the social and political setting within which it occurred. In the last quarter of the twentieth century and into the present, advances in analytical methods have greatly improved the methods of determining the source of archaeological materials, while more sophisticated theoretical approaches have affected the ways in which archaeological data relevant to trade systems have been interpreted. These advancements are reflected in the goals, design, and implementation of modern studies of ancient trade and exchange in Europe. Determining the origin or provenance of archaeological artifacts, which requires following a number of scientific principles and prerequisites, is itself not the end of a trade study but establishes only the first link in a chain that also may include procurement, transport, manufacture, use, recycling, and disposal. The reconstruction of this entire sequence of activities is necessary for a full understanding of the associated human motivations and types of behavior. In Europe and the Mediterranean, many successful studies of trade and exchange have been done on stone (obsidian and marble), ceramics (amphorae and decorated pottery), and metals (copper, lead, and silver), providing important information about interregional contacts and social and economic systems and the manner in which they changed over time.

### TRADE AND EXCHANGE

In modern economics, trade is defined as the mutual movement of goods between hands, but in the ar-

chaeological record, it is only the movement of the goods themselves, rather than their ownership or possession, which is easily recognizable. Anthropologists ultimately seek to establish a cultural biography for these goods, starting with the procurement of their raw materials and ending with their disposal. Furthermore, their exchange is not simply an economic transaction but also involves social relationships that may be the main purpose of the activity.

Anthropologists have defined three modes of exchange: reciprocity, redistribution, and market exchange. Reciprocity refers to balanced exchange between relatively equal individuals, whether it involves everyday items or a gift that creates an obligation for a reciprocal return gift later on; this exchange occurs in all societies. Redistribution, however, requires a centralized organization in the acquisition of goods and typically is associated with chiefdom or state-level societies. The centralized authority may acquire goods through control of production, taxation, or tribute collection. Market exchange combines the existence of a central location where trade can take place with a sociopolitical system in which free bargaining is possible.

Archaeological interest in trade and exchange has been very high since advances in analytical instrumentation in the 1960s and 1970s made it possible to chemically characterize or "fingerprint" such materials as obsidian, greenstone, marble, ceramics, copper, lead, and amber. Much effort has been devoted to the methods used to source arti-

facts, obtaining results for specific materials and places, and to their interpretation.

Among the early models proposed to explain trade are the gravity model, used to describe interaction zones in which different sources “compete” for market share, and falloff curves, in which artifact frequencies are graphically plotted against source distance. The shape of the falloff curve is determined by particular exchange mechanisms, and the slope or angle of falloff is determined by such factors as demand, transportation costs, and the availability of alternative materials. While such simplistic models may be useful in an exploratory sense, the circumstances surrounding ancient trade, as represented in the archaeological record, may have been quite complex. For example, exchange may have been sporadic, disrupted at times, or otherwise dynamic on a seasonal or other basis; populations and settlements may have grown or changed size; and several exchange mechanisms may have been in effect at the same time. Objects may have moved alone, as trade or gift items; along with individual people (traders, craftspeople, or brides); or with groups (migration, colonization, war, or foraging). Nevertheless, while interpretations of ancient trade mechanisms and circumstances may change, the determination of the source of a traded item will always demonstrate that at least indirect contact existed between two places and that cultural ideas, knowledge, and materials not preserved in the archaeological record probably also were moving about.

Flaked-stone artifacts are among the most common in the archaeological record and often are made from materials that do not occur locally (e.g., obsidian and flint). They are the products of several distinct types of behavior, which may have occurred at different times in different places:

- acquisition of the raw material
- preparation of a core
- flaking, trimming, and shaping
- use
- maintenance or modification
- disposal

In addition, their presence at a particular site will have been affected by such variables as the rarity of the raw material, the number of production

stages necessary, whether specialists played a part in production, and how long a tool retained its usefulness. Finally, the movement or trade of these stone artifacts may not have been strictly for their utility as tools but instead as prestige items used only by select individuals or under special (such as ritual) circumstances.

Stone used for axes and other ground, rather than flaked, tools also was often traded over great distances in prehistoric Europe, under the constraints of a similar set of factors and variables. By the Iron Age (the first millennium B.C.), however, stone tools largely were replaced by metal ones, and by Roman times the stone material most widely traded was marble, used mainly for sculpture. Besides the complex sociopolitical systems of classical Greece and Rome that created this demand, large labor forces and advanced transportation methods were able to support the trade of many tons of marble from sources in diverse areas of southern Europe.

Ceramics are very common at archaeological sites beginning in the Neolithic period (by the seventh millennium B.C. in southeastern Europe and somewhat later in the rest of Europe). The finished product, like flaked, ground, or carved stone, was the result of significant effort by experienced craftspeople. Production was even more complex, in that it involved the acquisition not only of clay, which probably was available locally, but also of temper and, in many cases, pigments for painting as well as fuel for firing. Unlike the attributes of stone tools, some of the most important properties of ceramics (form and decoration) were determined entirely by their makers. While ceramics may have been traded because of variance in these characteristics, in many cases it was the contents of ceramic vessels (e.g., amphorae) that were the primary materials being traded over large distances.

Metal artifacts also were the result of considerable effort and transformation from the raw ore. Unlike clay, most metal ores were not readily available, and it was necessary to expend significant effort in their acquisition; an even greater amount of flux and fuel was necessary for the smelting process, not to mention the furnace and its accessories. While the subsequent melting of already purified metal for casting artifacts was less complex and could have been done in any village settlement,

smelting would have required greater labor organization. By the Copper and Bronze Ages (fourth through second millennia B.C.), both purified metals (lead, silver, gold, copper, and tin) and finished, often alloyed (for instance, bronze) artifacts were traded over great distances in Europe and the Mediterranean. Unlike stone tools and ceramics, metal artifacts could be entirely recycled and turned into new objects.

Although stone, ceramics, and metals may be the most common materials found at archaeological sites, they were not the only materials traded in prehistoric Europe, nor are they the only ones for which one can potentially establish a source. Among the other trade items that have been studied are amber, a natural resin, and glass, another pyrotechnological product that became common only in the Roman period. As will become evident, however, trade studies have focused on ceramics and a few types of stone and metals because of their properties that allow artifacts to be matched scientifically with the source of their raw materials. European trade in obsidian and copper is discussed in further detail later.

#### PRINCIPLES OF PROVENANCE STUDIES

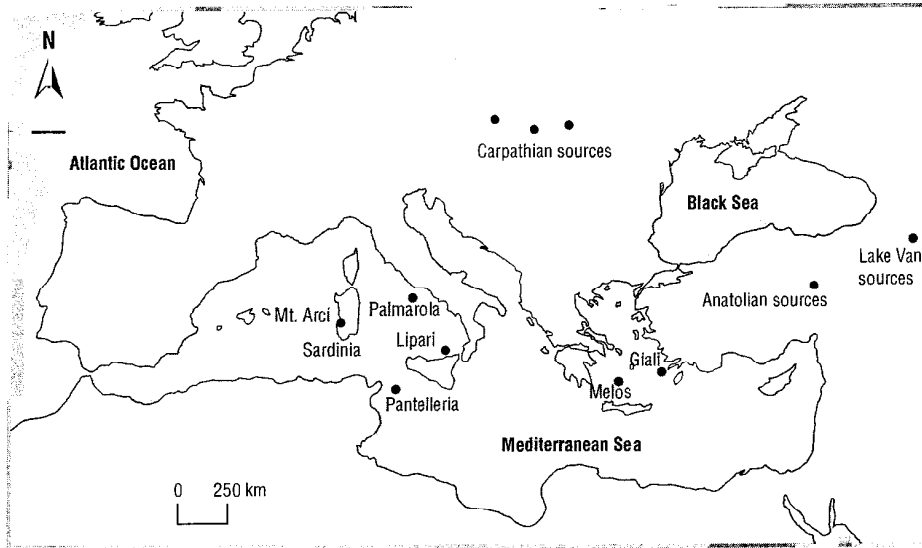
For a provenance study to be successful, there are several prerequisites: all relevant sources must be known; these sources must be characterized in terms of the physical properties or parameters (e.g., mineralogical, elemental, or isotopic composition) that are to be measured for the artifacts; one or more properties must be homogeneous within an individual source; measurable, statistically valid differences between sources must exist for one or a combination of these parameters; and these differences must be measurable using analytical methods appropriate for archaeological artifacts. In general, provenance studies are most successful when the number of possible geological sources is naturally limited. While many potential sources may be effectively excluded because of geographic distance (especially in certain time periods), a situation in which artifacts from "unlikely" sources are never identified as such must be avoided. With fewer natural sources, there is less chance of additional sources remaining unknown, there is a smaller total number of specimens to be characterized (advantageous in

terms of time and cost), and the likelihood of finding a parameter that meets the last three prerequisites cited earlier will be much greater. The characterization of obsidian in Europe, the Mediterranean, and the Near East is the classic success story for just these reasons.

#### ANALYTICAL METHODS

For stone materials, characterization begins with macroscopic observations and measurements of such properties as color, luster, other aspects of appearance, density, hardness, and refractive index. One of the few examples where these properties have been sufficient by themselves to distinguish reliably among sources is in Malta and the south-central Mediterranean, where dark green obsidian is from Pantelleria and black or gray obsidian most probably is from Lipari (which only occurs on Lipari and not the other Aeolian islands). Microscopic examination of a petrographic thin section, which allows for identification of the mineral grains and inclusions, commonly is used both for stone and ceramic materials, but it is destructive to the artifact, since a sample at least 1 square centimeter must be removed. There are many examples where petrographic analysis alone has been enough to distinguish lithic sources, for example, greenstones in the Alpine region and in southern Italy. Some success also has been achieved in establishing the source of flint using a combination of macroscopic and microscopic analysis. Petrographic analysis of ceramics usually cannot identify a particular geological source unless it has very uncommon mineralogical characteristics; strong matches, however, can be made between ceramic artifacts from different sites, including discards, or "wasters," from unsuccessful firings.

Since the early 1960s instrumental methods of chemical analysis have been used very successfully in archaeological provenance studies. Obsidian has proved to be ideal for such studies, although success also has been achieved with other stone materials, ceramics, and even certain metals. Numerous different analytical methods have been employed with good results in provenance studies. The most common elemental methods of analysis currently in use are neutron activation analysis (NAA), x-ray fluorescence spectroscopy (XRF), proton-induced x-ray



European and Mediterranean obsidian sources. DRAWN BY ROBERT H. TYKOT.

and gamma-ray emission, and inductively coupled plasma spectroscopy (ICP-S, or just ICP).

Isotopic methods include thermal ionization mass spectrometry (TIMS), used for precise measurements of the isotope ratios of heavy elements (e.g., lead and strontium); stable isotope ratio analysis for light elements (among them, carbon and oxygen); and ICP mass spectrometry (ICP-MS), which measures the abundance of both elements and isotopes for a large range of elements. Isotopic methods are particularly useful for provenance studies, because elemental composition may be quite different between a raw material (a metal ore) and a finished product (a metal artifact), whereas the relative abundance of the isotopes of most elements remains unchanged. TIMS has been employed extensively for lead isotope analyses of copper, lead, and silver objects in the Mediterranean, while ICP-MS with a laser ablation device is now being extensively used on a large range of materials.

With all chemical studies, sufficient samples from each potential source must be analyzed to establish its variability before artifacts can be reliably attributed. For Mediterranean obsidian, bivariate plots of certain trace elements often are sufficient to assign artifacts to well-defined source groups, but multivariate statistical analysis is necessary in provenance studies of most other materials.

#### OBSIDIAN

The first successful provenance study of obsidian relied on trace element concentrations of barium, zirconium, niobium, and yttrium, measured by optical emission spectroscopy, to differentiate many, but not all, of the sources in Europe and the Near East (see map). More detailed examination of the Mediterranean sources in the 1970s and 1980s, using NAA and XRF, was completely successful not only in attributing artifacts to specific islands (Giali, Lipari, Melos, Palmarola, Pantelleria, and Sardinia) but even in distinguishing among multiple flows in a single volcanic complex, usually the result of multiple eruptions over a geologically short span of time, on some of the island sources and the complex sources of central Europe and Anatolia. It was only in the 1990s, however, that the sources in Sardinia were fully identified and characterized and large numbers of artifacts were analyzed from many sites in the central Mediterranean. These studies began to reveal patterns in the exploitation of the different obsidian sources and thus emphasized the importance of assigning artifacts to specific source localities. In Sardinia, it is possible to distinguish chemically among several geographically specific sources in the Monte Arci area. Three (Sardinia A or SA, Sardinia B2 or SB2, and Sardinia C or SC, each a chemically distinct subgroup and a physically distinct flow or outcrop location) were used widely and have distinctive characteristics that might have been

important in their exploitation by prehistoric peoples (such as accessibility, size, and quantity of source material; color, transparency, and luster; and fracture properties).

Exploitation of the obsidian sources in Anatolia and on the island of Melos began in the Upper Palaeolithic period, the latter source demonstrating that sea travel began very early. While obsidian was not used prior to the Neolithic in the central Mediterranean, by the sixth millennium B.C. it was being traded several hundred kilometers from the island sources, reaching as far as southern France, north-eastern Spain, Dalmatia, and North Africa. Ten or more artifacts have been analyzed from about fifty sites in this region and allow for hypothesis testing and interpretation that was not possible with limited numbers of analyses. For example, it might have been expected that, during the Early Neolithic (c. 6000–5000 B.C.), less-organized selection of source material would result in the use of obsidian tools from many sources. By the Late Neolithic (c. 4000–3000 B.C.), however, procurement would have been better organized, focusing on the glassier Lipari and SA obsidian and featuring more efficient reduction technology in the production of cores and blades. Instead, at such sites as Filiestru Cave in northwestern Sardinia, the use of SB2 obsidian from the western flanks of Monte Arci declined over four Neolithic cultural periods, while the use of an opaque, less-glassy type of SC obsidian from the northeastern part of Monte Arci increased. Type SA is never more than 20 percent of the assemblage. At the same time, even though the similar frequencies of the Sardinian sources at sites in Sardinia, Corsica, and northern Italy is consistent with a down-the-line type of exchange system, the fact that more than 90 percent of the Sardinian obsidian found at sites in southern France is of type SA suggests differences in obsidian use or exchange mechanisms there.

These different obsidian use patterns—both geographic and chronological—imply that the cultural factors and exchange mechanisms involved in the life history of Mediterranean obsidian artifacts were complex. Obsidian may not always have been dispersed through simple down-the-line transactions from its respective source zones. It also is possible that maritime contacts between Sardinia and the mainland were not necessarily routed across the shortest open-water crossings (from Sardinia to

Corsica to Elba to Tuscany and then northward along the coast to Liguria and southern France). Differences in what obsidian tools were used for, especially if considered in the context of locally available alternative lithic resources, may correlate with obsidian selection and can be investigated through the integration of provenance determination with typological and use-wear analysis. Continued research in this area will go beyond the documentation of the provenance and quantity of obsidian that was exchanged during the Neolithic and will provide significant contributions to the understanding of exchange itself and the cultural system in which it operated.

#### COPPER

By the Late Bronze Age (c. 1600–1200 B.C.), bronze tools and weapons were in high demand in many societies. In the eastern Mediterranean, much of their production and trade must have been to satisfy the needs of the state-level societies of Greece, Crete, Anatolia, and Egypt. While the tin sources are still unclear, archaeological and analytical evidence points to Cyprus (from which the word “copper” is derived) as the most important copper source in this region. Several sites on the island have produced evidence for smelting of copper ores, including slag, tuyeres, and crucibles.

The best evidence for trade in Cypriot copper, however, comes from a characteristic style of pure copper ingot found off the island. Copper oxide ingots, weighing, on average, about 30 kilograms and resembling the stretched-out hide of an ox (most likely shaped that way to facilitate carrying), are known from sites in Cyprus, Crete, Greece, Turkey, Israel, Egypt, Albania, Bulgaria, Sicily, and Sardinia as well as the famous shipwrecks at Cape Gelidonya and Uluburun in Turkey (fig. 1). Most of the known ingots come from shipwrecks or from coastal sites, suggesting the importance of seaborne traffic for their distribution. Excavation of the shipwrecks at Uluburun and Cape Gelidonya, of the fourteenth and thirteenth century B.C., has indicated that large cargoes of copper and tin ingots, glass ingots, ivory, ostrich eggs, ebony logs, myrrh and frankincense, and probably resins, olive oil, and wine were transported regularly over great distances in the eastern Mediterranean. The personal possessions found on-board both wrecks point to the Levant as the home

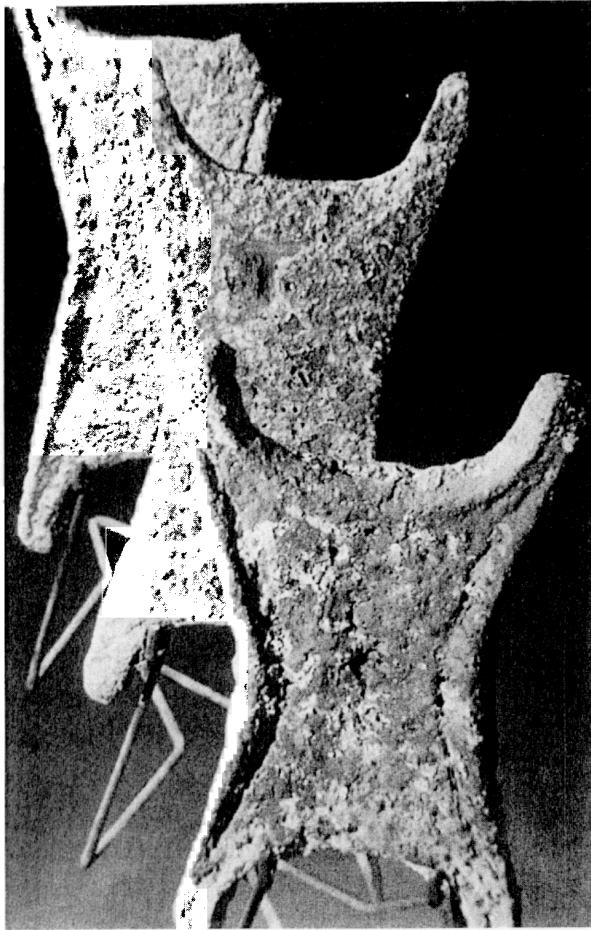


Fig. 1. Oxhide ingots from the Cape Gelidonya shipwreck. COURTESY OF ROBERT H. TYKOT. REPRODUCED BY PERMISSION.

of the crew. The locations of these wrecks and the main cargo items on board indicate that they were heading west, while archaeological evidence and ancient texts suggest that shipments also must have headed south to Egypt.

While copper sources also existed in many of these areas, copper is a refined product, ready for alloying and casting, and thus would have been immediately useful and exchangeable for other goods at any Bronze Age settlement regardless of its location. Nevertheless, it also is possible that local copper was used to make “oxhide” ingots, under the control of Aegean or Levantine prospectors, or simply to imitate a recognized standard type. Modern mass spectrometers are sensitive enough to measure

copper and silver artifacts containing trace quantities of lead in addition to lead objects. The lead isotope ratios determined for copper artifacts thus can be matched directly to known ore samples, because the ratios of the isotopes do not change during the smelting or refining process, although the quantity of the element does.

In the last two decades of the twentieth century an extensive database of lead isotope ratios for copper and other ores throughout Europe and the Mediterranean was established, and many ingot and artifact collections were tested. The results obtained strongly indicate that Cyprus was the source of the vast majority of the copper oxhide ingots, including those found in Sardinia, an island with its own significant copper sources. At the same time, the lead isotope ratios for artifacts and other shaped ingots match those of the local ore sources, although there is also evidence that artifacts may have been made of mixed ores or recycled copper and bronze. Since oxhide ingots (though they are of pure copper) could not have been made in a single smelting but must have been remelted, they, too, could have mixed lead isotope ratios. This possibility has generated some debate over the reliability of the lead isotope approach, since the mixture of ores from two different sources might result in values similar to a third that has not yet been found or documented. It is always possible that some artifacts were made from small ore deposits that are now worked out, but these items should constitute only a fraction of the overall production, and for the most part, the analyses of the oxhide ingots have produced very consistent results. Mycenaean-style ceramics found at many of the same sites where oxhide ingots have been found also have been chemically tested and shown to match Aegean clay sources. Thus, it is socioeconomically likely that copper ingots and many other materials were traded together with these ceramics and their contents, both by land and by sea.

## CONCLUSION

Many lessons can be learned from the few examples of European provenance studies presented here. First, the obsidian case study highlights the importance of complete characterization of all relevant geological sources before the analysis of archaeological artifacts. In addition, the analysis of large numbers of artifacts from good archaeological contexts

lends greater significance to the results obtained and to their interpretation, which varies geographically and chronologically. From an analytical perspective, obsidian is ideal because many techniques can produce the desired results, and methods that are minimally destructive or nondestructive can be selected. The second case study, on copper, reveals the greater complexity—in terms of both methodology and interpretation—of studying trade in materials that have been changed radically from their natural sources. Nevertheless, when ore sources have not been mixed, the trade in copper, lead, and silver can be reconstructed. In both examples (obsidian and copper), the trade in these particular items must always be considered in the context of other materials that also were likely to have been exchanged, keeping in mind that stone, ceramics, and metal are the main items left behind in the archaeological record.

See also Trade and Exchange (vol. 2, part 7).

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