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Ancient Cypriot Glass: Production, Reception, and the Collections at the Claremont Colleges

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Ancient Cypriot Glass:
Production, Reception, and the Collections at the Claremont Colleges

by

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Submitted to Scripps College
in Partial Fulfillment of the Degree of Bachelor of Arts

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Finally, thanks to my parents, John and Jenny Carothers, for supporting and motivating me throughout school and internships.
**Introduction**

In the basement of the Humanities building Scripps College is a collection of—up until recently—long forgotten glass from Cyprus. It is thought to be nearly 2000 years old. There is drawer after drawer full of archaeological glass in blue, green, yellow, turquoise, and clear. Some is iridescent, some dusted with sand, and some milky due to age.

As an art conservation and art history dual major, my focus has always been on pursuing art conservation as a career. Therefore, I wanted to write a thesis that was hands-on and incorporated conservation. That this is a collection of archaeological materials is also in keeping with my particular interest within the field of conservation. This project has included research, sorting through primary source documents, and visual and scientific analysis of objects. While I could not conserve any actual pieces from this collection, I wrote condition reports for them as well as recommendations for stabilization and for the future. One of the goals of this thesis was preparation for future projects in the field of conservation.

While I was selecting this collection to be the focus of my senior thesis in Art Conservation and Art History, the Mudd family and Harvey Mudd College were in communication with the University of Cyprus regarding the same collection. As my research started in earnest over the summer of 2018, a decision was reached to send the Mudd collection back to Cyprus, as a donation to the University of Cyprus in Nicosia. Thus, after being ignored for decades, the collection was coincidentally the subject of a thesis and in the beginning stages of a voluntary repatriation in the same year. This gave a sense of urgency to researching this collection, as it needed to be examined and recorded before travel. Therefore, if anyone was going to do it, it would have to be me.
This collection of glass proved to be difficult to work with, due to its complicated ownership history. When asked, some told me it was donated to Harvey Mudd college, while others said the glass still belonged to the Mudd family. Either way, it had been stored in the basement at Scripps for decades. Additional research confused things further, as it became clear that there was other glass mixed in with the Mudd collection. These pieces were also from Cyprus but are presumably owned by Scripps.

This thesis comprises of five chapters. The first chapter focuses on the collection itself and includes a brief summary of the founding of the Mudd family’s Cyprus Mines Corporation, which led to the collection of the glass. The repatriation of the collection is also detailed. The second chapter examines the history of Cyprus, and how valuable resources such as copper led to trade on the island. A history of glass is given: how it was made, what it was made out of, and how it was used and appreciated at different times in history. The third chapter addresses the history of the glass trade and production on Cyprus. Island-specific shapes and production are explored. This chapter also looks at how glass was valued and used by different levels of society as glass production evolved and led to a saturated market. The fourth chapter focuses on five pieces selected from the Scripps and Mudd collections. These case studies include conservation condition reports. Physical description, condition, use, and similar examples in other collections are detailed. The final chapter addresses glass conservation. It contains an analysis of previous conservation interventions, descriptions of different types of weathering and degradation, and tips for stabilizing, storing, shipping, handling, and displaying the collection.

It would appear that oftentimes, more scholarship has been done to document the history of ceramics and metalwork that were produced on Cyprus, at the expense of glass. This makes some sense, as there is no evidence that Cyprus was at the forefront of innovation with regards to
glass-working. However, glass appears to have been routinely ignored by most scholars who focus on archaeological goods from Cyprus. There are a few researchers who study Cypriot glass, such as Ian Freestone and Andrea Ceglia, but oftentimes the scholarship focuses on Byzantine production at the expense of the origins of the glass industry on Cyprus during Roman rule. The Ringling Museum’s collection of ancient art from Cyprus, for example, has a 75-page catalogue. Only five of those pages are dedicated to glass. The Museum of Art and Archaeology at the University of Missouri-Columbia catalogue also treats glass as an afterthought. There are only five pieces of glass listed (taking up a sparse 1.25 pages out of 39), while also cramming all five pieces into one photo for the plate illustration. Thus, while there are a few experts, surveys of ancient art often overlook glass. *Luxus: The Sumptuous Arts of Greece and Rome* is a relatively recent book about luxury goods from the ancient world.¹ It has chapters on precious metals, stones used as intaglios, cameos, and organic materials such as ivory, amber, textiles, and pearls. But there is no section dedicated to glass. This shows a dismissal of glass as a luxury good in Hellenistic and Roman times.

This thesis seeks to place the glass objects from the Scripps and Harvey Mudd collections in their original context on Cyprus. The history of glass production on Cyprus—from ingredient procurement to common glass forms—is examined to understand more about these two collections, and in particular the five objects from the case study. This thesis is also had advice on how to preserve the glass for whoever cares for the collection next.

Chapter One

The Harvey Mudd Cypriot Glass Collection

The history of how the Mudd family came to own a collection of Cypriot artifacts, including glass, is complex. The family’s presence on Cyprus started in the early 20th century, when prospecting for copper. Through most likely a variety of situations—none of which are recorded—glass, copper, ceramic, and bronze artifacts were acquired by Seeley Mudd. The glass eventually ended up in storage at Scripps College, and on display at the Dean’s office at Harvey Mudd College. In 2018, the Mudd family and Harvey Mudd College officials decided that the best place for the entire collection was at its place of origin—Cyprus.

The Cyprus Mines Corporation

The copper mining business run by the Mudd family on Cyprus led to them collecting Cypriot artifacts. In 1913, a prospector for Seeley Mudd and his business associates headed to Cyprus to look for copper. This man, C. Godfrey Gunther, picked the hills inland from Morphou Bay to look for slag heaps and evidence of previous mining. He had gotten the idea to search for copper on Cyprus after reading texts by Homer (who lived somewhere between the 12th – 8th centuries BCE) and Pliny (23CE – 79CE) that alluded to a copper source on the island.

The area that C. Godfrey Gunther picked based on these texts was in the foothills of the Trodos Mountains in the northwest of the country, near the villages of Katydhata and Lefka (figure 47). This land was promising since it had been mined twice previously: during Phoenician rule on the island from 600-200 BCE, and by the Romans, from 200 BCE to 200

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CE. Slag heaps covered the landscape. After taking samples from the older mines, copper was found at the site. In order to avoid paying higher prices as a foreigner renting the land, Gunther approached the Ottoman Bank about the concession and a local sent out to examine the site and take care of the deal more discreetly. During this complicated process, Gunther applied for and received a mining concession from the government of Cyprus sometime between 1913 and 1914. Cyprus became a British protectorate under Ottoman rule in 1878. In early November 1914, Turkish Cypriots announced loyalty to the British and the British formally annexed the island and took control of governance. Due to the complicated regional politics of the time, Gunther’s letter does not make it clear whether or not it was the Ottoman or British government from which he actually acquired the concession. Lavender writes that Gunther had to work with Ottoman land laws, and that the Ottoman bank was involved, so this may give a clue as to whom he was working with. The concession was for one square mile of land to be leased for 50 years. The concession focused on the Foucassa Hill in the Katydhata district. The hill was surrounded by small valleys on all sides. Gunther chose the dilapidated monastery at Skouriotissa as his home base after making arrangements with a Bishop on Cyprus. This included use of the lands belonging to the Skouriotissa Monastery. The monastery and its

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5 H. Robertson Plate, Report on the Skouriotissa Mine, 8.
6 Lavender, The Story of Cyprus Mines Corporation, 75.
7 ibid, 85.
8 C. Godfrey Gunther, “Typed letter, LA, Nov. 17.”
10 ibid, 6.
12 The bishop’s name and city are not mentioned in this letter. However, Lavender refers to both the Bishop of Kyrenia (Lavender, 79) and the Archbishop, Kyrillos III (Lavender, 81) as being involved in the land arrangements. However, Kyrillos III wasn’t made archbishop until November of 1916, which confuses matters.
13 C. Godfrey Gunther, “Typed letter, LA, Nov. 17.”
surrounded lands (totaling 123 acres) to the southwest were also leased for 50 years.\textsuperscript{14} The benefit of this location was that Morphou Bay was just 5.5 miles away, so shipping the copper would be relatively easy.\textsuperscript{15} Even though the mine that Gunther selected was at Katydhata, he referred to the mine as Skouriotissa.\textsuperscript{16} In 1916, the Cyprus Mines Corporation was officially founded.\textsuperscript{17}

**Collecting the Artifacts**

While overseeing the mining operations on Cyprus, Seeley Mudd and his son, Harvey, acquired antiquities. Unsurprisingly, little is known about the objects’ origins. Various stories have been told to me about how they were obtained—from being found in the mines by workers to having been purchased by the Mudds and their employees from dealers and markets on Cyprus. It is possible that both are true. We do know that a remarkable ox hide copper ingot was purchased from a dealer in the 1930s, but I could find no purchase record of less significant pieces.\textsuperscript{18} Because of a lack of records, I have not been able to find information on when the artifacts from Mudd were moved to Claremont. Some of the items from the Mudds had the accession number starting with 74 on them, so it’s possible that the year is 1974.

Looking through Mudd family documents in the Claremont Colleges’ Honnold-Mudd Library, I did not find a single reference to the glass in the collection. In fact, out of all the boxes, only one paragraph was relevant to collected artifacts of any material. The undated document is titled “Mudd, ?.Speech, Skuuriotissa [sic] Mine on Foucassa Hill”. It is unclear when it was

\textsuperscript{15} ibid, 7.
\textsuperscript{16} Lavender, *The Story of Cyprus Mines Corporation*, 84.
\textsuperscript{17} Gilkeson, “Copper and Mudd.”
\textsuperscript{18} ibid.
written, and by whom. It could not have been by Harvey or Seeley Mudd, nor Gunther, because they are named in the speech in the third person—a way that would not make sense if one of them was the speaker. The very last page (figure 38) of the speech has the relevant information:

So in drilling for copper, these Americans come upon something quite startling. They found several tombs and in opening these many objects of interest were brought to light, which the arch_______ [sic] have been able to date as far back as 2700 B.C. and which show evidences of belonging to the Mycean [sic], Egyptian, Phoenicians, Greek and Roman periods. The law is such at present, that when antiquities are discovered, the Cyprus government has 1/3 choice to the find; the country owning the land, the next third and the people doing the discovering the last third or what is left, and here are some of the left overs - Show specimens.19

While the speech was about the history of the Cyprus Mines Corporation, the author ended it by mentioning some Cypriot antiquities. His notes to himself suggest that he had some specimens with him to hold up to the crowd who was listening. There is no mention of what items these may have been. Judging from this text, at least some the items in the Mudd collection were discovered in tombs that were uncovered during the mining process.

Vasiliki “Lina” Kassianidou, a researcher and professor from Cyprus, has also written about the Mudd antiquities. However, her focus is on the bronzes in the collection, not the glass. She writes that many employees of the Cyprus Mines Corporation collected antiquities from Cyprus during their time on the island.20 In a paper about metallurgy at a historic site on Cyprus, Kassianidou writes that the famous ox hide-shaped copper ingot in the Mudd collection was bought in 1936 from a dealer who had acquired it from a clandestine excavation.21 In another paper, Kassianidou writes that the collected antiquities were both bought and found—a specific

20 Kassianidou, “Ancient Copper Mining,” 581.
21 Kassianidou, “Metallurgy and Metalwork,” 86.
hoard of copper and metal artifacts from Mathiatis is referenced as an example.\textsuperscript{22} Purchased items could come from dealers or looters, while found items were uncovered during mining. This indicates that the archaeological objects were acquired in a variety of settings. Initially, objects found by Mudd’s staff became his property.\textsuperscript{23} Once the Antiquities Law was enacted, items had to be declared and a share went to the island Cyprus.\textsuperscript{24} The Antiquities Law is the actual name of the law, and such an unspecific name makes finding details about this particular piece of legislation difficult. According to Kassianidou, this law was enacted in 1935 and it governed discoveries and excavations.\textsuperscript{25} Perhaps it is because of Kassianidou’s focus on metals, but once again there is no specific mention of glass. These sources appear to suggest that some artifacts were found or purchased legally, and some were not. While the specific examples given were in reference to metals, it will have to be assumed that a similar purchasing and finding pattern applies to the glass as well.

\textbf{The Collection in Claremont}

Because the glass collection is divided between the colleges of Scripps and Harvey Mudd, it was impossible for me to get a count on how many objects (of any material) make up the Mudd collection. Some are stored in the basement of the Humanities Building at Scripps College, while others are on display in offices at Harvey Mudd College. I was only able to study the pieces at Scripps. Therefore, I must rely on the 1985 master’s thesis by Kimbeth Coventry to report that the collection consists of 177 objects.\textsuperscript{26} Reportedly, half of this is bronze-age pottery, with a few

\textsuperscript{22} Kassianidou, “Late Bronze Age Cypriot Hoards,” 213.
\textsuperscript{23} Kassianidou, “Ancient Copper Mining,” 589.
\textsuperscript{24} ibid, 589.
\textsuperscript{25} ibid, 582.
\textsuperscript{26} Coventry, \textit{The Mud [sic] Collection of Cypriot Art}, 2.
Hellenistic and Roman pieces. There are 42 or 43 glass objects (Coventry vacillates on the number throughout her thesis), and some terra-cotta and limestone works as well.\(^{27}\) I relied on Coventry’s thesis as little as possible because she routinely got basic facts wrong. That being said, she was the first to document the collection, which must have been a daunting task and for that I commend her. I do agree with Coventry that the Mudd collection of glass is a standard sample of the artifacts typically found on Cyprus. The glass was not innovative, but generally well made for everyday use.\(^{28}\)

The Scripps collection came from the managing director of the Cyprus Mines Corporation, James Latimer Bruce. According to a private letter by one of his descendants, the collection was donated to Scripps around 1947. It was collected when family members visited Cyprus, although the year(s) that they visited is unclear.

**Repatriation**

Since I started this thesis, it has been announced that all of Harvey Mudd’s collection—glass included—will be returned to Cyprus. The University of Cyprus will take control of the antiquities as soon as they raise the funds to pay for packing and shipping. There, the objects will be researched and put on display to be enjoyed by Cypriots and university visitors.

A signing over ceremony of the Mudd collection was held at Harvey Mudd College on December 11, 2018. One of Harvey Mudd’s granddaughters, Tori Mudd, gave a speech in which she said that the collection was assembled over time but with no mention of specific dates. She did state that every purchase was legal.\(^{29}\) While this could easily be true, I have been told by the


\(^{28}\) ibid, 112.

Harvey Mudd College administration there is no documentation of the collection purchases, so I could not verify this statement.

Following Tori Mudd’s speech, Harvey Mudd President Maria Klawe spoke about the collection’s history as well. She added that it was acquired in the 1930’s, and that everything was initially brought to Harvey Mudd’s California home. At some point over the following decades the glass collection was transferred into storage in the Scripps basement, with a few particularly fine pieces placed on display in the administrative offices at Harvey Mudd College. Just over a year before this signing ceremony, President Klawe said, Dr. Kassianidou had reached out to the college to ask about taking 3D scans of the Cypriot artifacts—in particular the prized copper ox hide ingot. Discussions with the Mudd family ensued, and a different decision was made. The Mudd family and Harvey Mudd College decided that instead of permitting researchers from the University of Cyprus to come over and scan the artifacts, the whole collection should be repatriated to the island, to be placed into the care of the university there.

The Rector of the University of Cyprus, Constantinos Christofides, spoke about how valued the repatriated Mudd collection would be once it was returned. He lamented that although Cyprus has a rich archaeological history, it was ruled by foreign powers for thousands of years and as a result each empire that controlled the island took the best archaeological finds away with them. Christofides thanked Harvey Mudd College profusely for their repatriation efforts.32 Christofides ended his speech by highlighting the completion of a new library at the University of Cyprus and he showed a promotional video that was created about it. The excitement

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31 ibid.
regarding the new library was based on the plan that this is where the Mudd collection would be housed once it has arrived. Christofides explained that the collection would be displayed in cases beneath a rotunda in the main foyer in the library. This is clearly a place of honor where the glass would be seen by every visitor to the library and reflects a genuine interest in the Mudd collection and how valued and appreciated it will be. Such a prominent location is a far cry from the filing cabinets in the Scripps basement that much of the collection has known for the previous decades. The Mudd collection of Cypriot artifacts will finally be home and properly exhibited for the appreciation of all. Before shipping they will need the attention of a conservator so that no damage will occur to them during transportation.
Chapter Two

The History of Cyprus & the History of Glass

A Brief History of Cyprus

With its eastern Mediterranean location, Cyprus has historically had an advantageous geographic locale for trade. The island lies 40 miles south of Turkey, 60 miles west of Syria, and 250 miles north of the Nile Delta. All of these present-day countries were ruled throughout history by empires that influenced and traded with the inhabitants of Cyprus. The sea and wind currents guided ships to its shore, ensuring its relevancy in trade. When Cyprus was not the final destination for ships going from Greece to the Middle East, it was a stopover site for replenishing supplies. It was a main hub for the trade of food between Egypt and Anatolia, in particular. There is evidence that Cyprus was inhabited as early as 10,000 BCE. And recent archaeological evidence on Crete and other islands reveal that Mediterranean seafarers—Neanderthals or stone age people—may date back to an astounding 130,000 years ago. By 2000 BCE, the island was a center of trade in the region. This reputation grew when the Phoenicians arrived in the middle of the 9th century BCE. The Phoenicians were known seafarers and traders and so their arrival to the island bolstered Cyprus’s reputation a rich island and put it on the map of Mediterranean trade. Phoenician control ended with the Assyrian Empire establishing a presence on Cyprus in 709 BCE, and possession of the island was passed around among other regional empires roughly every 100-200 years with the wealth on the island increasing with each new imperial overlord. The Assyrians, Egyptians, and Persians each had a

33 Panteli, Historical Dictionary of Cyprus, vii.
34 Ceglia, “Glass Production and Consumption in Cyprus,” 74.
35 Panteli, Historical Dictionary of Cyprus, xiii.
36 Lawler, “Neandertals, Stone Age People.”
37 Panteli, Historical Dictionary of Cyprus, xiii.
period running the island before Alexander the Great conquered the Persians and control of Cyprus was passed on to Alexander.\textsuperscript{38} The fact that the island provoked repeated disputes resulting in a regular changing of hands between different empires surrounding the ancient Mediterranean speak to the value of its resources and location.

Less than 200 years after Alexander exerted Hellenic control over Cyprus, the Ptolemies of Egypt conquered the island and exploited its resources. Grains and ship-building timber, in particular, were harvested and shipped back to Egypt.\textsuperscript{39} While the island was a useful stopover for ancient traders during trips through the Mediterranean, it was the natural deposits of copper across the island that made it particularly valuable and the copper alone drew many ships to its shore. Ever since the Chalcolithic era\textsuperscript{40}—around 3900 BCE—copper had been mined on Cyprus. While the island was a useful place for ancient traders to stop over at during trips through the Mediterranean, the copper alone drew many ships to its shore. Historically, the constant desire that others had for its copper, supplementing income from its agricultural economy, kept Cyprus wealthy and desired by foreigners well into the 20th century. It is easy to see how important copper was to Cyprus and how associated the island and the metal were when the name of the island is examined: copper's etymological origin stems from \textit{aes Cyprium} or \textit{aes cuprum}, which translates as “metal of Cyprus.”\textsuperscript{41}

\textbf{Trade and Resources on Cyprus}

\textsuperscript{38} Panteli, \textit{Historical Dictionary of Cyprus}, xiv.
\textsuperscript{39} Tatton-Brown, \textit{Ancient Cyprus}, 17.
\textsuperscript{40} Chalcolithic - the copper-stone age where copper and stone were the primary technologies used.
\textsuperscript{41} Tatton-Brown, \textit{Ancient Cyprus}, 18.
The north and north-east slopes of Cyprus’s Trodos Mountains were where major copper deposits were located, although some could be found in the southern foothills as well.\(^{42}\) Thus, industry and settlements were built up in this area throughout the history of settlement on Cyprus. The foothills west of Nicosia show copper deposits that were mined as early as the 19th century BCE. However, this is not when copper’s story began on Cyprus since copper objects have been found locally, dating as far back as 4000 BCE, from Cyprus’s “copper-stone” age.\(^{43}\) Copper smelting sites and ore crushing areas have been found only meters away from mines, indicating that the same Cypriot communities were involved in multiple stages in the production of Copper.\(^{44}\) The production and control of copper on Cyprus brought valuable resources and wealth to whichever empire was in power. Therefore, while Cyprus’s geographic location opened it up to the world early on, its copper deposits were likely major contributors to its wealth and prominence.

While trade goods were being exported from Cyprus, foreign products and ideas also flowed into it. For example, during the Ptolemaic period (305-30 BCE), for example, Greek cults and culture were introduced to the island. Hellenistic styles became visible in the art that was produced then. The close ties with Egypt can be seen in sculptural styles, architectural features which are similar to those in Alexandria, and even in burial customs.\(^{45}\) Thus, Cyprus was not simply sending goods away from its shore and receiving money in return: cultural exchange must have been taking place.

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\(^{42}\) Tatton-Brown, *Ancient Cyprus*, 18.

\(^{43}\) ibid, 18.

\(^{44}\) Åström, *Acta Cypria*, 49.

\(^{45}\) Tatton-Brown, *Ancient Cyprus*, 32.
Like the Egyptians before them, the Romans exploited the resources and geography of Cyprus to advance their own wealth and prominence in the region. The Roman Empire’s reign over Cyprus began in 58 BCE, but they lost control for 17 years when Cleopatra put it once again under Ptolemaic rule.\textsuperscript{46} The Battle of Actium in 31 BCE ended Cleopatra’s reign and returned Greece, Asia Minor, the Levant, Egypt, and Cyprus back into Roman hands. During the Roman period that followed, Cyprus was treated as a province of the great empire. Many roads were built across the island, allowing for the connections of towns and an increase of local trade. As in other Roman provinces, gymnasia and theaters were also built for the entertainment of civilians. This shows Roman investment in the island which allowed its prominence to grow as copper continued to be mined, this time by the Romans.

Because the Romans by this point controlled much of the mainland regions surrounding Cyprus, they used it as a hub of trade to connect the Eastern Mediterranean (mainly the Levant and Egypt) with the rest of the Roman Empire in the west.\textsuperscript{47} Cyprus hence served as the connecting piece in a large empire. Not only was the island a link between two regions, but Cyprus itself was informally split into two with regard to trade. Although it is unclear when this division started, certainly by Roman times the eastern half of Cyprus did more trade with the Syro-Palestinian coast to which it is most proximal, while the western side of Cyprus saw more trade with Egypt.\textsuperscript{48} Therefore, when Roman ships landed in Cyprus, they could pick up goods from different parts of the empire by entering different ports within a relatively small area.

\textsuperscript{46} Panteli, \textit{Historical Dictionary of Cyprus}, xiv.
\textsuperscript{47} Ceglia, “Late Antique Glass Distribution,” 214.
\textsuperscript{48} ibid, 214.
A Brief History of Glass

One of the inventions that impacted daily life, trade, and the arts in Cyprus and the ancient Mediterranean was glass. After pottery and metal, glass was the third of three main inorganic technologies that were invented in ancient times.\textsuperscript{49} The earliest known date for glass production was around 2500 BCE in Mesopotamia.\textsuperscript{50} Glass was originally created by fusing plant ash and silica in a 2:1 ratio in a small crucible under high temperatures.\textsuperscript{51} For the first 1000 years of its production glass was predominantly used to make beads, and little if any experimenting with the process was done. Science historian Cyril Stanley Smith points out that beauty can also contribute to innovation, not just necessity.\textsuperscript{52} Since glass continued to only be a medium for beadwork for the first 1000 years of its creation, the concept of beauty being the innovation is plausible. The early glass beads had no purpose that could make everyday life easier—instead, glass was created as an adornment and the process was not changed for a millennium.

The next innovation in the production of glass was to make small vessels by dipping clay cores into molten glass (a technique borrowed from bead making), or slumping soft glass over a clay form.\textsuperscript{53} These first glass vessels appeared in Mesopotamia around 1500 BCE, although faience—which is similar to early glass—was being produced in places like Egypt as early as 4000 BCE.\textsuperscript{54} Since faience was a precursor, it is not surprising that the earliest glass forms copied the shapes of faience vessels. Since they were replacing the earlier technology, replicas instead of innovation came first. Faience continued to be made even after the invention of

\textsuperscript{49} Henderson, \textit{Ancient Glass}, section 1.4.
\textsuperscript{50} Cyprus Room wall text at Fitzwilliam Museum.
\textsuperscript{51} Henderson, \textit{Ancient Glass}, section 1.3.
\textsuperscript{52} ibid, section 1.3.
\textsuperscript{53} Cyprus Room wall text at Fitzwilliam Museum.
\textsuperscript{54} Henderson, \textit{Ancient Glass}, section 1.4.1.
molded glass, although its production eventually did decline as glass became increasingly common. Faience initially stayed in use because it could be made in a one-step process of mixing copper oxide, crushed quartz, plant ash, and water and heating the paste in a mold to get the desired shape. Molded glass, on the other hand, required two separate treatments—heating and annealing.\textsuperscript{55} Thus, the earliest glass production in this form was an elite pursuit and not readily available to just anyone.\textsuperscript{56} Faience was more accessible to a larger market, while few could afford this early glass. Hence, at its inception glass was a luxury good.

From the mid 1st millennium BCE through the 9th century CE, soda-lime-silica glass with natron was the dominant type of glass created in the production of glass.\textsuperscript{57} Natron is a soda-based mineral that was a good source of alkali required for glass.\textsuperscript{58} It is widely accepted that most natron came from Wadi el-Natrun in Egypt and from the Levantine coast.\textsuperscript{59} Both sites were known to have other roles in glass production. Clearly, sourcing resources for the primary production step of glass from these locations makes sense: materials would not need to be transported far. Types of glass with plant ash instead of natron were also manufactured, but they were not as common during this time.

**The Primary and Secondary Production Stages of Glass**

For centuries, glass production was split into two stages that were completed by different workshops in different parts of the Mediterranean. These stages are known as primary and secondary production. Primary production of glass consisted of creating glass by mixing soda,
lime, and silica. It is reasonable to assume that primary glass production was often centered around sources of silica, since this mineral made up such a high percentage of glass composition.\(^{60}\) At these primary workshops, the glass was created and then cooled and broken into rough chunks that were easy to pack for shipping. In the eastern Mediterranean, from early Roman imperial times through the late antique era, such the main primary production workshops were in the Levant and in Egypt.\(^{61}\)

Frit—the powdered silica mixture that becomes glass once it has been heated— is often used as evidence for identifying a primary production site. The structure and size of glass furnaces, if they remain, can also reveal which stage of production a site performed.\(^{62}\) During the Roman and Byzantine periods, workers at primary production sites in these two regions used color branding to differentiate their primary glass from glass produced in the other glass hub.\(^{63}\) Glass of an Egyptian origin was sodium rich and so had a yellow-green tint to it. Levantine glass on the other hand, was more blue-green in color. Color branding was also useful because it informed secondary workers as to how the glass could be handled and how it would act when heated. For example, Levantine glass was more viscous.\(^{64}\)

The secondary production stage took place elsewhere, using the imported glass. Secondary production workers would melt the glass back down into a viscous state and then de-color or color the glass. At these sites glass was then shaped and blown for local customers or for trade.\(^{65}\) To identify a secondary production site, one looks for evidence of blowing, molding, and

\(^{60}\) Henderson, *Ancient Glass*, section 8.4.
\(^{61}\) Ceglia, “Late Antique Glass Distribution,” 213.
\(^{62}\) Henderson, *Ancient Glass*, section 1.5.
\(^{63}\) Freestone, “HIMT, Glass Composition,” 159.
\(^{64}\) ibid, 156.
\(^{65}\) Ceglia, “Late Antique Glass Distribution,” 213.
decorating glass styles. Clues would include the following: glass furnaces with annealing chambers, annealing ovens, fuel deposits, molds, crucibles, drops, dribbles and pulls of glass. Glassblowing required a level of mastery that mixing ingredients for primary production did not. In the early second century CE, fewer secondary sources where still functioning, so presumably as demand grew the workshops that still existed were producing on a larger and larger scale.

The Invention of Glassblowing

The glass industry was changed forever when glassblowing was invented in the middle of the first century BCE on the Roman Levantine Coast. This invention changed the process, shape, and market of glass. First, blowing sped up the production of glass objects. Since it was faster to blow a vessel than it was to mold it, glassworkers could make more goods each day and expand the output of the factory. Initially, glassblowing and molded glass were combined into one process where a glassblower would blow the glass into a mold to create the desired shape. The original blowpipes were most likely ceramic, not iron. This way, glassblowers themselves could fashion the pipes they needed, without having to pay an ironworker to create tools for them. This hypothesis is based on archaeological finds and contemporaneous terra cotta lamps with decorations depicting such as scene. However, it is surprising that an artisan who works with glass as his main material would also craft and fire ceramic wares as well. The fragility of hollow ceramic pipes limited the size of vases and jugs that could be made—the pipes would crack or break if supporting a weight above about 170g. By 70 CE, the demand for ever larger glass items

66 Henderson, *Ancient Glass*, section 1.5.
69 Cyprus Room wall text at Fitzwilliam Museum.
70 Stern, “Roman Glass-blowing in a Cultural Context,” 446.
led almost all glassworkers to adopt the iron blowpipe.\textsuperscript{71} Compared with the millennia it took to advance from glass beads to core-formed glass, this innovation over roughly 100 years happened very quickly. The adoption of iron blowpipes caused the production of small bottles and vases to give way to larger glass objects such as plates and massive cinerary urns, some weighing up to 500g.\textsuperscript{72}

Glassblowing also allowed for an expansion of what could be made out of glass and permitted more distinction between low- and high-quality goods. Larger and more complex shapes started to be made and sold. By blowing glass instead of molding it, an artisan could have more control over the thinness of the glass. Therefore, blown vessels became more refined and more varied than allowed by earlier glass production techniques. The variety also came from inclusion or exclusion of color in glass—something that was increasingly being experimented with. This led to a greater distinction between glass objects that could be afforded by the high and low classes. Moreover, glassblowing made the production process for glass cheaper. By making more glass available than at any time previously, the cost of purchasing a glass object decreased. Originally a luxury object only available to the elite, this meant that glass became accessible to more people from a variety of economic backgrounds. Not all glass was available to everyone, of course. Quality and color of glass still dictated what each social level could afford.

\textbf{Colored Glass}

Initially, glass was colored so that it would appear to imitate semiprecious stones. Aqua, amber, and blue were common colors for early Roman blown glass. Cobalt and copper were two

\textsuperscript{71} Stern, “Roman Glass-blowing in a Cultural Context,” 447.
\textsuperscript{72} ibid, 447.
common additives to molten glass that produced deep blue and turquoise colors. Of all the colors used, cobalt is the most intense because it is a transition metal. An addition of 0.02% cobalt oxide (CoO) in soda-lime-silica glass is enough to produce a dark blue color. By coloring glass with cobalt, glassworkers were creating a product that imitated lapis lazuli. Although it clearly would not have been a perfect match, having glass that looked like such a precious stone would have been signified the good taste and wealth of its purchaser. The cobalt that was used as a glass colorant primarily came from Persia, specifically the Anarak and Qamsar regions where the cobalt was rich in antimony. This antimony impurity in the cobalt used in glass allowed for the tracing of the colorant back to its source. Antimony from Anarak was also used as an opacifier for glass, suggesting that the Anarak mine, in particular, may have been of great importance to eastern Mediterranean glass production since it supplied more than one material to the glass trade. Around the second century CE the cobalt colorant in Hellenistic glass became rich in manganese instead of antimony, suggesting a different source of the element starting around that time and therefore a shift in trade networks. Copper was added to glass to make the finished product look like the semiprecious stone turquoise. The use of copper to color glass is a holdover from faience production, where Cu$^{+3}$ ions were used to create a turquoise color as well. Unlike cobalt, copper sources are widespread and impurities in the copper cannot suggest a location for its origin. However, in the case of glass production on Cyprus, which gained its wealth in part from copper mining, it is reasonable to assume that copper used for colorants would be local in origin since the importation of copper to Cyprus would be redundant.

73 Henderson, *Ancient Glass*, section 3.3.1.
74 ibid, section 3.3.2.1.
75 ibid, section 5.1.
76 ibid, section 3.3.2.1.
77 ibid, section 3.3.2.2.
Glass Trade - Ingredients and Finished Works

The origins of materials in glass can sometimes be discerned by examining the silica within the glass if the glass has not been melted down multiple times. In the Levant, beach sand with seashell fragments was probably used as the source of silica. Therefore, primary Levantine glass had low zirconium levels (60 ppm) and high strontium levels (400 ppm) due to the inclusion of shells. Silica (SiO$_2$) made up 65-70% of the soda-lime-silica glass. Glass from primary production sites was mixed with broken vessels at secondary production sites. This means that chemical elemental analysis to determine the origin of the primary glass silica can become uncertain when glasses from a variety of places are melted together. According to glass historian E. M. Stern: “Ancient artisans were slow to discover that glass can be totally re-melted because they did not make their own glass. They bought it as solid ingots or chunks and had little understanding of how the material was made”. The separation of the primary and secondary stages of production had existed since the second millennium BCE, and so familiarity with the material only went as far as the tasks that each worker performed. While the recycling of glass may seem obvious to the modern observer, it was not so to the ancient craftsman.

With the trade of completed objects, it was more economical for glass goods to be shipped by sea rather than by land. Furthermore, the gentle rocking of a boat was less likely to break glass vessels than the jostling glass could experience while on the back of a pack animal or cart. Therefore, surrounded by ocean, Cyprus would have seen a lot of glass come and go in its

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78 Freestone, “HIMT, Glass Composition,” 178.
79 Henderson, Ancient Glass, section 3.1.
80 ibid, section 3.1.
83 ibid, 472.
ports. The type of finished glass that traveled the longest distances in the Roman empire was fine tableware. This makes sense, as only the wealthy could afford to scour the entire empire for the perfect dining set and afford the shipping prices. Lower income people would purchase whatever was made closest to them. The increase in glass trade during the Roman Empire can be seen when examining shipwrecks in the Mediterranean. The growing middle class in Roman society desired more and more glass for their tables, and so glass cargo on ships increased starting in the first century BCE.\(^8^4\) It should be noted that glass was never the only commodity on ships. Trade ships would carry a variety of goods between ports, and glass was increasingly one of them. Not only were finished glass objects carried as a cargo to sell, trade ships also carried raw glass ingots. Transporting raw glass from primary to secondary production sites by ship was cheap because damage to it did not matter and it could be used as ballast on those ships. Once it was discovered that glass could be recycled, cullet\(^8^5\) became ballast as well.\(^8^6\)

Tableware was sold on its own with no contents inside of it, so trade routes throughout the Mediterranean reflect the commerce of the glass itself.\(^8^7\) The same cannot be said for bottles and vials that replaced ceramic ware, such as amphora and unguentaria, where the contents of the vessel—such as oils and perfumes—were the desired commodity. This process also required a level of cooperation between the content manufacture and the glassworker, although it is unclear how far apart the two would typically be. “The active role played by eastern Mediterranean merchants in the long-distance sea trade may to some extent account for similarities between glass shapes made in the eastern and western part of the Roman empire,” writes Stern.\(^8^8\) Thus, as

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\(^8^4\) Henderson, *Ancient Glass*, section 7.4.
\(^8^5\) Cullet - broken or waste glass before it is melted down into new glass
\(^8^6\) Stern, “Roman Glass-blowing in a Cultural Context,” 475.
\(^8^7\) Ibid, 467.
\(^8^8\) Ibid, 473.
more and more glass objects were being traded around the Mediterranean, workshops on both ends were seeing foreign vessels and drawing inspiration from them and experimenting with new techniques to imitate their counterparts hundreds or thousands of miles away.

Glass was a revolutionary synthetic invention that replaced metal and ceramics in many instances. Unlike terra cotta amphorae, it was impermeable and could be completely cleaned. Unlike metal vessels, it didn’t affect the flavor of what was stored inside of it. Glass lamps burned longer and nearly twice as bright as did the earlier terra cotta lamps. The ingenuity of glass lamps was that they were mostly filled with water with a thin layer of oil on top so the water in the translucent glass lamp allowed for more light to be transmitted. By the 4th century CE, glass had all but replaced pottery in multiple functions, such as drinking vessels and for cosmetic storage. Because it was much more accessible, it had become increasingly important to daily life. The monetary value of glass decreased concurrently with its increasing necessity within many households of the Roman world.

90 ibid, 481.
Chapter Three

Glass Production on Cyprus & the Value of Glass in the Ancient Mediterranean

Because of the Mediterranean’s demand for copper, Cyprus was in a good position for trading for other goods that were not as prevalent on the island. Therefore, it is quite likely that copper was traded off the island in exchange for imported raw and finished glass.91 Like other areas in the Mediterranean, Cyprus imported primary glass and finished glass objects from Egypt and the Levantine Coast. The primary-production glass from Egypt had a greenish-yellow tint to it, while Levantine glass appeared more blue-green.92 Cyprus had a relatively modest market for glass, and so the most common color of Cypriot glass found has pale green hues, indicating no treatment to add or remove color.

Primary Production Glass Origins

More so than glass, Cyprus is known for pottery production, which goes back to at least 4000 BCE.93 Therefore, much more research on the history and trade of Cypriot ceramics has taken place. However, some discoveries about Cypriot pottery can perhaps apply to Cypriot glass as well. According to research on pottery and its trade routes in the Mediterranean, eastern Cyprus was connected more with the Syro-Palestinian coast while western Cyprus did more trade with Egypt and islands in the Aegean Sea.94 Studies have found that glass was imported from both primary production sites, but the comparative significance of these two sources is harder to discern. In a study of glass from the Late Antique Period on Cyprus (c. 6th century CE), all

91 Coventry, The Mud [sic] Collection of Cypriot Art, 104.
92 Freestone, “HIMT, Glass Composition,” 182.
93 Boness, “Ceramic Neolithic Pottery.”
94 Ceglia, “Late Antique Glass Distribution,” 214.
tested sites across Cyprus contained more than 50% glass originating from the Levantine coast.\footnote{Ceglia, “Late Antique Glass Distribution,” 220.} Therefore, without any testing, it could be assumed that any piece of glass is more likely to be Levantine than Egyptian. However, this study focuses on glass that was made one to two centuries later than the focus of this thesis, so no assumptions are firmly held.

Because of Cyprus’s location between Egypt and Syria-Palestine, it does make sense that glass from both locations would be discovered. However, there are several ways to interpret why glass from each location was found on certain parts of the island. On hypothesis, according to glass scientists Ceglia, Cosyns, et al., is that Egyptian glass was found more on the western side of Cyprus because that was closer to Egypt.\footnote{Ibid, 220.} Similarly, their chemical analysis revealed that more Levantine glass is found on the eastern side of Cyprus which is closer to that primary production site. The presence of Egyptian glass on the western side could also be attributed to that side’s role as a stopover on the Constantinople - Alexandria grain route,\footnote{Egypt was the main source of grain for the Roman Empire and Constantinople was the capital of the Eastern Roman Empire starting in 330 CE.} so an exchange of goods would take place there. However, it is important to remember that most of the glass found on the island is of Levantine origin. A second hypothesis is based on the observation that out of the sites studied by Ceglia, Cosyns, and their colleagues, the sites were founded and abandoned from west to east. This may mean that Egyptian imports declined early during the founding of the glass industry on Cyprus allowing Levantine primary glass to quickly became almost exclusively used in secondary production.\footnote{Ceglia, “Late Antique Glass Distribution,” 220.} Freestone argues that raw glass from Palestine could potentially reach Cyprus in its primary pure form due to the island’s proximity to the Levantine
coast.\textsuperscript{99} When a ship set sail from the coast, its first stop would most likely be Cyprus; the island would be the first land-mass reached. While this is a strong argument, there is no reason to think that glass couldn’t have been recycled and melted down on the Levantine Coast before being loaded onto ships in the first place. Therefore, proximity does not seem like a strong enough argument to argue for pure primary glass shipments arriving on Cyprus.

One of the ways that primary glass origins could be identified is by using isotopic analysis on the strontium (Sr) present in the glass.\textsuperscript{100} Strontium is a reactive alkaline earth metal that is similar to calcium.\textsuperscript{101} It is found in shells and some types of coral. Therefore, higher levels of strontium in Levantine glass, which was made from sand gathered from beaches, can be used as an identifier. Meanwhile, Egyptian primary glass draws on sand and limestone from inland sources, indicating a lower strontium content. However, as soon as glasses of varying origins are mixed and re-melted during the recycling process, strontium isotopic analysis becomes useless. To give an example, if broken glass jugs from Egypt and unguentaria from Syria were melted down together, the resulting molten glass could be re-used. If this glass was blown to form a bottle and is then tested by scientists 2000 years later, the strontium results will be useless since the glass is formed from a combination of Levantine and Egyptian glass. Scientists would not know that a mixture of glass sources had taken place. Therefore, it is important to be cautious about using strontium results for identifying a source of primary glass.

\textsuperscript{99} Freestone, “The Origins of Byzantine Glass,” 258.
\textsuperscript{100} Degryse, \textit{Glass Making in the Greco-Roman World},” 80.
\textsuperscript{101} Royal Chemistry Society, \textit{Strontium}. 
**Workshops on Cyprus**

It is likely that Cyprus did not have a glass industry at all until glassblowing was invented.\(^{102}\) Because Cyprus was not a recognized early hub of innovation, there was not the skill or market for earlier glass pieces. Workshops for glassblowing on Cyprus were established in the first century CE.\(^{103}\) These workshops were identified from remains of furnaces, discarded lumps of primary glass, and a few glass-blowing pipes.\(^{104}\) These shops appear to have specialized in jars, beakers, and flasks for holding oil and perfumes. While several sources state that multiple secondary-production workshops have been found, the only location that is named is Arsinoe, a town in northwest Cyprus.\(^{105}\) If Cypriot glass workshop organization is anything like that of their counterparts who work with ceramics, there was a seasonal division to their craft.\(^{106}\) Due to the Mediterranean climate, glass blowing perhaps took place during the cool winter, while marketing, ordering new supplies, and furnace repairs took place during the summer. By separating tasks based on the seasons, the hot work of glass blowing and working around furnaces would take place during cooler months, while the hot summer could be spent without lighting the furnace. This would have made the most tolerable conditions during both seasons and allowed for a predictably scheduled work cycle.

**Common Glass Shapes on Cyprus**

Confirming the origins of glass can be difficult when examining both form and chemical makeup. This is because favored shapes changed over time and glass vessels from all over the

\(^{103}\) Tatton-Brown, *Ancient Cyprus*, 33.
\(^{104}\) Cyprus Room wall text at Fitzwilliam Museum.
\(^{105}\) Childs, *City of Gold*, 237.
Mediterranean were continuously melted down with raw glass to create new vessels that are unidentifiable with modern testing techniques. Therefore, most hypotheses regarding the origins of Cypriot glass remain educated guesses. According to wall text at the Fitzwilliam Museum in Cambridge, glassworkers from the east and west used different shapes and decorative techniques. These differences could be used to distinguish origins. However, information and techniques were traded around, and glassworkers were known to travel, bringing methods and designs from their homeland with them.

Several specific shapes of blown glass were found more frequently than others during Cypriot archaeological excavations. The first is the candlestick unguentarium. Candlestick refers to the long slender shape of the vessel, while unguentarium in Latin refers to a small vessel used for holding and dispensing an unguent, such as oil or perfume. The candlestick unguentarium was found to be widespread across the island of Cyprus, suggesting its prevalence in ancient times.

The second popular shape was a squat little beaker, described as appearing “sack-like.” The mouth of this form, which is almost as wide as the body, would allow for easy use of the vessel. Ingredients could be poured in or withdrawn through the mouth with ease. The unfinished rims on this type of vessel indicates that they were more likely used for storage than for direct drinking of beverages. The fact that two distinct shapes were common in glass finds across Cyprus suggests that they were popular among the Cypriot people. This popularity may mean that these pieces were among those produced on the island for local use.

107 Cyprus Room wall text at Fitzwilliam Museum.
109 ibid, 110.
An analysis of the catalogue of a small collection of Cypriot glass from the Ringling Collection finds quite a few small slender unguentaria.\textsuperscript{110} They were typically the natural pale green of untreated glass. Their simple form causes the curators of the Ringling Museum to assume that they were locally made, a conclusion I have also reached based on the simplicity of many pieces in the Mudd collection.

The candlestick unguentarium and the squat beaker typically have no forms of ornamentation. They were simply functional pieces of glass made in the natural slightly greenish or blueish primary glass that was imported to Cyprus. These vessels are part of a trend where most glass objects found during the first several hundred years of secondary glass production on Cyprus, few luxury items were produced. This assumption is made because few have been found on the island in archaeological contexts. The more elaborate glass vessels, although scarce, appear to have been imported from Syria, where more skilled and established glass-blowing communities were located.\textsuperscript{111} Because demand for such goods was not as high in Cyprus, it would appear that glass blowers did not develop stronger skills since there was only a small market for luxury goods. Unguentaria and beakers were much easier to sell and use in daily life.

**Glass on Cyprus**

Historically, Cypriot glass has often been found in burials across the island. The Tomb at Limassol on the south-west coast dates to around 220 CE contained blown-glass vessels as part of the belongings or gifts laid to rest with the dead.\textsuperscript{112} The glass artifacts from the Ringling Collection supports this glass burial theory. Most of the glass vessels in that collection were

\textsuperscript{110} John and Mable Ringling Museum of Art. *Ancient Art from Cyprus*, 19.

\textsuperscript{111} Tatton-Brown, *Ancient Cyprus*, 33.

found in Roman rock-cut tombs.\textsuperscript{113} Due to the generally simple glass items on Cyprus, it is assumed that most goods were made on the island. However, due to the difficulty of testing the origins of glass, this would be difficult to confirm.

The Historic Value of Glass

Over one thousand years before glass blowing was invented, glass was a prized commodity that was treated as a luxury good. The famous shipwreck found off the coast of Turkey, known as the Ulu Burun wreck, has been dated to around 1,300 BCE. It is suggested that the ship was full of goods picked up from ports in the eastern Mediterranean and was on its way west when it sank.\textsuperscript{114} Its cargo reveals that it was predominantly carrying expensive items from around the Mediterranean. The wreck has yielded copper ox-hide ingots (as found on Cyprus), cedar from Lebanon, ebony, ivory, and Egyptian hippo teeth. Also found were murex shells\textsuperscript{115}, faience cups, thousands of glass beads, gold beads, gold, and electrum. Mixed in with these treasures on the sea floor were around 170 glass ingots in the shape of “cupcakes,” varying in color from amber to turquoise to purple, while a majority were cobalt blue.\textsuperscript{116} Since the ship’s contents were all quite valuable and could be afforded by a small percentage of the Mediterranean population, it is surmised that glass was considered a luxury comparable to hippo teeth, purple dye, and gold. Another example that speaks to the high quality of glass is found in Pompeii (destroyed in 79 CE). Although it was a much later time period than when the Ulu Burun ship sailed, archaeologists have found that glass sales took place in the same sector of Pompeii where

\textsuperscript{113} John and Mable Ringling Museum of Art, \textit{Ancient Art from Cyprus}, 64.
\textsuperscript{114} Henderson, \textit{Ancient Glass: An Interdisciplinary Exploration}, section 5.1.
\textsuperscript{115} Murex - a marine mollusk that when crushed produced a purple dye known as Tyrian Purple. During Roman imperial times, only royalty could wear garments dyed with murex.
\textsuperscript{116} Henderson, \textit{Ancient Glass: An Interdisciplinary Exploration}, section 5.1.
frankincense was sold.\textsuperscript{117} This would suggest that it was being sold as a luxury item alongside valuable imported goods from abroad.

Early Hellenistic core-formed glass vessels were created for holding perfume and at the time were valuable and rare.\textsuperscript{118} By middle-Hellenistic times, glass (in a limited number of vessel shapes) was more common but still used exclusively in elite socioeconomic contexts. This exclusivity initially carried through to Roman times, when it would have been a luxury to eat from glass dishes. As more glass was made with the advent of new production techniques, more Romans from different strata of society were able to purchase goods made from it. Ancient glass researcher Julian Henderson explains the rising popularity of glass in ancient Rome by writing:

\begin{quote}
The growth of the Roman middle class and the use of glass as luxurious decoration in private and public contexts would itself have created a demand. For example, such vessels were displayed near the entrance to Roman villas, so that visitors could see them. It is only really in the Roman period that dinner sets become common, and middle-class urban life would have involved showing off the glass … Metal dinner sets were replaced with glass ones because the former were said to stink, especially in the summertime.\textsuperscript{119}
\end{quote}

Thus, not only was glass useful to display wealth and good taste, but it was also an innovation that made for a more pleasant dining experience. It quickly became an indicator of wealth and taste, fueling innovations within the industry.

The Roman emperor Augustus (r. 27 BCE - 14 CE) came into power when glass production and innovation was beginning to flourish. Highly colored glass was fashionable, and as emperor he was able to obtain the highest quality goods. He moved some of the most skilled glassmakers of the time from Syria to Rome.\textsuperscript{120} Since the Levantine coast and Syria are where

\begin{flushright}
\textsuperscript{117} Stern, “Roman Glass-blowing in a Cultural Context,” 471.
\textsuperscript{118} Henderson, \textit{Ancient Glass: An Interdisciplinary Exploration}, section 7.5.
\textsuperscript{119} ibid, section 7.5.
\textsuperscript{120} ibid, section 12.
\end{flushright}
the innovations in glassblowing were taking place, it makes sense that the most skilled workers would be from there. By importing the best of the innovators, Augustus established glass as a material that was upscale, which no doubt led to its increasing popularity among the rich populace in Rome. Augustus’s workmen then taught local glassworkers their trade so the skills could be reproduced. Thus, the spread of knowledge about glass happened faster than it would have in other contexts.

Archaeologist E. M. Stern notes that glass products belong in several categories from an economic and trade perspective. These include the markets for creating raw material, household and utility wares, and luxury items (such as fine tableware).\textsuperscript{121} Although less is known about it, there was also probably a commercial outlet for recycling glass as well. Long distance trade dealt mainly in fine tableware, raw glass, and cullet. This trade was quite profitable for those involved. A separate, more local market was created for most (empty) unguentaria, ordinary household containers, daily middle-class tableware, and funeral urns.\textsuperscript{122} These more common goods were sold in local and regional markets, since nothing was particularly unique about them. Therefore, multiple industries were quickly created that were centered around blown glass.

**Glass Colorants**

As mentioned previously, opaque glass was initially synthesized to imitate semiprecious gemstones such as lapis lazuli, turquoise, and amber. This fits in with the overt displays of wealth and love for gaudiness that Romans had. Surprisingly, fashions changed quite quickly and crystal-clear glass became the new trend among the Roman elite by the second century CE.\textsuperscript{123}

\textsuperscript{121} Stern, “Roman Glass-blowing in a Cultural Context,” 467.
\textsuperscript{122} ibid, 467.
\textsuperscript{123} Henderson, *Ancient Glass: An Interdisciplinary Exploration*, section 7.1.
The desired clear glass was not simply the untreated blue-green or yellow-green glass that primary glass workers produced. Instead, it was a glass that was specially treated to make it as clear and colorless as possible. Clear glass was made by starting with silica that contained a relatively low percentage of iron and adding manganese oxide (MnO) to it. The manganese oxide would act as a “decolorizer” and remove some of the natural tints present in the mixture. The clearness of this new glass was prized because it resembled a different stone—rock crystal. Transparency was highly valued, and in the early years of the Roman Empire, goblets for emperors to drink from were often carved out of rock crystal, such as a *skyphos* from the first century CE (figure 36). Thus the color of glass that a Roman used stated their income bracket, as different colors (or lack thereof) could only be afforded by certain people. Stern notes that “glass is one of the few materials where color is a significant factor in determining the price.”

Besides decorating glass by adding a colorant to the molten form, adornments could be added during the blowing process or once the vessel was cooled. To make a relatively simple pitcher more interesting, for example, a glassblower could add a handle made out of green glass, to contrast with the natural color of the glass body. Or a patron placing an order at a glass workshop could request that dots or spirals of colored glass to be added to the surface as a form of decoration. While not adding much to the price, small decorative choices could make the glass object more unique and stand out when displayed in someone’s home. Once glass had cooled, the glassworker could also incise patterns into the glass object. These patterns typically took the

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124 Henderson, *Ancient Glass: An Interdisciplinary Exploration*, section 3.3.3.
126 *Skyphos* - a two-handled wine cup.
form of bands formed by grooves in the glass. Combining this technique with the already expensive perfectly clear glass created the most valuable type of glass vessel.

**The Monetary Value of Glass**

Glass blowing was a revolutionary invention, and mass-produced pale green vessels flooded the market across a broad geographical area as demand for it made it available to all levels of society. These vessels became common in the transport and trade of other goods that were now more valuable than the containers that held them. Petronius, who lived during the reign of Nero (r. 54 - 68 CE), wrote about the usefulness but changing prices of glass. In *Satyricon* (50-51), he said: “Pardon me if I say that I personally prefer glassware, since glass vessels do not give off an odor. If they were not breakable, I would prefer them to gold. And now they are very cheap.” This observation illustrates the popularity of glass for holding foods and delicate scents without corrupting them. With this quote, he even compares glass to gold, a metal which has always been treasured. It seems as if Petronius is lamenting the fact that glass is now something that can be afforded in some form by almost everyone—as if its exclusivity was part of the allure. Thus, while the monetary value of glass had dramatically decreased, it had become a staple in Roman life that was a worthy replacement for gold.

Differences in workmanship, size and color indicate that once established in Roman daily life, glass vessels covered the entire spectrum from opulent gifts to simple utilitarian goods. Middle-class homes purchased glass tableware sets as soon as the markets were saturated enough to bring prices down. Therefore, quantity is not a good indicator for the value of glass. The value

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130 ibid, section 7.1.
of glass in the form of its exclusivity was replaced by its value as a necessity. Whereas once glass was valued for its scarcity, it quickly became a staple of daily life in the ancient Mediterranean, from trade goods to dinner sets. Despite its prevalence, glass was still a valued good: in the new Roman economy, it was essential in everyday life for a majority of people.
Chapter Four

Case Studies

The following chapter is an examination of five selected glass objects from the collection. These five were selected before anything about their accession numbers was known. Based on their accession numbers, two are definitively from Harvey Mudd’s collection. The origins of the other three are less clear. All five have been stored in the same metal filing cabinet (along with dozens of other glass pieces) for decades. However, three do not have the characteristic 74.6 accession number that indicate Mudd artifacts. One item has no number whatsoever, while the other two have accession numbers that begin with “C.G.” and “A”, respectively. It is not clear whether these three were left off a list of Mudd glass, or if they were stored in the cabinet since everything was glass. Scripps has a small Cypriot collection from a man named Bruce, who was a contemporary of Mudd’s on the island of Cyprus at the same time. Perhaps these are from him. Throughout the following pages, the pieces with 74.6 accession numbers will be referred to as belonging to the Mudd family. The other three will simply be referred to as being in the Scripps basement, so as not to assign ownership to some objects whose background is unknown. 1974 is the year when the glass was accessioned and transferred to Harvey Mudd college, but ownership is unclear.

Luigi Palma di Cesnola excavated on Cyprus from the late 1860s to the early 1870s. The glass that Cesnola found was from tombs.\textsuperscript{132} It was dated based on other finds in the tombs and based on the styles of the glass. All dates are approximate. Cesnola sold somewhere between 520 and 753 glass items to the Metropolitan Museum of Art shortly after it opened.\textsuperscript{133} In 2017, the

\textsuperscript{132} Lightfoot, The Cesnola Collection of Cypriot Art: Ancient Glass, 16.
\textsuperscript{133} ibid, 11.
Met published a catalogue of their Cesnola glass, with photos and descriptions of each piece. This catalogue was used to find objects that were similar to the five pieces that are focused on below, in order to draw comparisons between them. The particular usefulness of this catalogue over others is that all pieces in it are from Cyprus, which makes use easier than the Princeton catalogue, which focuses on all ancient glass, regardless of origin. Other collections will be interspersed throughout when comparisons are necessary. Often, their source of historic Cypriot glass was Cesnola as well.

A Note About XRF Testing
I decided to perform scientific analysis on the glass to get experience using equipment that I would use in the future as a conservator. Scientific analysis is important for conservators because it can help reveal information the materials that they are dealing with. It can also shine light on technical art history, such as sourcing of materials in ancient times.

Small samples of delaminating glass were taken to the conservation science lab at Los Angeles County Museum of Art (LACMA) for X-ray fluorescence analysis (XRF). XRF testing is done with a device that emits an X-ray beam at a material and causes characteristic X-rays to be excited in the material. The excited rays cause peaks that can be identified as corresponding to different elements. This indicates the makeup of elements within a sample that is being tested. In this case, small samples of glass from the delaminating vessels were taken for testing. Hand-held XRF machines do not require samples to be taken, but the glass objects could not be removed from the basement and so in this case the testing required samples. The blue decorations on the lamp and the green jug handle showed no signs of delamination, and so samples for these two could not be collected. That means that they were not able to be tested with the XRF, and so
there is no data for their make-up. Samples were taken with a needle and tweezers. The XRF scanning and analysis of results was performed by conservation scientist Laura Maccarelli, using an Olympus Innoq-X Delta X-Ray, from the early 2010s. The machine was used in geochem mode, using two beams for the first 30 seconds at 40KV and the second 30 seconds at 10KV. The sample size in collimated mode was ~3mm in diameter.

Elements such as silica are present in large quantities because they make up so much of the body of the glass. It is typically found as SiO$_2$, and in introduced as sand.$^{134}$ Sodium is common as Na$_2$O, because it makes up the soda. Calcium as CaO is common and is introduced as a form such as limestone. Together, these three additions make up the soda-lime-silica combination that form the base of glass. Potassium is also commonly found in glass, as it is used as a flux to allow melting of glass components at a lower temperature.$^{135}$

After XRF testing was completed, I came to realize that this was not the best method for identifying components in glass. Laser ablation would have been a better choice to get a more complete reading of chemical makeup. Furthermore, taking samples for XRF rather than pointing the device directly at the object was problematic. Unfortunately, the glass vessels could not travel on public transportation to Los Angeles with me, so samples were the only option. The issue with taking a sample is that it was in the form of delaminating flakes. Delamination of glass is caused by leaching of the components (chapter 5). This means that by its very nature each sample would be missing elements and ratios could be skewed compared to the intact body of the vessel. For example, any delaminated layer would be leached of elements such as sodium, potassium, and copper. Thus, readings were not as accurate as I had hoped.

$^{134}$ Brill, “What Elements are Used to Make Glass?”
$^{135}$ ibid.
Yellow Conical Vessel (Lamp), No Accession Number

6 ¾ x 4 ¾ x 4 ¾ (inches)

Labels: none

Figures 1-8.

Description

This object does not have any accession number or marks indicating its history in the collection in Scripps’s basement. The vessel is cone-shaped, with the widest part at the rim then tapering down into a narrow point with a flattened bottom. There is a slight indent in the glass, about two centimeters down from the rim, sometimes referred to as a collar. This was probably used to keep the glass steady in whatever support it rested on. The bottom is not large enough to support the vessel, so historically it must have had some support system to keep it upright that hung from the collar. There is no trace of the original sconce or tripod that this vessel would have sat on.

Parts of the object are a sort of gold color, though other areas appear clear. It seems that a relatively clear (not decolorized) glass was coated with something to give it a brighter color, sometimes called “honey yellow.” The coating that was applied to the inside looks iridescent gold when viewed from the outside. However, when looking at the coating from the inside of the vessel, it appears coarse, flaky, and black. There is an iridescence to the glass on both the inside and the outside.

The glass itself is quite thin and appears to have been blown. There are faint swirls of color and bubbles visible (called blowing spirals), which suggests a lack of homogeneity in the glass mixture when it was heated in liquid form. It is unclear if this was due to composition or temperature.

There are adornments added to the outside of the glass. Positioned evenly around the outside near the rim are two ovals and two clusters of dots. When examined closely, it can be seen that these decorations are made of blue glass. The dot clusters are in a triangle with more dots in each row, from one to four, totaling ten. They point the same direction as the vessel does, with fewer towards the foot and more towards the rim.

Overall the vessel is quite clean. Unlike other pieces in the collection, it has little visible dirt or sand remaining on the surface. This suggests that any surface accretions were removed at some point in the past.

**Condition**

- This vessel is not in a stable condition.
- The vessel is repeatedly chipped around the rim. This is not unusual because the glass is so thin and old.
- Over half of the shiny coating on the inside of the vessel is missing, which reveals the nearly clear glass that the vessel is made out of.
- The glass is also severely delaminating (chapter five). Whenever the vessel is handled, tiny iridescent flakes of glass are separated from the surface and are left on whatever the vessel is sitting on. It would appear that some sort of glue coating was applied to the outside of the vessel to stop delamination. This coating is no longer working.
- Previously, the glass vessel was broken into 13 pieces in a variety of sizes. At some point, the vessel was reassembled with an unidentified glue. With hindsight, this restoration attempt was poorly executed. The glue has yellowed and too much was used so it bulges out periodically on both the inside and outside of the vessel. The glass shards are not flush with
one-another, which further accents the poor-quality intervention. There is no written record of the vessel breaking or being repaired.

• The blue glass is weathering differently than the yellow-clear glass is. It is not delaminating but instead is full of tiny pits (chapter 5). This indicates a different type of weathering damage to the surface.

Identification and Commentary

There are two lamp entries in the Cesnola collection catalogue from the Metropolitan Museum of Art that bear similarities to this lamp. The first, accession number 74.51.310, is similar in shape. However, the narrow section on this piece is longer, and it ends in a thick rounded-off end. Overall, it has the same conical shape but is about an inch smaller. It also has the slight indentation collar near the rim. This item, however, has no ornamentation and is a natural blue-green color. It is from the 4th century CE. The commentary on this shape notes that this would have been used for a goblet or a lamp in late antiquity in the Roman empire. The catalogue notes that these vessels are often decorated with colored blobs or incision lines (the Met’s Cesnola collection contains only one example of the former and none of the later). This shape for lamps is not common in Cyprus.\footnote{Lightfoot, The Cesnola Collection of Cypriot Art: Ancient Glass, 125.} If the lamp hadn’t been previously cleaned, traces of burning or oil residue could have been looked for on the inside of the vessel in order to identify its use. However, the shape is more often than not that of a lamp, and so that is what it has been identified as here.

The second similar lamp, accession number 74.51.309, is also a natural blue-green. It is more of a beaker shape, although it too has the indented line just below the rim of the vessel. The similarity between this piece and the lamp that is of interest in the Scripps basement is that this
one has three small blobs of teal glass. These are similar to the three cobalt blue blobs of glass on the Scripps beaker.\textsuperscript{138} This object was dated to the 4th century CE.

A third similar example exists at the British Museum (accession number 1871,0123.3), although it was originally owned by Cesnola as well. There are no photos of it online, but it is described as being a greenish blown glass conical beaker with a flattened base. It is decorated with blue blobs of glass and wheel incisions and was dated to the 4th century CE.\textsuperscript{139} Thus while such lamps and decoration upon them were not common in Cyprus, they have occasionally been found.

By the first century CE, small glass chips were added to blown objects while they were still hot as a form of decoration and incorporating additionally color into the piece. The blue glass added to the British Museum’s vessel would have been applied this way. Triangular motifs were common.\textsuperscript{140} On one cup (accession number y1966-119) and two lamps (accession numbers y1940-153 and 2006-474) in the Princeton University Art Museum, blue chips of glass are used as decoration. While none of the three is from Cyprus, they are all identified as being from the eastern Mediterranean (Syro-Palestine or Egypt) and from the 4th-5th centuries CE.\textsuperscript{141} Thus, a similar date could be argued for the piece in the Scripps collection.

Overall, I would conclude that this decorated, un-accessioned vessel in the Scripps basement is a lamp. I would identify the triangles of dots as blue glass grapes. Grouped together, they form a shape that could depict a bunch of grapes. It is less clear what the oval is supposed to

\textsuperscript{138} Lightfoot, \textit{The Cesnola Collection of Cypriot Art: Ancient Glass}, 124.
\textsuperscript{139} “Lamp / Beaker 1871,0123.3” \textit{British Museum}.
\textsuperscript{140} Antônaras, \textit{Fire and Sand}, 31.
\textsuperscript{141} ibid, 123, 135, 136.
represent, but it could simply be a decoration, as seen in the Met example above. Due to many similar lamps being dated to the fourth century CE, I would suggest a similar date for this object.

**Test Results**

A small sample from the flaky black coating inside of the lamp was analyzed with XRF (figure 40). It contains significant amounts of aluminum, silica, calcium, manganese, iron, copper, zinc, strontium. There is also phosphorus present. There are trace amounts of sulfur, titanium, nickel, lead, potassium.

A small sample was taken from the outside of the vessel as well (figure 41). It contains significant amounts of aluminum, silica, sulfur, calcium, manganese, iron, zinc, and strontium. There are trace amounts of phosphorus, titanium, and potassium. It is possible that the yellow-amber color comes from the sulfur.¹⁴²

The low levels of potassium in both samples are most likely indicators of leaching in the glass due to weathering over time.

The blue glass used as a decoration was pitting instead of delaminating. Therefore, samples could not be taken for XRF testing. Due to the blue hue, it is possible that cobalt was added as a colorant.

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Small Blue Bottle L.74.6.29

2 ½ x 1 x 1 (inches)

Labels: none

Figures 9-14.

Description

This small blown-glass bottle is lop-sided and does not sit exactly vertical when upright. It is an oval shape with shoulders and a neck. The rim flares out slightly from the neck but is not as wide as the body of the piece. When viewed from above, the rim is not the same diameter all the way around the piece. The bottom of the vessel is slightly concave. Because of its small size, it is made from relatively thin glass. Perhaps due to its opacity, there are no visible bubbles.

The glass is a deep blue color. There is an iridescent sheen to the piece. About half of it has a milky brown weathering on it (chapter 5). This coating blocks the blue color from being visible. However, the weathering appears stuck to the vessel and can’t be wiped away as if it were dirt. Around the neck, there are faint lines or scratches through the surface of the unidentified coating.

The bottle does not appear to have been cleaned, since the coating is on the outside. The inside of the neck has a build-up of sandy material.

Condition

- This vessel is in a slightly unstable condition.
- The vessel is delaminating on the sections that remain dark blue. However, the delamination does not appear to be flaking off so although flakes are loose and the glass below them is visible, there appears to be no inclination for the flakes to lift off of the surface, even when the bottle is being handled.
• The piece does not appear to have ever had any repairs. It shows no signs of having been broken nor chipped.

Identification and Commentary

Small bottles made from a similar color are also present in the Met’s Cesnola collection. They are described as being “cobalt blue.” ¹⁴³ However, in the Mudd collection, this is the only item that is a bright cobalt blue.

A small bottle (accession number 74.51.217) of a similar height and shape is in the Met Cesnola catalogue. Its neck is slightly shorter and narrower. It is a natural pale blue color, instead of a deep cobalt blue. It is dated to the 1st-2nd century CE. ¹⁴⁴

A small bottle like this would have most likely been used to store a perfume or some sort of beauty product. Due to the relatively simple shape, a similar date of 1st-2nd century CE is possible.

Test Results

A small sample of glass was taken from the side of the blue bottle. XRF analysis revealed some confusing results (figure 42). There are significant levels of aluminum, silica, phosphorus, sulfur, potassium, calcium, and iron. There is also strontium recorded. There are reportedly trace amounts of titanium, copper, lead, and arsenic.

The reported presence of arsenic should be examined with skepticism. This is because lead produces two peaks, at La energy 10.5 keV and Lb at 12.6 keV. ¹⁴⁵ The Lb peak is the one typically used for lead analysis. However, the best peak for arsenic is its Ka peak, which is also located at keV 10.5. The XRF device would not be able to tell the difference between the

¹⁴⁴ ibid, 207.
¹⁴⁵ Olympus website.
secondary lead peak and the primary arsenic peak since they completely overlap. Thus, the arsenic detection level is elevated.\textsuperscript{146}

The results above are confusing as the XRF machine indicated that there was no cobalt present. The range where cobalt would be found in the spectrum is indicated, to show that there are no peaks present. It was assumed that cobalt was the case of the blue color in the glass, but the sample analysis contradicted this. According to the Museum of Fine Arts in Boston’s Conservation and Art Materials Encyclopedia Online (CAMEO), cobalt oxide and copper oxide can be used to create a blue color in glass. However, the blue glass created with copper is much closer to turquoise. The color of this bottle could only be described as “cobalt blue.” Therefore, it is unclear how this bottle was colored.

I contacted Stephen Koob at the Corning Museum of Glass for help interpreting the lack of cobalt. He explained that there is probably such a low amount of cobalt needed to make such a rich color that it cannot be picked up by the XRF. According to Koob, an average analysis of cobalt in glass found that glass can appear blue with a presence of just 0.04\%. Therefore, instead of XRF, I should have used laser ablation for testing all of my glass samples. I suggested that due to the fact that the samples were from delaminated layers, they may be rich in silica and little else due to leaching. Koob agreed with this. Therefore, based on appearances, the glass was colored with cobalt, but testing with XRF was inconclusive and other tests should be done instead.\textsuperscript{147}

\textsuperscript{146} Olympus website.
\textsuperscript{147} Email communication from Stephen Koob to the author, 27 Mar. 2019.
**Small Jug, C.G. 1275**

2 ⅜ x 1 ¾ x 1 ¾ (inches)

Labels: small circular sticker under handle, reads “P.13 / A / 12 lot” in pencil and pen. In red paint near the bottom of the body on the side is the accession number “C.G.1275”.

Figures 15-21.

**Description**

This small blown-glass jug has a rounded body with a tapering neck that gets slightly narrower as it goes up. The rounded body is slightly indented on the bottom so as to allow the vessel to sit on its own. The neck is approximately as tall as the body is. The rim isn’t the same size all the way around and is slightly shorter on the side away from the handle. The rim is also slightly flared. On one side, there are two ribs of glass reaching down from the rim. They form a sort of wishbone shape.

There is a slight indent on one side of the glass. This would have been formed while the glass was in the process of being made and was still hot. It could have accidentally been knocked against something that pushed the glass in slightly on contact.

The handle is attached separately and is positioned right below the neck and just beneath the rim. It is one piece but has a groove down the center with folded edges (sometimes referred to as “reeded”). Just before it connects with the rim, the glass has been folded on itself to create slight ornamentation and perhaps also to function as a thumb rest.

The glass of the body is a slightly greenish-blue of natural glass that has not been de-colorized or had color added. The handle is a darker green that is almost olive in color. This is the result of intentionally coloring the glass. The glass has no iridescence. There are several large bubbles in the glass. They are rounded in the body and elongated on the neck.
A build-up of dirt remains on the jug, particularly on the inside of the neck. The dirt appears sandy and is a pale brown.

**Condition**

- Overall, the glass is in a stable condition. It does not appear to be delaminating at all.
- The vessel does not appear to have ever had any repairs.
- There is a small chip of glass missing from the rim.
- There is an oval-shaped crack on the side of the vessel that is opposite the wishbone. It is slightly over an inch wide and just under an inch tall. The left side of the crack ends in a five-pointed star-shaped crack.

**Identification and Commentary**

There are many jugs with handles of varying sizes in the Met’s Cesnola collection. A few with some similarities to the one in the Scripps basement are mentioned below. Jugs of this shape were apparently considered abundant in Cyprus by archaeologists in the 20th century.\(^{148}\)

The first, accession number 74.51.145, is a jug with a similar rounded body shape. Its neck is shorter and its rim more pronounced. The body is a deep reddish-purple color, while the handle is bright blue and is attached separately. This is similar to the jug that is focused on here, which also has body and handle colors being different. It is dated to the mid-1st century CE.\(^{149}\)

The folded glass handle is also present on accession number 74.51.133. This jug is overall larger and more refined in shape, yet the ornamentation created by folding the molten glass on the handle is the same. In this case, the handle and the body of the jug are made from


\(^{149}\) ibid, 129.
glass that is the same color. Apparently, Luigi Palma di Cesnola found over a dozen similar examples while excavating tombs across in Cyprus. It is dated to the 1st century CE.\textsuperscript{150}

Another jug, accession number 74.51.5783, is nearly identical in size. The natural pale blue color for the body of the glass is similar as well. Both have a handle that is thick at the bottom and folded near the rim. Only in this instance, the handle is slightly more teal than the olive green in the Scripps version. This jug is dated to the 1st-2nd century CE.\textsuperscript{151}

The Museum of Fine Arts in Boston has a similar jug (accession number 72.464), made from natural colored blueish glass with a matching folded handle. It has a smoother transition from the body to the neck than the Scripps jug. It also has a much larger rim. It is simply dated “Roman Imperial Period.”\textsuperscript{152} A vessel in the Met’s Cesnola collection is nearly identical to this one, and it is more specifically dated to between the 2nd-3rd centuries CE.\textsuperscript{153}

A similar match was found in the Fine Arts Museums of San Francisco (accession number 1946.18).\textsuperscript{154} It is exactly the same height, but a little wider. The handle is smaller and not quite as green. However, the overall shape and design bears remarkable similarity.

One amphora in the Met Cesnola collection has similar decoration (accession number 74.51.146).\textsuperscript{155} It is much larger and has two handles. Of importance here is the fact that the glass on the body has been manipulated to form “wishbones” back to back. This suggests that the single design on the Scripps piece may actually be intentional even though the placement is unusual.

\textsuperscript{150} Lightfoot, \textit{The Cesnola Collection of Cypriot Art: Ancient Glass}, 131.
\textsuperscript{151} ibid., 132.
\textsuperscript{152} “Jug 72.464.” \textit{Museum of Fine Arts, Boston}.
\textsuperscript{153} Lightfoot, \textit{The Cesnola Collection of Cypriot Art: Ancient Glass}, 146.
\textsuperscript{154} \textit{Small Green Ewer} 1946.18, The Fine Arts Museums of San Francisco.
\textsuperscript{155} Lightfoot, \textit{The Cesnola Collection of Cypriot Art: Ancient Glass}, 160.
In the 1920’s, the Met’s collection of Cypriot glass from Cesnola was accessioned with numbers 74.51. Prior to this time, the prefix was C.G. (Cesnola Glass). The Cesnola collection was so large that it was decided that the Met could “dispose” of duplicates. These items were then sold off to other museums around the country. The Met also sold 250 pieces of glass to private individuals between 1916-1928. This piece has a C.G. number, which caused me to reach out to the catalogue’s author, Christopher Lightfoot. He confirmed to me that “C.G.” on the glass proves that (a) it was part of the Cesnola collection from Cyprus, and (b) it once belonged to the part of his collection that was acquired by the Met. Oddly, there is no record of the jug in the archive at the Met. Presumably a piece that has been accessioned and deaccessioned should appear in archive searches carried out by Lightfoot on my behalf.

Lightfoot examined photographs of this piece and suggests it is from the third century CE.

**Test Results**

There was only very minor delimitation in one place on the bottom of this vessel, and so the sample was particularly small and thin (figure 43). Therefore, the testing was particularly difficult. The XRF analysis showed that there are significant amounts of silica, phosphorus, sulfur, potassium, calcium, and iron. There is also strontium present. There are trace amounts of nickel and lead.

The glass that forms the handle was in very good condition, and no delamination was occurring so samples could not be taken for testing. It is postulated that the color would come from iron.

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157 ibid, 15.
158 Email communication from Christopher Lightfoot to the author, 21 Feb. 2019.
159 ibid.
**Candlestick unguentarium, L.74.6.11**

5 ¼ x 3 ¼ x 3 ¼ (inches)

Labels: small round sticker on base reads “102 / 14” in pen beneath a red symbol or stamp.

Figures 22-27.

**Description**

The majority of this blown-glass unguentarium is comprised of the neck. The body is wide and bell-shaped yet is still quite flat. The neck extends up from the body (which doubles as the foot) and tapers thinner as it goes. The rim is flared upwards and outwards. The bottom side of the foot is slightly concave, but flatter than not. The glass that this vessel is comprised of is relatively thin.

The glass is uncolored but has a faint green tint to it. There is also a faint iridescence to the glass. The glass appears dull or frosted in appearance. There are no visible bubbles, but there is a faint blowing spiral on the neck.

There is a fair amount of dirt accumulated inside of the unguentarium, right up to the rim. The outside of the glass appears dark blue or purple wherever dirt is stuck on the inside. This gives the vessel a wider variety of colors than it actually has. There is some sort of white coating or reaction product under much of the dirt inside of the vessel.

**Condition**

- This vessel is in a relatively stable condition.

- The glass has begun to delaminate slightly. It is most prevalent on the foot and the lower half of the neck. Where the flakes are looser, the glass is an opaque white.

- There is a crescent-shaped indent that is about 2cm long in the body that is about 2cm from the edge.
There is an approximately 2cm “split” in the glass where glass is missing, which is about 2.5cm above the crescent.

**Identification and Commentary**

This vessel is what is called a “candlestick unguentarium.” It would have been used to store some sort of perfume or scented oil for cosmetic use. The long narrow neck on such a vessel was created to minimize evaporation of the valuable contents inside. It also allowed for more control when pouring from the unguentarium.\(^\text{160}\)

There are several similar candlestick unguentaria in the Met’s Cesnola collection. The first is accession number 74.51.15. It too has a neck that tapers up to a flared rim. The glass is weathered similarly as well. The base of the neck on the Cesnola vessel is tooled at the base, meaning it gets slightly narrower (due to squeezing it with tools while the glass was still hot). According to archeologist Vessberg, who catalogued and created a typology for unguentaria found on Cyprus, the body of this vessel is sloped and “bell-shaped.” It is known as Type IV. The flattened bell is quite similar to the one that is focused on in this entry. This vessel is dated to the 2nd-3rd century CE.\(^\text{161}\)

Another candlestick unguentarium, accession number 74.51.6, is similar to that discussed above, except the neck base is not tooled, which makes it an even closer match to the one in the Mudd collection. It is only slightly taller. The body of this vessel is also not as flattened as the one that belonged to Mudd. This one is dated to the mid 2nd-3rd century CE.\(^\text{162}\)

Unguentaria with flatter disk-like bodies, categorized as type III, are apparently abundant in Cypriot collections on the island. At one point, there were nearly 80 type III’s recorded in

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\(^\text{160}\) John and Mable Ringling Museum of Art, *Ancient Art from Cyprus*, 64.
\(^\text{162}\) ibid, 261.
Luigi Palma di Cesnola’s collection. While there is no mention of how many type IV pieces were present, this suggests that unguentaria were overall quite popular and produced locally. A reasonable date for this piece is that it was made between the 2nd-3rd century CE.

**Test Results**

A small sample of delaminating glass was taken from the foot of this unguentarium (figure 44). XRF testing revealed it contains significant amounts of aluminum, silica, phosphorus, potassium, calcium, and manganese. There is also sulfur and strontium present. There are trace amounts of iron and copper present.

The presence of manganese could indicate its use as a decolorizer, in the form of manganese oxide.

The K peak of this spectra is remarkably high—indicating, perhaps, an abundance of flux in the glass. However, because the shape is so prevalent to Cyprus at the time period in question, an alternative location of origin is unlikely.

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Incised Vessel, A 3085

4 ½ x 3 ¼ x 3 ¾ (inches)

Labels: Small round sticker on the bottom reads “A / 3085” in pen.

Figures 28-34.

Description

The body of this blown-glass bottle is rounded, like a sphere. The base is small and flat, which keeps the sphere-like shape. On the bottom, there is a small half-circle shaped indent, which is only about 1cm long. There is a neck that comes up from the body and is the same diameter all the way up. There is no flared rim.

This vessel is made from a relatively clear glass. It doesn’t appear to be any of the “natural” green or blue colors of glass that are untreated. It is opaque, which makes it look white. The glass itself is pretty thick. In some places, the glass is a pearly iridescent. In others, it is more of a dull white. It was most-likely clear originally, with no iridescence. There are small pinprick bubbles on the vessel, and multiple blowing spirals are present.

Small amounts of dirt can be seen inside of the bottle, as it makes darker splotches show through to the outside of the glass. Overall, the vessel is quite clean, on both the inside and the outside.

The most striking feature of this glass is the fact that it is decorated. A geometric design has been incised in the glass. On the neck, there is a horizontal band, approximately 2.5 cm below the rim. On the body of the vessel, there is a pattern that repeats three times around the surface. The pattern is a square that rests on one of the points, with small slash-marks inside of it. One square has six marks, another seven, and the third has eight. Each of these three squares branch off of a triangle when the piece is examined from above. The points of the triangle are
each split into another triangle with a line. Three small hash-marks are below each of these smaller triangles. It is perhaps because of the intent to incise this bottle that the glass was left thicker, so that it could stay intact as it was incised. (For diagram, see figure 37).

**Condition**

- This vessel is in a relatively stable condition.
- Despite the iridescence on this bottle, there does not appear to be any delimitation where glass flakes are parting from the surface.
- At some point in the past, the bottle was broken and repaired. There are no records of the break or repair occurring. It was broken into three pieces, with an additional crack. The break extends over much of the body of the bottle, including across part of the bottom.
- The break was mended with a thick glue. This repair was very poorly done. The pieces were not flush against one another, and so some stick up while others are indented. The glue has discolored and is brown and dirty. It is oozing out in some places, indicating that too much was used.

**Identification and Commentary**

In the Met’s Cesnola collection catalogue, I counted six glass items with incised lines on them. Two are footed beakers used for drinking. Each has a pair of incised lines running horizontally around the body of the vessel. They appear nearly identical. Accession number 74.51.227 is dated to the late-1st century to the mid-2nd century CE, while accession number 74.51.248 is dated to the 3rd century CE.164 A third item is a small bowl, with two incised bands in the middle, and one near the foot and one near the rim. It is dated to the mid-1st to 2nd century

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These dates show that incising glass was carried out throughout various eras of glass production on Cyprus.

There are several bottles with a shape similar to that described above in the Met’s Cesnola collection. One such bottle, accession number 74.51.93, has the similar spherical body with a neck protruding from it. In this example, however, there is a flared and stepped rim, and the neck itself is slightly slimmer and is tooled at the base. The glass is quite clear but with a purple tint, which would be due to some sort of dirt-build-up since it is not uniform. This bottle has two incised bands, but they are nearly impossible to see. It is dated to the mid 1st-2nd century CE.\textsuperscript{166}

Two other bottles also have incised bands. The first is accession number 74.51.71. Its body is pear-shaped with a long thin neck, all in natural translucent blue glass. It has three shallow incised bands around the body. It is dated to the 1st to early-2nd century CE.\textsuperscript{167} Another, accession number 74.51.42, is of a similar shape to the Mudd one. It has a spherical body with a slightly shorter neck extending up from it. There is a small, less pronounced rim than those mentioned above. It has a single incised band just below where the neck and body meet. The Mudd bottle is nearly twice as tall as this Met Cesnola piece. The Met Cesnola bottle is dated to the 1st to early-2nd century CE.\textsuperscript{168} It would be reasonable to assume that this vessel was made between the 1st and second century CE.

One of the ways that the Scripps bottle is unique compared to those in the Met Cesnola catalogue is the neck and rim design. It has no flared rim leading away from the neck. The neck

\textsuperscript{165} Lightfoot, The Cesnola Collection of Cypriot Art: Ancient Glass, 112.
\textsuperscript{166} ibid, 152.
\textsuperscript{167} ibid, 153.
\textsuperscript{168} ibid, 195.
simply tapers up and then ends. None of the bottles in the Met Cesnola catalogue appear to be that way.

Incised glass vessels were known during Roman times as works in relief.\(^\text{169}\) Incised lines or decorations were created by running a rotating stone or metal (such as copper) lathe over the surface. Pointed metal tools were also used. This technique linked glass working to the production of miniature art, according to Princeton.\(^\text{170}\) During the first century CE, it was popular to decorate clear, decolorized glass with band incisions. At this time, it was noted that glass that was going to be incised was left thicker. This can be seen with the specific vessel that is the focus of this entry. Later on, cheaper items such as bowls began to get a few bands, but no decoration beyond that. During the third and fourth centuries, the rhomboid pattern\(^\text{171}\) became popular, and was thought to represent that straw cover used to protect such glass vessels.\(^\text{172}\) This complicates the dating of this particular glass piece, since its shape and thickness suggest 1st century production, but its design might indicate a later creation date.

The incised design that decorates this piece appears to be unique, so far as my research has found. There is nothing remotely comparable in the Met’s collection of Cesnola’s glass from Cyprus. Not even the Princeton University Museum, which focuses more broadly on all archaeological glass, has anything similar to this piece in the Scripps basement.

It is unclear what a bottle of this size would have been used for. Perfume bottles typically took the form of candlestick unguentaria or smaller versions of this form.

\(^{169}\) Antōnaras, Fire and Sand, 27.
\(^{170}\) ibid, 27.
\(^{171}\) While the catalogue mentions the rhomboid pattern and straw covers, they include no pictures. No images of either could be found online either, which makes a comparison difficult.
\(^{172}\) Antōnaras, Fire and Sand, 27.
Judging by the recurring dates of 1st to 2nd century CE for incised glass and bottles close to this shape, I would propose a similar date for the creation of this vessel. Perhaps an early date is supported by the fact that the glass in this vessel appears to be thicker than those in the Met Cesnola catalogue. As confidence grew in the incision process, glass may have gotten thinner, as seen in accession numbers 74.51.71 and 74.51.42.

Due to its white (originally clear) color and the incised decoration, it is my guess that this piece was historically quite valuable to whoever owned it on Cyprus. As mentioned in previous chapters, clear uncolored glass was very sought after. Furthermore, taking the time to incise a decoration—and one with more than a few simple bands—would have increased its value.

**Test Results**

Small samples of delaminating glass were taken from the side of this incised vessel (figure 45). XRF analysis indicates that there are high levels of aluminum, silica, phosphorus, sulfur, potassium, calcium, and iron present. There is also strontium. Trace amounts of nickel was also recorded.

**Case Study Conclusions**

Based on examinations and the limited results from XRF testing, it seems likely that the five glass vessels are not forgeries. They appear consistent with authentic glass items from the first few centuries CE. Their provenance would be stronger if there was a record of their discovery and purchase.

All of the items need to be examined and treated by a conservator, and suggestions are provided in chapter 5.

It is important to keep in mind that how we view these glass objects today is not how they originally looked. The weathering that most have experienced changes the appearance and makes
the vessel that we see today aesthetically different from how it looked when it was used nearly 2000 years ago. For example, weathering has impacted how we view the color of the glass. It may be paler, murkier, browner, etc. The texture has also undoubtedly changed from weathering, as the vessel may be flaky and pitted when it was once smooth. While it is beautiful, the iridescence on glass is often a result of weathering as well.
Chapter Five

Conservation and Care of Archaeological Glass

Archaeological glass is not a particularly sturdy material. The environment and weathering can cause damage to it over time. It is therefore important to recognize different types of deterioration and understand how to treat them. This chapter will examine glass deterioration and how to mediate it, as well as offer recommendations for future care and storage of this collection of glass. First however, the previous conservation interventions on two pieces from the Mudd and Scripps collections will be examined. Both have been broken and put back together again at some point, although there is no record of this happening.

Previous Conservation of Conical Vessel

The conical vessel identified as a lamp was broken into numerous pieces and put back together. A thick glue was used in excess to re-attach the glass shards. Since then the glue has aged, resulting in a yellow color while also collecting dirt. The person who tried to conserve the piece also did a poor job of restricting the glue to the broken surfaces. Instead, it was permitted to ooze out from between the contact zones of the pieces onto the outside and inside surfaces of the vessel. In some places, the “restorer” apparently tried to wipe the excess glue away but ended up leaving streaks and lines of glue that covered more of the external glass surface.

Whether or not as a result of poor “restoration” or age, the different glass shards are not flush with one-another, creating an uneven surface on the glass. If a finger is run over the surface, it catches at each border between glass fragments. This disrupts the appearance of the glass and highlights the break and poor repair.
There is also a sheen to the glass of this object that suggests that it was completely coated in some sort of glue or varnish. It is likely that all delaminating flakes were brushed off the glass at one point and a coating applied to prevent future delamination. The surface of this lamp has a particular shininess to it that does not look natural as a result of this extra layer on top of the glass. Furthermore, the glossy layer is no longer preventing the glass from continuing to degrade, as it is delaminating quite badly, particularly near the rim of the vessel.

**Previous Conservation of Incised Vessel**

The incised vessel has also been broken and repaired. Once again, there is no record of this occurring, but the repair technique is similar. A thick glue that has not aged well was used to re-assemble the pieces. The glue has turned a dark brown (or picked up a lot of grime), which stands out dramatically against the pearly white surface of the glass. The glass shards are again not flush with one another, which may lead to it destabilizing over time.

This piece is not delaminating dramatically like the conical vessel, and so it does not appear that a varnish or glue has been used to coat the surface. The delimitation is pin-prick sized and does not appear willing to lift off the surface of the glass.

**Types of Weathering**

Archaeological glass is known as soda-lime-silica glass: its composition is typically 70% SiO₂, 20%Na₂O, and 10%CaO.¹⁷³ There are impurities and the addition of colorants and decolorizers, so these ratios are never exact. In addition to actual breaks that cause harm, water is the main

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¹⁷³ Koob, *Conservation and Care of Glass Objects*, 11.
source for weathering and damage to glass. Water interacts with the different components of glass and causes visible damage after a sustained period of time.

The long-term exposure of glass to moisture causes the alkali ions present to slowly leach out of the glass. Hydrogen ions from the water take their place in the glass network. This process happens in a cycle that occurs every few years, adding more and more layers. Meanwhile, the layers become increasingly silica-heavy as the other components leave the glass. When these flakes are lifting up on the surface of the glass, this is referred to as delamination. The Corning Museum of Glass, a center for glass research, notes that it is unclear why glass decomposes in layers and states that the deterioration cannot be entirely predicted.

There are a variety of terms to describe different weathering and deterioration types on glass. Dulling can be seen in the candlestick unguentarium, for example. The transparency that the piece once had is no longer visible. The surface of the glass appears hazy. Iridescence is visible in the candlestick unguentarium, the incised vessel, the lamp, and the blue bottle. This iridescence is caused by changes in the composition of the surface of the glass. The thin layers in the glass caused by leaching of alkali ions interferes with the rays of light that hit their surfaces and reflect off of them. The layers can be uniform and compact, or flaky and vary in size. Opaque weathering (referred to as milky weathering earlier) is visible across much of the small blue bottle. This occurs when there is a large buildup of silica layers—many more than what cause the iridescence. The layers for this type of deterioration start out as white, and gradually become browner and more mottled over time. It can eventually look like enamel and cling to the

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174 van Giffen, Weathered Archaeological Glass.
175 ibid.
176 ibid.
177 ibid.
178 ibid.
glass. *Pitting* is visible on the blue ornamentation of the lamp, as well as across the surface of the incised vessel. This effect looks like small circles or dots that are indented from the glass’s surface. This is caused by corrosion that starts just beneath the surface of the glass, and spreads outwards.\textsuperscript{179} Eventually, the glass above this corrosion is lost, resulting in a small pit or hole on the glass surface.

Historically, it was fashionable to remove as many traces of weathering from the surface of archaeological glass as possible before selling or displaying the glass object. However, despite the weathering, there are important surface details (such as incisions or paint) that may be obscured or lost if the outside layers are peeled off. There are also often small soil deposits left on the surface from the ground which the glass was left in for centuries. Information can also be gained from examining such accumulations. It is better to think of the glass’s damage and weathering as part of its history that can be studied and learned from. The removal of weathering or surface build-ups is not acceptable due to information that could be lost and the integrity of the piece.

**Stabilization and Repairs**\textsuperscript{180}

It is important to remember that archaeological glass that is weathered is fragile to the touch. It should be handled as little as possible. When touching or carrying the glass is necessary, the safest way to do this is with clean, bare hands. Tactile sense is important to judge if pressure is causing damage.\textsuperscript{181} Gloves inhibit this sense and should not be worn.

\textsuperscript{179} van Giffen, *Weathered Archaeological Glass*.

\textsuperscript{180} The following instructions are based on a procedure that I learned and performed at the Seattle Art Museum in 2017.

\textsuperscript{181} Koob, *Conservation and Care of Glass Objects*, 15.
Before any of these pieces can be sent off to Cyprus, they must first be stabilized to ensure that they are not damaged when packed or shipped. Each piece should be closely examined and each instance of delaminating glass lifting up should be mapped on printed out images of the object. Paraloid B-72 is a resin that is favored for repairs because it does not yellow or become brittle with age. Paraloid B-72 pellets are purchased and then mixed with solvents such as acetone, ethanol, toluene, and xylene to create an adhesive. Dip a very fine brush in a 10% solution of Paraloid B-72 in acetone and touch it to where the flake is lifted away from the surface of the glass. Capillary action should ensure that the dot of glue on the paintbrush is sucked beneath the glass flake. One should be able to observe the glue spread out beneath the surface and watch the flake settle down, as if by suction. If there is difficulty getting the glue to be drawn beneath, first touch a brush dipped in acetone to the surface and allow it to be drawn beneath the flake of glass. Quickly follow this with the Paraloid B-72 in acetone, which will be pulled under by the acetone before it evaporates. Each place where Paraloid B-72 is added should be documented, as mentioned above.

The benefit of Paraloid B-72 is that it is colorless and does not discolor over time. It can easily be made in any conservation lab.182 Repairs made with Paraloid B-72 should last more than 100 years.183 Because “like-dissolves-like”, Paraloid B-72 in acetone can be removed from a surface by applying acetone.

If the pieces were to be repaired before being sent to Cyprus, this would be done after the Paraloid B-72 was used to secure the delaminating flakes. Of the five glass objects that I focused on, the lamp and the incised vessel are the two that are in need of the greatest attention due to

182 See Koob for instructions.
183 Koob, Conservation and Care of Glass Objects, 141.
their previous damage. Solvents such as acetone would be gently rubbed against the cracks repeatedly to see if the glue that was used to hold the shards together can be dissolved with the least dangerous solvent. Once the pieces are removed and the object is disassembled, the edges should be cleaned with acetone to remove any dirt or remaining glue. Apply Paraloid B-72 in 40% acetone in small dots along the rim of the glass shard and the piece it is being connected to, about 0.75 cm apart. This form of Paraloid B-72 will be much thicker and these dots will dry quite quickly. Once the pinpricks of glue are dry, line up the two pieces of glass along the future join and hold them in place, ensuring that they are flush against one another. Dip a fine paintbrush in acetone and run it along the crack (from the inside of the vessel, if possible). This will briefly soften the Paraloid B-72 and allow for the fusing of the two pieces. While the glue is still softened, gently run a finger across the join. It should be difficult or impossible to tell when one piece becomes the next. Continue this process with the entire vessel until it is reassembled.

**Shipping and Handling**

First, it should be remembered that many of these vessels are cracked or damaged. Unfortunately, much of the glass is weathered. The delaminating layers means that flaking and losses could occur during shipping. That is why ideally, they should be treated before packing. However, careful wrapping with tissue paper can at least contain some of the flakes that are bound to be knocked loose. Therefore, extra care should be taken when handling them as their stability has already been weakened. Each object should be wrapped in a single piece of tissue

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184 It should be noted that Paraloid B-72 will contain tiny bubbles of air. This should not be a problem as the amount used should be small enough that bubbles are not visible when viewing the repaired cracks.
paper, packed in foam, and placed in a cardboard box which fits inside of a crate. The foam should be Ethafoam that is cut to fit each individual object. A cutout that is half the depth of the glass should be made, the glass inserted into it, and a cutout that matches the remaining half set on top. This ensures that the glass is only touched by soft material and cannot shift during the flight. Koob recommends having at least three inches of foam on all sides of the glass object. Multiple pieces of glass may be put in the same box so as to save space. The cardboard box should be a size that it can easily be carried by one person. A list of the object accession numbers inside should be written on the lid. This box would then be placed inside of the larger crate.

**Display**

Once they reach Cyprus, the objects will be put on display in the library. It is unclear if conservation or stabilization efforts will happen first. Glass cases will be used to exhibit the artifacts. Any wood or paint used in the cases should be tested first, to ensure that there is chemical stability and no off-gassing. If the glass is being set on a painted surface, a safe option is to put a cutout of Mylar that is slightly larger than the foot between the glass and the shelf. Some objects may need a mount to keep them steady. This should be made of plexiglass or brass with a Paraloid B-72 coating. First, the glass item should be thoroughly inspected by a conservator to ensure that it can safely be supported. Adhesives or “museum gel” should not be used to keep the glass positioned in one place. It can stain the surface and is difficult to remove.

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185 Koob, *Conservation and Care of Glass Objects*, 147.  
186 *ibid*, 147.  
187 *ibid*, 132.  
188 *ibid*, 133.
Storage

In storage, it is best to keep the air at a moderate temperature and ensure that there is ventilation. Relative humidity is an important factor, and should stay around 45%, give or take 5%. If glass is unstable, the humidity should be lowered slightly, to around 40%.\textsuperscript{189} Temperature and humidity should be monitored with the appropriate devices. It is crucial to ensure that there are not great fluctuations in humidity.

Whether the glass is stored on open shelves or within boxes or cabinets, all surface that the glass touches should be padded. The Corning Museum of Glass recommends using closed cell-polyethylene (Ethafoam or Volara) for lining all surfaces.\textsuperscript{190} They also recommend storing smaller archaeological glass items in drawer units, such as map or filing cabinets that have been lined with polyethylene.

The previous repair efforts performed on two of the glass pieces in the Mudd/Scripps collections show how techniques change and are improved over time. Newer techniques focus on stability, instead of trying to make the object look just like it originally did. The various types of weathering present attest to the survival of the glass for nearly two-thousand years buried in the earth or in tombs. Weathering and dirt accumulations can be used to learn about this history of the glass and so should not be removed. Conservation is recommended for the entire glass collection, as soon as possible. Each object should have a condition report written and the necessary treatment carried out. In their new location in the library, they should be in safe yet visible housing.

\textsuperscript{189} Koob, \textit{Conservation and Care of Glass Objects}, 141.
\textsuperscript{190} ibid, 142.
Conclusion

Using the collection of glass in the basement at Scripps as a case study, I examined the history of glass on Cyprus. Conservation of archaeological glass was examined with five selected pieces as the focus. Reports were written on weathering, damages, and previous repairs. I have concluded that collection of glass is a reflection of what was typically used on the island of Cyprus in the first few centuries of the common era. Decoration to the glass was minimal, and the pieces showed competency but not a mastery of glass blowing. These conclusions are expected since Cyprus was a center of trade, not innovation, when it came to glass. However, the collection is important because it gives an idea of what daily life looked like on Cyprus at the time. Thus, there is still a lot that can be learned from the pieces. Therefore, it is important that they are conserved using the most modern techniques available so that they can be appreciated in their new home. There is always room for more research, and I expect students at the University of Cyprus will continue to learn from the glass. Before that can happen, the priority should be to conserve and stabilize the entire collection.

Researching the collection would have been much easier had it been properly documented over the past century. With no written provenance, no information about find spots, circumstances of sales, or history of the pieces can truly be known. While it is too late for this collection, it should be standard protocol to save all receipts of purchase for private collections such as this. Much of my investigations into the collection were hampered by no one creating or saving records relating to the glass objects, so nothing is known for sure about their origins.

One of the most obvious examples of the importance of provenance with regard to this collection is the small jug, C.G. 1275. After my research, we now know that it was discovered by Cesnola and owned by the Metropolitan Museum of Art. However, there is no record of this
object in the Met’s archives, so nothing is known about how it ended up in the basement at
Scripps. The circumstances of the sale, the date, and the person who presumably purchased it are
not recorded at the Claremont Colleges nor at the Met. This was a significant discovery and it is
frustrating that so little can be learned from it due to poor record keeping within multiple
institutions.

Although the writing and research for this thesis is completed, there is still more work to
be done with this collection, specifically with technical analysis and conservation. After
completing XRF testing, I learned that it was not the best method for extracting the information
that I wanted from the glass. Due to leaching and mechanical issues, the XRF process was
further complicated. If I had more time, or in the future, laser ablation and ICP-MS testing
should be used instead. There is also more to be learned more about the possible coating inside
of the lamp. What was its purpose, and what would it have looked like originally?

The value of glass on Cyprus and in the ancient eastern Mediterranean is a complicated
and often overlooked history that is not complete. The theme throughout this thesis has been the
value of glass in the ancient Mediterranean through to the present day. During Hellenistic times,
it was a complicated process to produce few pieces and so only society’s elite could afford glass,
making it a symbol of status. At the onset of the Roman Empire, glass blowing was invented,
which changed the market. Pieces could be produced much more rapidly, and so the glass market
grew and thrived as glass was suddenly affordable by nearly all social classes. Its prevalence
lowered the monetary value, while at the same time it was essential for daily life as a storage
container and drinking or eating vessel. This mundaneness is mirrored in the history of the Mudd
and Scripps collections, as they were ignored for decades only to now be greatly valued by the
University of Cyprus as repatriation begins.
By being repatriated, the glass is embarking on a new chapter in its “life”. It will once again be used and appreciated in its homeland. It will not be used as it was historically, when filled with perfumes and oils and wine, but used instead as an object to learn from. Although the glass collection has not yet returned home, its place of honor in the newly built library at the University of Cyprus awaits it. There, it will be admired and examined by students and visitors daily. Some students will be able to examine the pieces and learn about aesthetics and glass functions in their own history. Others will be able to take samples of glass or surface accretions and discover more about the production and origins of these specific specimens. This is the best fate to befall the collection.
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Numbers that are in *italics* indicate trace amounts of an element. Numbers that are in **bold** indicate large quantities of an element. Highlighted numbers indicate a very large peak. Important: The numbers in these tables are for reference but should not be taken as accurate.

| A   | Date | Reading | Mode | Object      | B   | C | D | E  | F  | G | S | % | H | I  | J  | K  | L  | M  | N  | O  | P  | Q  | R  | S  | T  |
|-----|------|---------|------|-------------|-----|---|---|----|----|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1   | 3/8/19 | #2C   | Geochem | Inside coating lamp | 24176.69 | 86912.18 | 1986.83 | 229.02 | <LOD | 16200.54 | 1228.58 | 9202.92 | 11419.52 | <LOD | <LOD | <LOD | 40.79 | 31.78 | <LOD | 40.79 | <LOD |
| 2   | 3/8/19 | #3C   | Geochem | Outside lamp | 17076.47 | 76434.87 | 2357.59 | 3010.92 | 75.77 | 12805 | <LOD | 148.45 | 3969.58 | <LOD | <LOD | <LOD | <LOD | 44.68 | <LOD | <LOD | 16.54 | <LOD |
| 3   | 3/8/19 | #4C   | Geochem | Unguentarium | 12750.33 | 109855.8 | 1848.96 | 339.15 | 7356.17 | 3803.21 | <LOD | 835.89 | 277.03 | <LOD | <LOD | <LOD | <LOD | <LOD | 4.2 | <LOD | <LOD |
| 4   | 3/8/19 | #5C   | Geochem | Blue Bottle | 8124.44 | 82855.65 | 1925.41 | 3563.65 | 831.62 | 7270.13 | <LOD | <LOD | 2867.38 | <LOD | <LOD | <LOD | 4.5 | 4.24 | 7.16 |
| 5   | 3/8/19 | #6C   | Geochem | Incised bottle | 10234.19 | 55783.38 | 2002.72 | 1584.78 | 4959.5 | 1353.08 | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | 2.2 | <LOD | <LOD |
| 6   | 3/8/19 | #7C   | Geochem | Juglet | <LOD | 3476.27 | 1350.69 | 1206.47 | 505.53 | 2286.12 | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | 2.2 | <LOD | <LOD |
| 7   | 3/8/19 | #8C   | Geochem | Juglet | <LOD | 3554.2 | 1586.27 | 1322.28 | 516.98 | 2266.43 | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD | <LOD |
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