

# The history of glass making



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The history of glass making goes all the way back to ancient Egypt and Mesopotamia. For centuries glass was made in these areas, and the craft of glass making traveled throughout the Middle East and Near East. One of the most important regions for glass making was Ancient Syria. It was in Syria that the craft of hand-made glass became a well-established skill which was sought after by many throughout the ancient world. During the 7<sup>th</sup> century through the 9<sup>th</sup> century the flourishing Syrian glass industry existed in Damascus, Sidon, and Tyre, as well as the famous city of Raqqa. These cities became the hub in which merchants and sailors were the main transmitters for the spread of glass artifacts and the trade itself. These merchants spread the craft glass making from Syria throughout the Mediterranean world and eventually into Europe via Italy (Glassmakers, 2016).

It is important to discuss the history of glass and how it ultimately became the craft we see in the Islamic era of ancient Syria and the surrounding areas. It was believed that the first glass was made accidentally. According to Eichholz, it was Pliny the Elder who wrote in the first century AD that glass was initially discovered because merchants in the region who were known to trade in “Soda” had docked along a beach to cook a meal, and needed a way to support their cooking vessels. Because there were no stones readily available they decided to use lumps of soda from their ship to support the cooking vessels. When the soda lumps became hot, they fused with the sand from the beach; the sailors noticed that streams of an unknown clear-ish liquid flowed from beneath the cooking vessels. It was later identified as some of the first known glass. This account is most likely untrue because glass had been found in the archaeological material record dating back to as

many as 2500 years earlier. But this was one of the first written records confirming the knowledge of glass. (Pliny, *NH* 36. 65; Eichholz, 1962, 151).

The base ingredients of early glasses were silica, soda, and lime. In the early Mediterranean region, these three ingredients were found in the form of natron (soda) and sand which contained shell fragments (silica and lime) or calcium-free sand and crushed quartzite. The raw materials used by glassmakers in ancient Syria in the middle of the first millennium A. D. were natron and calcium-rich sand. Some of these ingredients were readily available and were collected on local beaches; the most well-known source was the beach at the mouth of the Belus (Na'aman) River. Most of the deposits of natron in the Mediterranean were found in the Wādi el-Natrūn, an area located between Cairo and Alexandria, in Egypt (Corning, 2019).

Some of the manufacturing techniques for glass remained relatively the same for centuries, but due to political and environmental issues the ingredient list changed. The key ingredients, specifically natron, changed dramatically. (Burke, 2019). Accessibility of natron became scarce and caused ancient glassmakers in Syria to source new materials to keep the industry alive and thriving. The best example of this change in base materials was the switch for Syrian glassmakers from Egyptian natron as a flux to a plant-based alternative found locally. The switch to plant-ash from natron was an expensive transition. At the site in Bet She'arim, Israel, too much lime in the batch was introduced by glassmakers, by combining calcium-rich beach sand and one perhaps less familiar ingredient calcium-rich plant ash, and caused the melt to fail. This resulted in the reported loss of nearly nine tons of raw glass. The severity of this loss suggested that this

new ingredient (plant-based ash) was forced upon Syrian glassmakers for reasons beyond their control (Freestone, 1999).

Understanding the major steps in glass production and drawing a distinction between the two “ Primary” and “ Secondary” is important to get the full picture of the size of early Syrian glass making. Primary glass production is the first step of the glass making process which involves collecting and heating raw ingredients to form large chunks of raw glass which would be heated in large kilns (Tank Furnaces). Once these chunks were cooled, they were broken into manageable pieces sometimes referred to as “ Ingots.” These raw chunks of glass would then be shipped to “ Secondary” glassmakers for forming into their final designs. The Secondary production of individual artifacts made from the raw glass was a craft which was highly skilled. These craftsmen often required years of apprenticeship. Another key difference was the location of these secondary sites. There were usually geographic differences in both primary and secondary production. Primary production often took place at sites which were located closer to both the raw ingredients but also close to areas with enough “ Fuel” to fire the enormous kilns needed to support the large scale primary glass manufacturing. There has been substantial archeological evidence supporting the separation of these production sites. Some evidence has been collected from shipwrecks in the Mediterranean area which had glass ingots in their holds (Gan, 2017, 269)

Secondary glass makers were responsible for finalizing the raw glass into its intended form. Some of the materials used in their trade were “ frits” which were ground glass with minerals added to create colors. Some of the

minerals used were a copper oxide which created a green color, iron which created a yellow/orange color, cobalt created blue colors, and finally, manganese which was used to create a purple or brown color (Burke, 2019). Some of the telltale signs of secondary glass production found on glass artifacts were the “ Molis” which signified the presence of being blown, as well as wasters which were artifacts ruined during kiln firing. The recycling of glass was also prominent during this period (Burke, 2019). Kilns were also used for the annealing process which slowed the cooling of finished glass artifacts. If the glass was cooled too quickly, it was prone to breaking (Corning, 2019).

A good archeological example of glass production was instituted by a ruling Caliph according to Dr. Timothy Insoll and Henderson would have been under Caliph Harun al-Rashid 796-808. It was during this time that Raqqa was the Abbasid capital. Harun al-Rashid built an industrial complex which included glass manufacture. A full glass workshop in Raqqa was surveyed dating back to 804 A. D. which helped outline the shift to the newer and local plant-based sodas for firing glass. It was a large number of “ wasters” found at this site that helped archaeologists understand what this shift may have looked like and it identified the location as a site of glass manufacturing.

The types of finished glass artifacts resulting from secondary production had many uses. The archaeological records from the 6<sup>th</sup> century through the 11<sup>th</sup> century is well documented, and glass played an important role in building materials in the form of windows, all the way down to ornate dromedary flasks for holding high-value liquids. According to Seth C Rasmussen, “

Contact between the Byzantine Empire and the new empire of Islam allowed Islamic glassmakers to add the known Roman and Byzantine glassmaking techniques to their own glassmaking knowledge. As with many chemical arts, this cumulative glassmaking knowledge was then preserved by the world of Islam until the coming of the Renaissance in the West. Glassmaking flowered again for a time, combining Roman knowledge with indigenous traditions.” (Rasmussen & 1001Inventions, 2012). Examples of amazing stained glass windows dating back to 7<sup>th</sup>-century mosques in Syria still show the amazing craftsmanship and chemistry mastery necessary to endure the test of time and remain stunning to this very day.

Another use for glass was for weights and measures purposes. These essential measuring devices had to be calibrated precisely to maintain continuity in the markets, banks, Treasuries, and mints throughout the region. To properly create these glass measuring weights the glassmaker would not only have to have been of great skill and consistent chemistry but also trustworthy to those in charge. Fulghum describes that the original function of the smaller glass discs as being used to not only verify but also to control the weight of gold coins, the large, heavyweights may have been used to weigh commodities (Fulghum, 1998). An exact calibration is often inscribed on early Islamic weights (Fulghum, 1998).

The dromedary flask had a unique history and physical description and required great skill to make at the time. The Metropolitan Museum in New York describes them as playful utilitarian flasks which testify to the transition between two glassmaking traditions, the Roman and the Islamic. They are examples of the versatility and flexibility of glass as a medium, which poses <https://assignbuster.com/the-history-of-glass-making/>

no restrictions on the creativity of the glassmaker. They were often small bottles for ointments or valuable liquids such as essences and perfumes and were transformed into zoomorphic figurines that “ carry” the container as part of their burden. (NY MET, 2002)

“ Once a bottle had been blown and shaped, the rest of the figure was constructed around it from trails and blobs of hot glass, forming the stylized body, legs, head, and burden surrounding the functional vessel. The quadruped with a bottle is typical of early Islamic production. It combines a figure that supports a slender tubular flask known as balsamarium (container for balm) and is in turn encased in a cage.” (NY MET, 2002)

In the case of stained glass produced in the ancient Islamic era between 6-11 ce. There is a good record of both manufacturing techniques and artifacts still in existence. Carboni and Adamjee of the New York Metropolitan museum describe stained glass and the process of making it, “ Painted glass objects were decorated with a brush or a pen once their final shape had been attained. After being painted, they were fired in a kiln at temperatures that permanently fixed the designs on the surface without compromising the object’s shape.”(Carboni & Adamjee, 2002)

Quite a lot of stained glass was produced in Syria from the 7<sup>th</sup> through the 9<sup>th</sup> century. It was painted with pigments containing silver and copper, and then fired in a kiln at a lower temperature. Glass treated this way usually is not considered to be lustrous, the pigment was “ absorbed” below the surface of the glass by a chemical reaction and became permanently colored

and stained, becoming part of its atomic structure. (Carboni & Adamjee, 2002)

Most of the stained glass artifacts from this time are pale-colored glass with decorations in a brownish or yellowish pigment creating a monochrome appearance. Paints made with Silver as their base was known to turn the glass a yellow color initially but as the heat increased these yellows turned progressively more amber and ultimately a deep brown. Paints with a copper-base would become a red almost ruby color; it was extremely hard to fire these copper-based paints and the solution at the time was to add a small amount of silver to the paint to help stabilize the copper pigments. By combining both copper and silver paints, a yellow or orange color could be achieved. Another popular technique was to apply pigments to both sides of an open shaped vessel; this technique allowed glassmakers to highlight details or outlines in the glass and exploited the walls of these artifacts to create shading effects. Even today controlling the firing temperatures and getting the timing correct is one of the most challenging aspects in the production of stained glass objects. (Carboni & Adamjee, 2002)

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