



Glass of the Ancient Mediterranean

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At the junction of artistry and craftsmanship, ancient glassmakers combined an eye for beauty with technical virtuosity. Over approximately three thousand years, glassmakers in the ancient Mediterranean region produced stunning vessels incorporating a variety of manufacturing techniques and decorative treatments.

From its origins in third millennium BC Mesopotamia and its further development in New Kingdom Egypt, to its widespread popularity in the Roman and Byzantine Empires, glassmaking evolved through innovation and experimentation. Some trends quickly came in and went out of style, while other changes revolutionized the industry and continue to be used by modern glassmakers. The result is a vibrant display of ancient technology and aesthetics.

The Yale University Art Gallery is home to one of the most extensive collections of ancient glass in the United States, highlights from which constitute this exhibition. Exemplifying major manufacturing and decorative techniques, the pieces on display open a window onto manufacturing, craftsmanship, artistry, daily life, trade, pilgrimage, and luxury in the ancient Mediterranean.

Alabastron (Perfume Container), Eastern Mediterranean, Roman, AD 1st century. Brown glass with white, 9 5/8 x 1 13/16 in. (24.5 x 4.9 cm). Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, bequest of Mrs. William H. Moore. Accession no. 1955.6.34. The color band technique produced the marbled swirls of white on this free-blown vessel.



WHAT IS GLASS?

Ancient glass was made of three main ingredients: silicon dioxide (in the form of sand), an alkali oxide (often soda ash or natron), and lime. When mixed together and heated to 2400–2700 degrees Fahrenheit, the ingredients fused to form glass. Ancient metalworkers and Egyptian ceramic manufacturers may have invented glassmaking by accident as a byproduct of their workshops.

THE HISTORY OF GLASSMAKING

Glassmaking began in ancient Mesopotamia about 2500 BC. Cold-worked, carved glass objects—beads, pendants, and inlays made from molds—provide the earliest evidence for glassmaking. Northern Mesopotamia was home to particularly pioneering glassmakers, who developed the ability to manufacture vessels from hot glass using the core-formed technique in the second millennium BC. These techniques quickly spread to Egypt, where glassmaking flourished by about 1450 BC under the reign of Pharaoh Thutmose III. Egypt not only manufactured glass objects, it also exported raw glass to the growing international market, as evidenced by a large number of blue glass ingots discovered in the fourteenth century BC Uluburun Shipwreck off the southwest coast of Turkey.

Lotus Beaker, Eastern Mediterranean or Italian, Roman, AD 1st century. Mold-blown pale green glass, 4 1/2 x 2 1/2 in. (11.5 x 6.4 cm). Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, bequest of Mrs. William H. Moore. Accession no. 1955.6.271. Clear glass was highly valued in the ancient Mediterranean. The almond-shaped nodules represent the buds of a lotus plant.

The Mycenaeans of mainland Greece and the Aegean islanders also produced glass objects, primarily cast glass jewelry, in the Late Bronze Age (ca. 1500–1100 BC). During the so-called Greek Dark Ages (ca. 1200–800 BC), glassmaking was interrupted in Mesopotamia and the Aegean, but when the eastern Mediterranean emerged from this period of turmoil in the eighth century BC, glassmaking reappeared in Mesopotamia and began to spread west. Both archaeological and ancient written evidence for this survives; glassmaking techniques are discussed in cuneiform texts from the library of the seventh century BC Assyrian king Ashurbanipal at Nineveh. Meanwhile, in



Egypt, glassmaking experienced a decline from the end of the New Kingdom (ca. 1081 BC) until about the fourth century BC.

From this point onward, glassmaking developed uninterrupted into the Hellenistic and Roman Imperial periods, using both core-formed and the new cast glass techniques. Following the invention of glass blowing in modern-day Israel in the second to first centuries BC, the glass industry boomed as the Roman Empire expanded, facilitated by the simpler technology, burgeoning production, and lower prices. From the first century onward, glassmaking centers were established throughout Italy and elsewhere, notably in Cologne, Germany, but also in provinces like Britain and Gaul.

This commercial success lived on in the post-Roman eastern Mediterranean where glassmaking continued during the Byzantine Empire in AD 500–700. Spanning approximately three millennia, the history of glassmaking in the ancient Mediterranean is a fascinating case study in ancient materials and technologies.



Palm Column Flask, Egyptian, New Kingdom, Late Dynasty 18–19, ca. 1400–1200 BC. Blue core-formed glass with yellow and white trailed threads, 3 3/8 x 3/16 in. (8.5 x 1.5 cm). Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, bequest of Mrs. William H. Moore. Accession no. 1955.6.1. The column flask was a common type of core-formed vessel made between ca. 1400–1250 BC and was used to contain cosmetics. The vessel's mouth is decorated with stylized palm fronds.

The single most significant development in ancient glassmaking technology was the invention of **free-blown** glass in the second to first centuries BC, in which the glassmaker used a hollow tube to inflate a gob of glass, which could then be manipulated to produce different shapes and color effects. It was this innovation that allowed glassmaking to become inexpensive and efficient, making glass vessels of almost every shape and function available to an ever-expanding market. The ancient free-blown technique remains the basis for much modern glassmaking.

MANUFACTURING TECHNIQUES

From its beginnings in small cold-worked objects, glassmaking evolved to produce vessels that at first were valuable objects available only to elite patrons and then became common household wares. Changes in manufacturing techniques largely determined the proliferation and value of glass objects.

The first manufacturing technique using hot glass to create vessels is known as **core-formed**, or sandcore, technique, which involved coiling hot glass around a core of sand, clay, or other material in the shape of the desired vessel, usually small bottles or jugs.

From the core-formed technique, glassmakers discovered that placing cut sections of glass cane into a mold and melding them together with heat produced beautifully contoured open vessel forms, generally bowls, cups, or plates. Polychromatic forms of this **cast**, or mold-pressed, technique are mosaic (or *millefiori*) and marbled glass, which used sections of multiple colors to produce vibrant patterns.



Deep Ribbed Bowl, Eastern Mediterranean, Alexandrian, Graeco-Roman, 1st century BC–AD 1st century. Dark blue glass with yellow and white, 2 1/16 x 4 3/16 in. (5.16 x 10.9 cm). Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, Bequest of Mrs. William H. Moore. Accession no. 1955.6.17. A marbling technique, similar to the mosaic technique, was used to create this cast bowl. Sections cut from canes of glass were placed in the mold and then stretched and manipulated during fusing to create the marbled coloring.

From free-blown glass evolved the technique of **mold-blown** glass, in which the glassmaker inflated the gob of hot glass into a multipart mold, which could then be opened and removed in order for the vessel to be completed with the addition of a foot, handles, etc. This technique combined the efficiency of free blowing with the regularity and precision of shape and relief decoration allowed by a mold.

DECORATIVE TECHNIQUES

Ancient glassmakers enhanced their vessels through the use of color and varied decorative techniques. Left uncolored, natural glass has a yellow-green or blue-green hue. Various mineral compounds could be mixed into the raw glass to achieve different colors. Copper compounds, for example, produced blue glass, while manganese oxides produced pinks and purples. Colorless glass imitating rock crystal was achieved by adding manganese dioxide.

Marvering, in which the warm vessel was rolled on a slab, integrated trails of colored glass into core-formed vessels, creating striped and zigzag patterns. Cast glass produced stunning mosaic designs. But



Bottle with Plant Motifs, Eastern Mediterranean, Romano-Syrian, AD 1st century. Mold-blown opaque white glass, 3 3/4 x 1 3/8 in. (8.3 x 4.2 cm). Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, bequest of Mrs. William H. Moore. Accession no. 1955.6.52. The intricately decorated panels display the level of detail mold-blowing could achieve and associate this vessel with the workshop of the glassmaker Ennio.

it was free-blown glass and its offshoots that allowed for the greatest variety of decoration, beginning with color band and splash glass. Free-blown vessels could also be manipulated with various tools to create effects like pinched ribs or to apply trailed patterns and handles.

Mold-blown glass vessels bear a wide variety of relief decoration, ranging from simple geometric patterns and floral motifs to artists' signatures and complex figural scenes. Decoration could be used as a marketing tool to appeal to a specific clientele, as with the Jewish and Christian symbols used on pilgrim flasks. The relief patterns on some mold-blown vessels, even in the absence of an artist's signature, are sometimes indicative of the vessels' origins in a particular workshop.

Facet cutting using abrasive wheels created simple but elegant geometric patterns on colorless free-blown vessels. Some glassmakers experimented with a combination of techniques, resulting in vessels like the Honeycomb Beaker. Ancient glassmakers were experimenters and innovators who explored the full spectrum of potential manipulation of the vessels they created, often producing remarkable results.



Honeycomb Beaker, *Eastern Mediterranean or Western Provinces, Roman, AD 4th century. Transparent yellow-green glass, 4 5/8 x 4 3/4 in. (11.7 x 12.1 cm).* Yale University Art Gallery, Hobart and Edward Small Moore Memorial Collection, bequest of Mrs. William H. Moore. Accession no. 1955.6.71. A combination of casting and free-blowing created the honeycomb pattern. The ability to experiment with combined manufacturing techniques was one of the opportunities that the free-blown technique provided.

GLASSMAKING WORKSHOPS

Every glass vessel produced in antiquity originated in a glassmaker's workshop. Unfortunately the specific location of the majority of these workshops remains unknown. Through artists' preferred vessel shapes and decorative schemes, and the occasional appearance of an artist's signature, groups of vessels can be determined to have come from the same workshop(s). Some vessels bear plant motifs in relief that can be traced to similar examples signed by the famous glassmaker Ennion, while others bear Greek inscriptions wishing good cheer to the user.

Glassmaking workshops spread from the eastern reaches of the Roman Empire, particularly the Levantine coast, to the western provinces in modern day Europe. Like other artists in the Hellenistic and Roman worlds, glassmakers traveled in search of commissions and new markets; their mobility further complicates modern efforts to understand the ancient

industry. We may never know the precise locations of most glassmaking workshops, but archaeological evidence aids in approximations.

SUGGESTED READINGS

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Glass Pitcher, *Eastern Mediterranean, Roman, ca. 3rd–4th century AD. Free-blown yellow-green glass, 11 3/16 x 3 3/16 in. (29.4 x 9.1 cm).* Yale University Art Gallery, gift of Stephen V. Kobasa, M. Div. 1972, in memory of Ella Wakeman Calhoun, 1921. Accession no. 1986.80.1. The pitcher's tall, elegant form is one of many versatile shapes that the invention of the free-blown technique made possible for ancient glassmakers.

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EXHIBITION CURATED BY Sara E. Cole

ON THE COVER: Jar With Sixteen Handles, *Eastern Mediterranean, Roman, AD 4th–5th century.*
Glass, 6 3/16 x 3 7/8 in. (16.6 x 9.9 cm). Yale University Art Gallery, Anna Rosalie Mansfield Collection.
Accession no. 1930.429. This jar is an example of the trailing decorative technique. The sixteen handles encasing the vessel were made from trailed coils of hot glass.