

Glass

- Durable like ceramics
- Changes in manufacturing techniques over time can provide opportunities for dating assemblages
- Form, decoration, lettering can provide information on relative expense, manufacturers, and contents

Learning Goals

- Learn the different materials, forms, and manutechs for historic glass vessels
- Learn and become proficient with the DAACS batching and cataloging protocols for glass vessels

Glass Composition/ Material

- Basic glass recipe requires three ingredients: formers, flux, and stabilizer
- **Formers** make up the largest percentage of the mixture to be melted.
 - In typical soda-lime-silica glass (e.g. bottle glass) the *former* is silica (Silicon dioxide) in the form of sand.



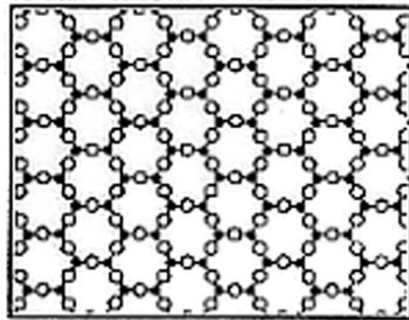


Glass Composition/ Material

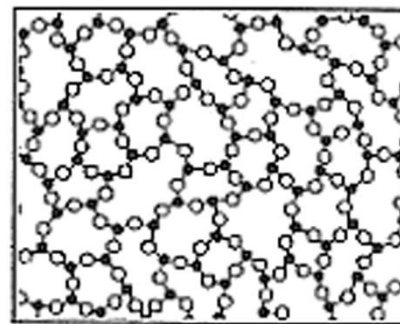
- **Flux** is a material added to lower the melting temperature of the another substance.
 - A flux is added to a batch of glass to facilitate the fusing of the silica.
 - Soda ash (Sodium carbonate, marine plant ashes) and Potash (Potassium carbonate, burned wood ash), both alkalis, are common fluxes.

Glass Composition/Material

- **Stabilizer** -- Keeps the finished glass from dissolving, crumbling, or forming unwanted crystals.
 - Calcium carbonate (lime) is a commonly used stabilizer that provides strength, keeps glass from crumbling, and makes it water resistant.
 - Lead was used as a stabilizer and clarifier for clear (colorless) tableware glass



quartz



glass

Material: Leaded Glass

- Added to colorless glass to improve clarity, increase strength and reflectivity
- Use shortwave UV light to determine whether glass contains lead
- When UV light shines on a vessel, the lead in the glass temporarily absorbs some of the light and then reflects a small amount of light that is of a different wavelength (color)
- Leaded glass fluoresces “ice blue” (not purple blue)



Leaded glass stopper
from Drayton Hall,
SC under shortwave
UV light

Glass Composition

- Other additives include metallic oxides that can change the glass color
 - Iron - Colors glass green.
 - Copper - Colors glass light blue.
 - Manganese dioxide - Can decolorize colored glasses. However, in higher amounts, this element can create purple and, in even higher amounts, glass that appears black.
 - Cobalt - Colors glass dark blue.
 - Gold - Colors glass deep red, like rubies



Glass Color

- We do sort glass by color
 - Use basic color sheet to match colors
 - The only colors we use to help differentiate form or time period are “Sprite Green” and “Brown” – used to ID modern soda and beer bottle glass



Patination/Weathering

- Unstable nature of glass leaves it vulnerable to corrosion
- Exposure to water causes alkali components to leak out
- Leaves behind distinct thin layers that alternative with air (laminar structure)
- Interfere with direct transmission of light – causes iridescence
- The layers may be uniform and compact, or flaky, fragile, and discontinuous – weathering crust, also known as patination
- <https://blog.cmog.org/2011/09/14/glass-corrosion-weathering/>
- <https://www.cmog.org/article/weathered-archaeological-glass>



Patination/Weathering: Cataloging

- Does cause glass to change color but do not catalog patination as “Gold/Gilt”
- Flakes not cataloged
- Fragments with and without patination are not differentiated in glass batching



Solarization

- Silica (main component of glass) can have iron impurities that give glass a green tinge/cast
- Manufacturers added manganese dioxide added to remove green tint (converts iron from reduced to oxidized state)
- Manganese is reduced when originally added but when exposed to UV light (e.g. sunlight) over long periods of time becomes oxidized again
- Glass becomes a light purple color
- Solarized glass should be cataloged as colorless/clear, not purple because that is the original glass color



Sorting Exercise 1: Glass color

- Work with your partner to sort your bag of glass by color using the Basic Color sheet
- Choose the Pantone chip that most closely matches the artifact as a whole

Vessel vs. Non-vessel Glass

- DAACS database used to record attributes from glass vessels **and** objects that were once part of a vessel

Vessel vs. Non-vessel Glass

- Vessel glass includes any vessels such as jars, bottles, wine glasses (stemware), as well as flat vessels (typically small plates)
- Glass objects that were once part of a vessel include milk glass jar lid liners and wine bottle seals

Vessel vs. Non-vessel Glass

- Utilitarian glass objects such as:
 - window glass
 - light bulbs
 - lamp chimney
 - insulators
 - chandelier pendants
 - jewelry parts
 - marbles, etc.

are cataloged in the **General Artifacts** module

Vessel vs. Non-vessel Glass

- Glass beads and buttons are cataloged in their respective tables

Category – Hollow or Flat



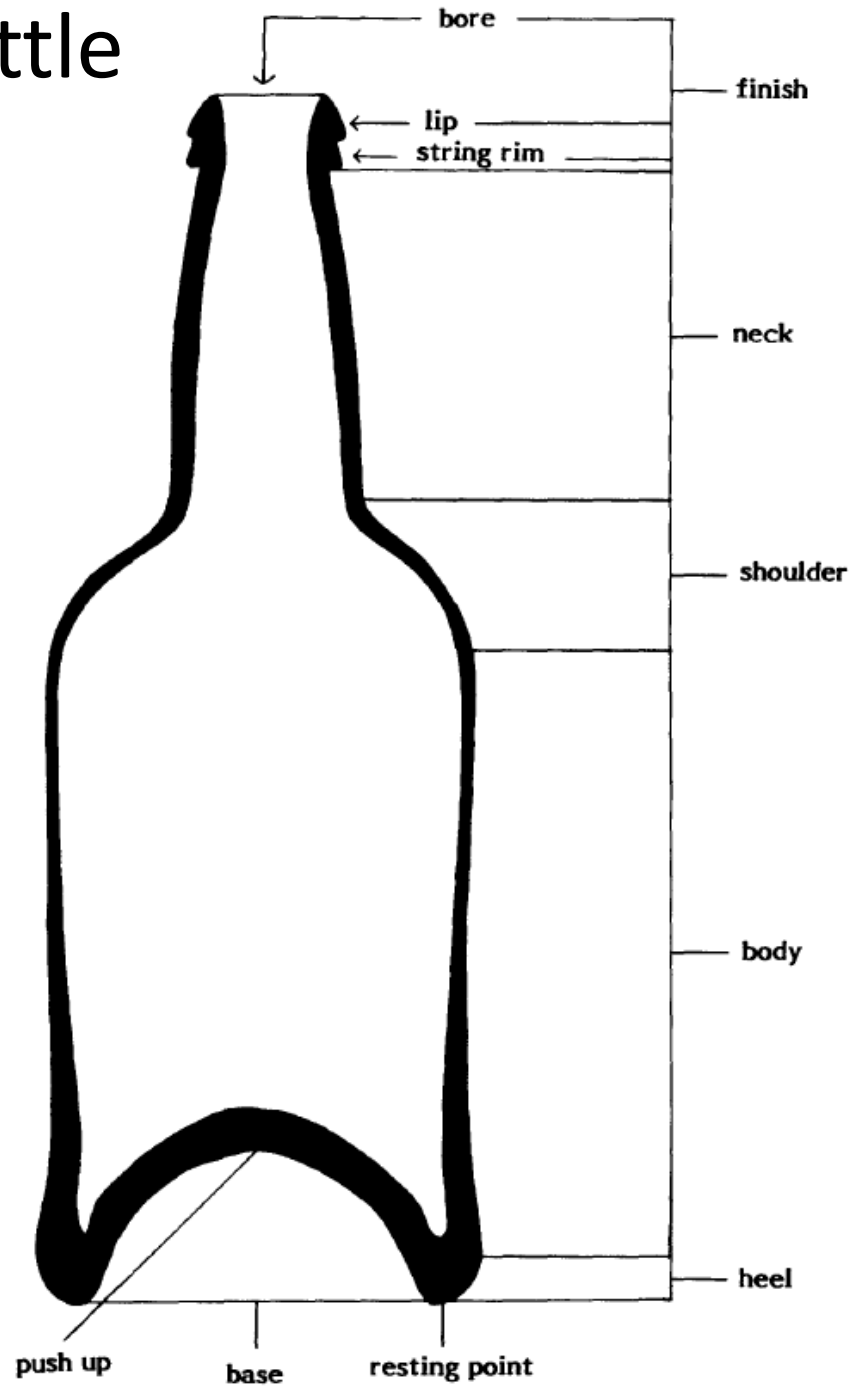
- Vast majority of what you will see is hollow
- Exceptions:
 - Salvers (handle-less tray for drinks/desserts)
 - Pressed glass plates (sandwich plates)



Glass Forms - Bottles

- Majority of glass recovered from sites of slavery in DAACS are bottle/container fragments

Parts of a Bottle



Glass Forms – Wine style Bottles

- Olive green bottle glass that likely held wine, spirits, or other consumables
- Note* some sources use the term “black” glass but all WBG should be cataloged as Green/Olive Green
- Shape changes over time – shaft and globe, onion cylindrical



Glass Forms – Wine Bottle Seals

- Seals fastened to bottles to personalize wine bottles
- Popular mid-17th century til 19th century in Britain and the colonies
- Individuals could use them as a mark of wealth/gentility
- Taverns/Inns also used them
- Are often found as separate objects
- Should be cataloged separately, with “Hollow” recorded for Completeness



Glass Forms – Case Bottles

- Stored in wooden cases
- Also held liquids/spirits
- Depending on century can vary dramatically in size
- Mold blown – Squared off corners, flat sides
- Short cylindrical neck, can have a variety of finishes



Glass Forms – Alcohol/Spirit Bottles

- Other types of alcohol



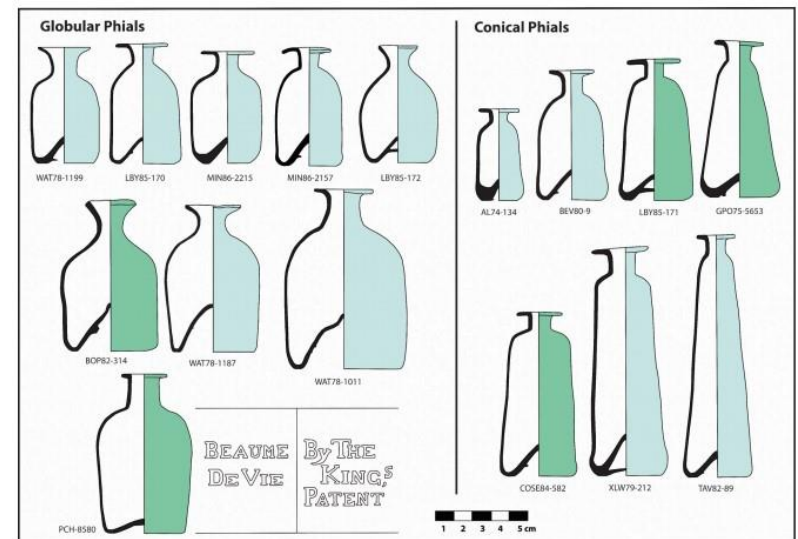
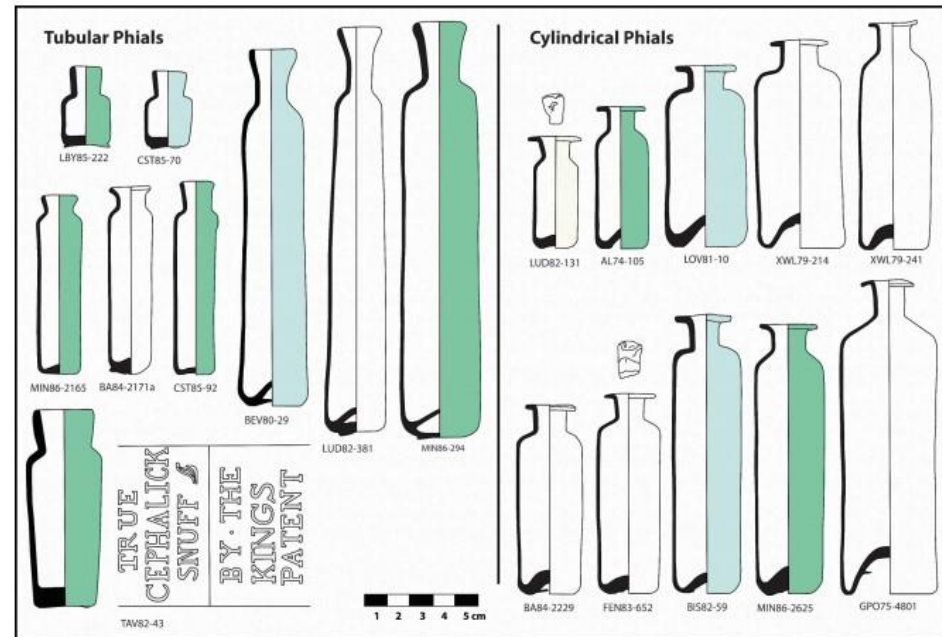
Glass Forms – Bottle/Vial, Pharmaceutical

- Containers for medicinal substances, patent medicines, druggist/prescription bottles (bitters, tonics, sarsaparilla, balsams)
- Long necks
- Variety of shapes
- Thicker overall than vials
- May have lettering/embossing



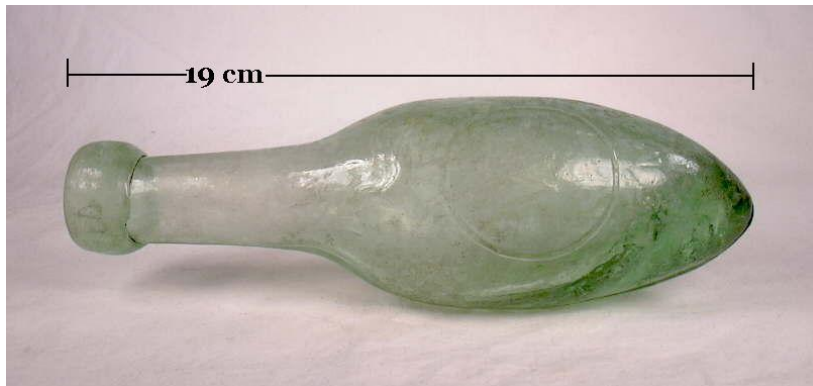
Glass Forms - Bottle/Vial, Pharmaceutical

- Vials
 - short/rudimentary necks
 - thin bodies
 - mouth blown into molds, some will have pontil marks
 - Often will have lettering
 - Often have expanding rims/lips
 - Often aqua/light green but not exclusively



Glass Forms – Mineral, Water, Soda Bottles

- Blob finishes (for internal stoppers – popular 1840s-70s)
- Round/torpedo bottoms
- Lettering/Embossing can give clues



Glass Forms -- Condiments/Food



Gothic style
pickle and
condiment
bottles –
common mid-
late 19th c.



Glass Forms - Cosmetic/Perfume Bottles



Glass Forms -- Ink Bottles



Glass Forms - Flasks

- **Flasks:** common 1815-1875 in the States
 - often “figured” (historic figures or scenes)



Non-bottle Forms

- **Jars**

- "Mason" fruit jars which utilized a zinc screw cap that was typically lined with a milk glass liner



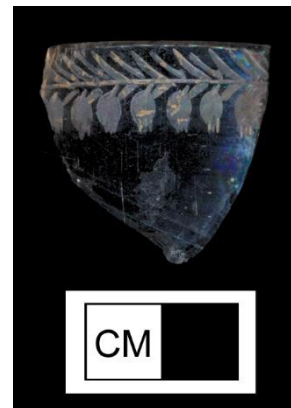
Non-bottle Forms

- **Container unid.:** sherds that are
 - Hollow
 - not tableware (i.e. not leaded, no obvious decoration, no evidence of stemware, drinking glass, tumbler etc).
 - Cannot be identified as bottles or jars (i.e. lacking neck, shoulders, expanding rim lip threading on rim/lip for jar)

Tableware Forms

Other categories include:

- **Stemware:** often leaded and decorated, usually colorless
- **Tumbler:** A type of drinking glass
- **Tableware:** often leaded and decorated, usually colorless, catch-all category for when specific forms cannot be determined e.g., tumbler or stemware



Glass Manutech: Free Blown

- **Free blown:** blown and shaped by hand **without the use of a mold**, usually in several phases

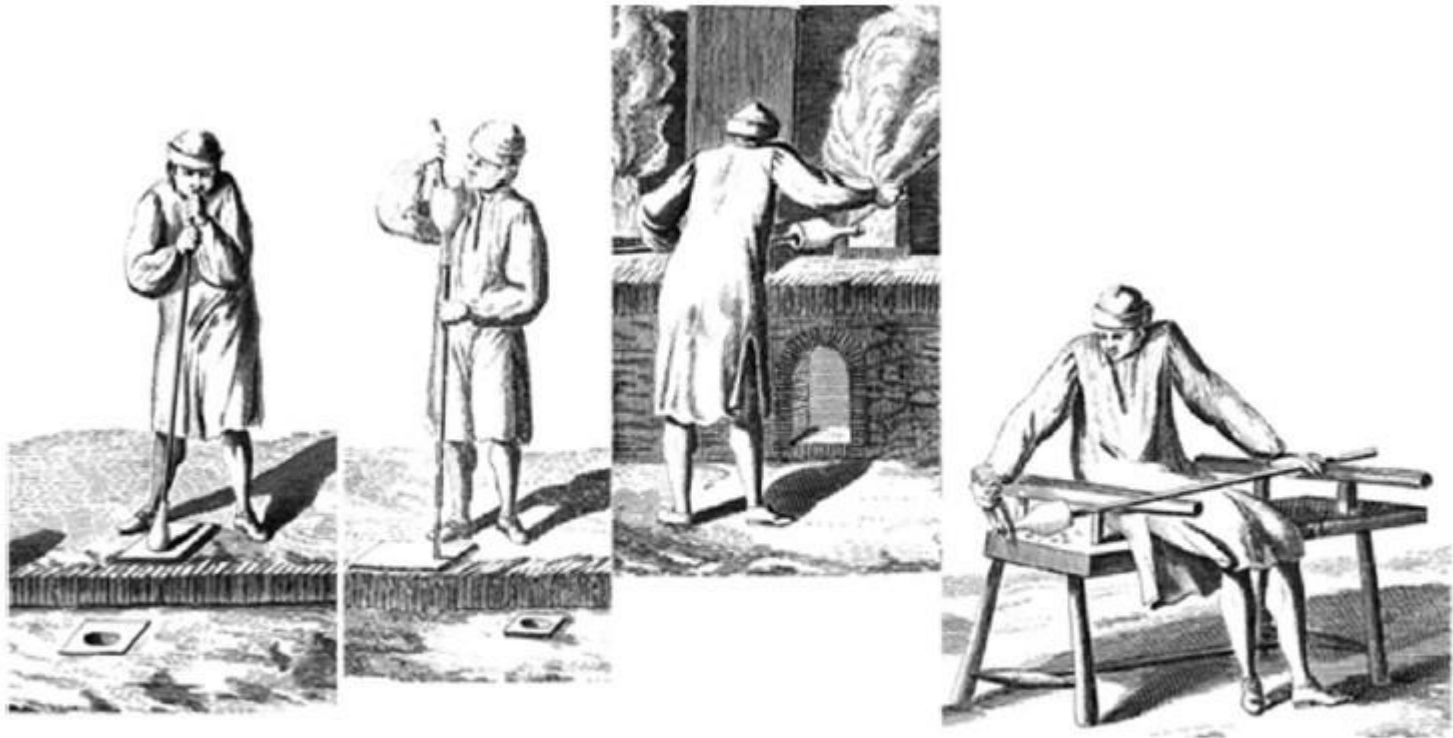


FIG. 2. The manufacture of free-blown bottles. From left to right: the glassworker inflates the parison (note the simple one-piece or dip mould at his feet), the kick or pushed in base is formed, the string rim is applied, and the neck finished (from Diderot's *Encyclopaedia*).

Glass Manutech: Free Blown

- **Free blown:** blown and shaped by hand **without the use of a mold**, usually in several phases:
- <https://www.cmog.org/video/glass-blowing>

Glass Manutech: Free Blown

- **Includes:** Early wine style bottles such as “shaft and globe” and “onion” shape bottles



Shaft and globe bottles
(middle 17th c)



Onion bottles (late 17th c)

Free Blown Attributes

- General lack of symmetry
- No mold seams (be careful of this on the fragment level though!)
- Simple globes and elongated shapes are found most often

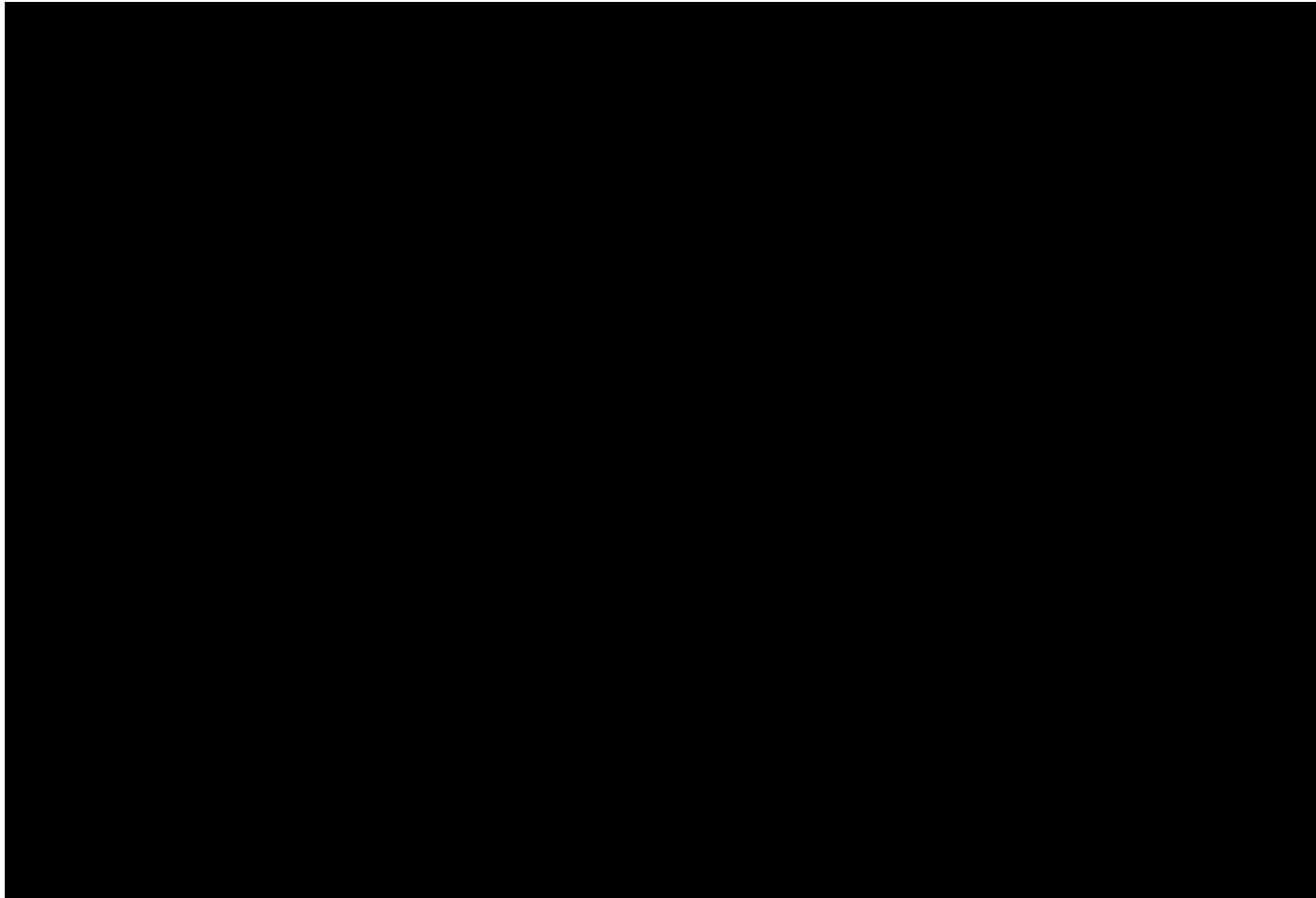


Glass Manutech: Mold Blown

- Glass may be blown by mouth into a wood, clay, or metal mold to give it form, decoration or both.
- DAACS uses mold blown to describe use of a dip or multi-part mold



Glass Manutech: Mold Blown



Glass Manutech: Mold Blown

- Characteristic mold attributes:
 - Presence of a mold seam
 - Presence of molded lettering
 - Regular body shape, sharp corners angular side and bases (e.g. case bottles)



Glass Manutech: Mold Blown

- Characteristic mold attributes:
 - Stippling/pockmarking along the surfaces
 - Indicates metal mold that had not yet reached heat comparable to glass or older/corroded mold. Texture from interior surface left on exterior of glass vessel.
 - Elongated bubbles can suggest turning or pulling from mold

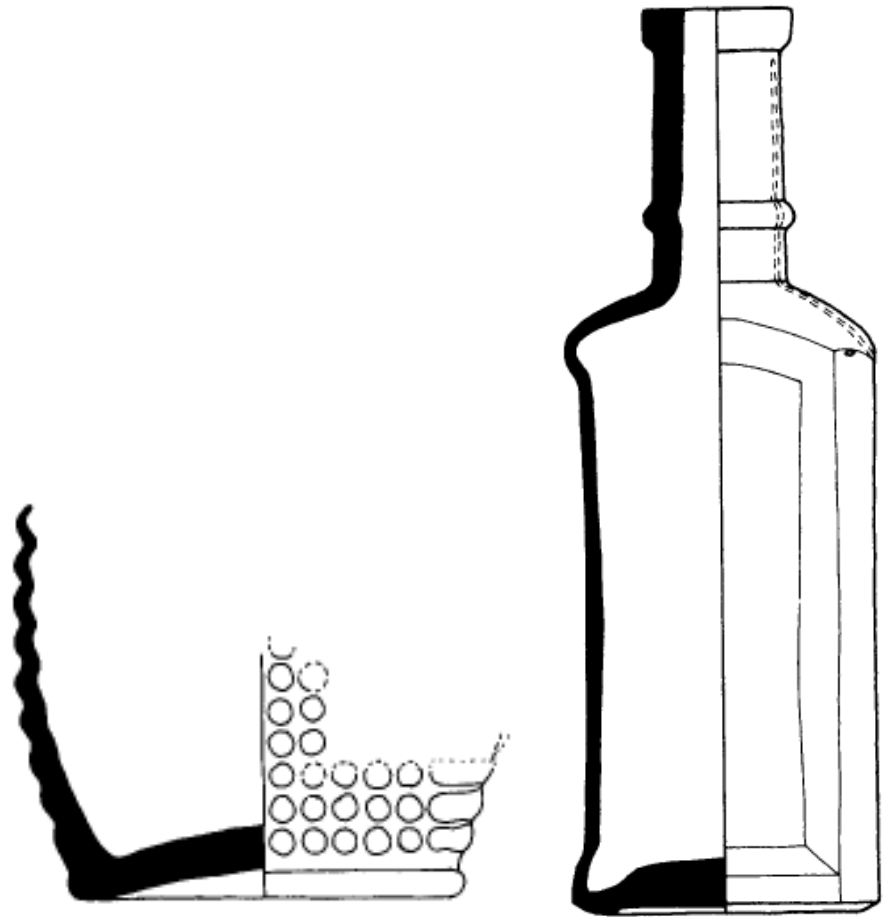


Glass Manutech: Mold Blown

- The finish is particularly helpful for differentiating between mold blown and machine made vessels
- Up until the invention of the semi-automatic bottle machine, finishes had to be applied or tooled by hand
- If the bottle finish lacks a seam that goes over the lip, it is molded not machine made

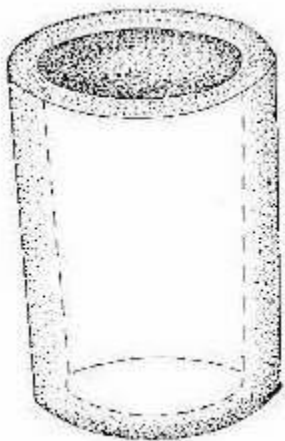
Types of Molds: Contact Mold

- Most common
- Interior and exterior are parallel to one another
- Interior follows any pattern of the exterior (convex, concave)
- In DAACS, includes two-part and three-part molds



Mold types: Contact Mold

- Dip mold – dip glass into 1 or 2 part mold and pull out vertically

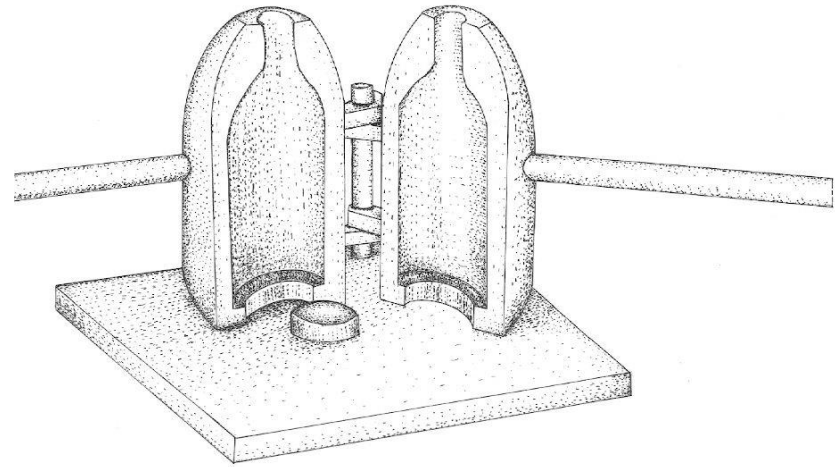


Dip Mold

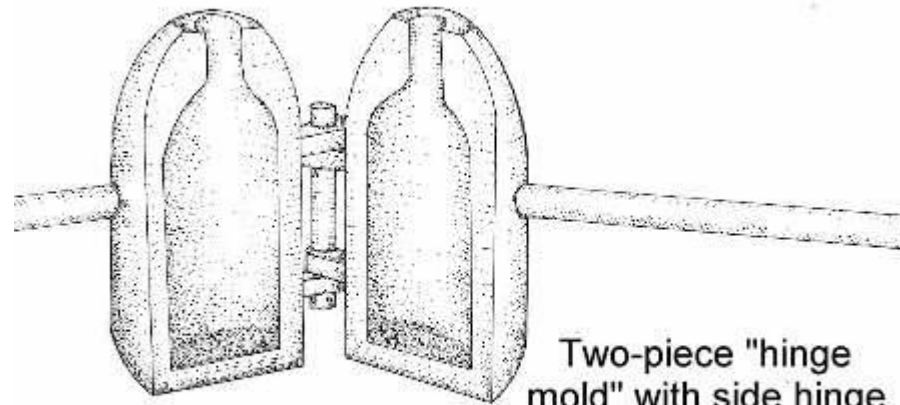


Mold types: Contact Mold

- 2- piece open and shut molds
 - Post bottom
 - Cup and post bottom



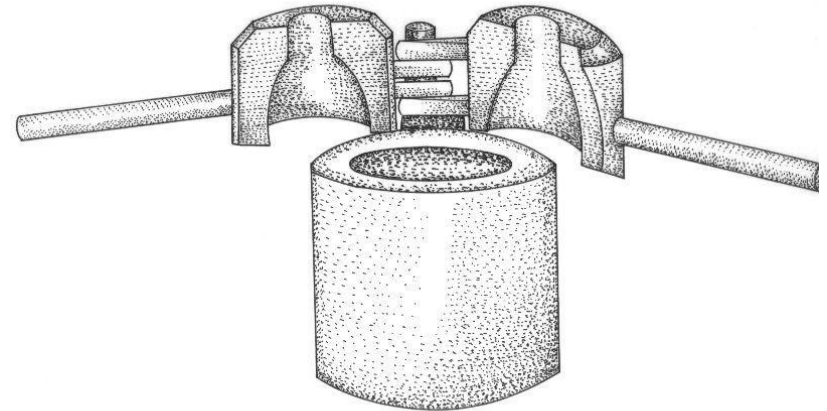
Two-piece "post bottom" mold with separate base plate.



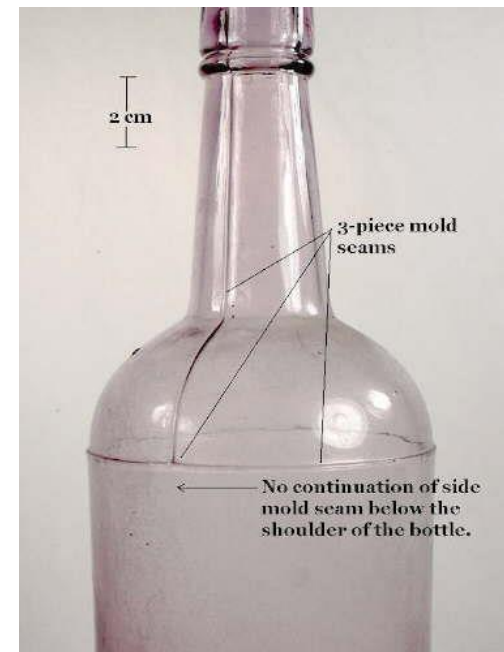
Two-piece "hinge mold" with side hinge
(there were also
bottom hinge versions)

Mold types: Contact Mold

- Ricketts mold – 3 part, patent filed in 1821
 - Allowed shaping of neck and shoulders, as well as body – mold seam visible on shoulder
 - Could also be used to emboss words and symbols on glass on shoulder
 - 1820s-1920s

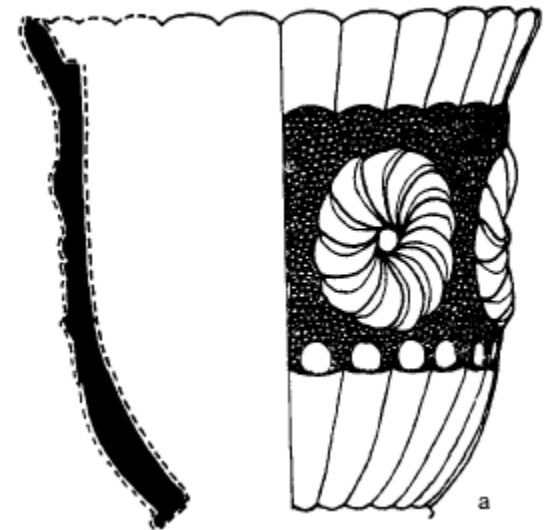


Three-piece mold



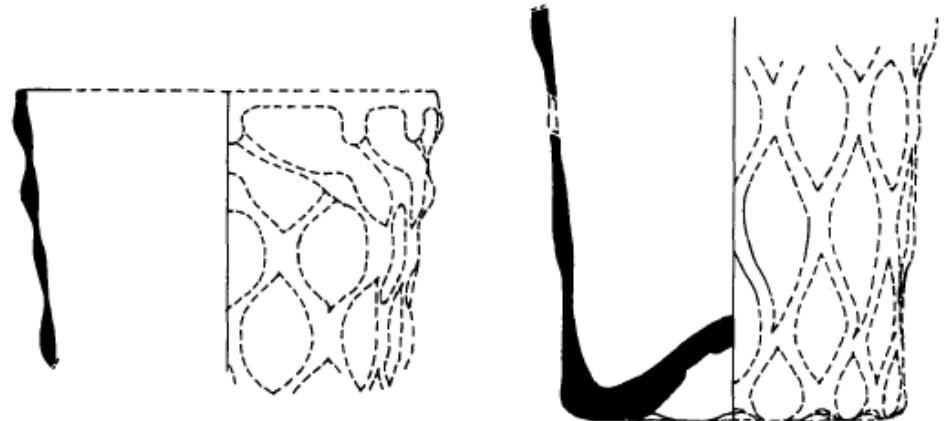
Mold Types: Press Mold

- Introduced in 1740
- Use of a hand- or steam-operated press that would force hot glass into mold
- Pressed glass may look cut, but always has seam
- One surface, usually the interior, is smooth while the other surface is patterned
- Smoothing results from plunger pressing inside of vessel into the patterned mold



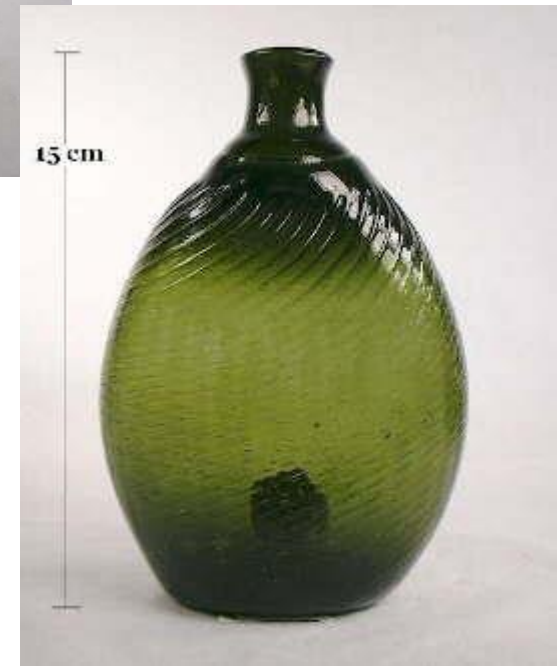
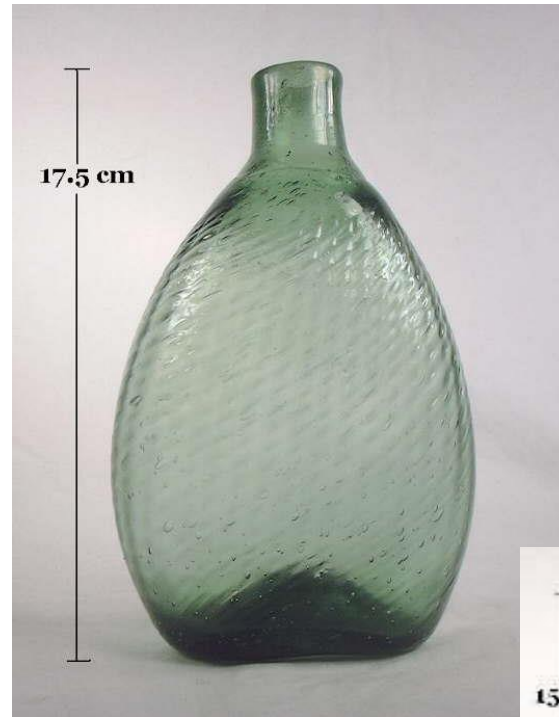
Mold Types: Pattern Mold

- Pattern inscribed on inside surface of mold transferred to vessel surface
- Used from Roman times up to present
- Corresponding contours on inner and outer surfaces
- Pattern tends to be more diffuse on areas like shoulders, more distinct on base

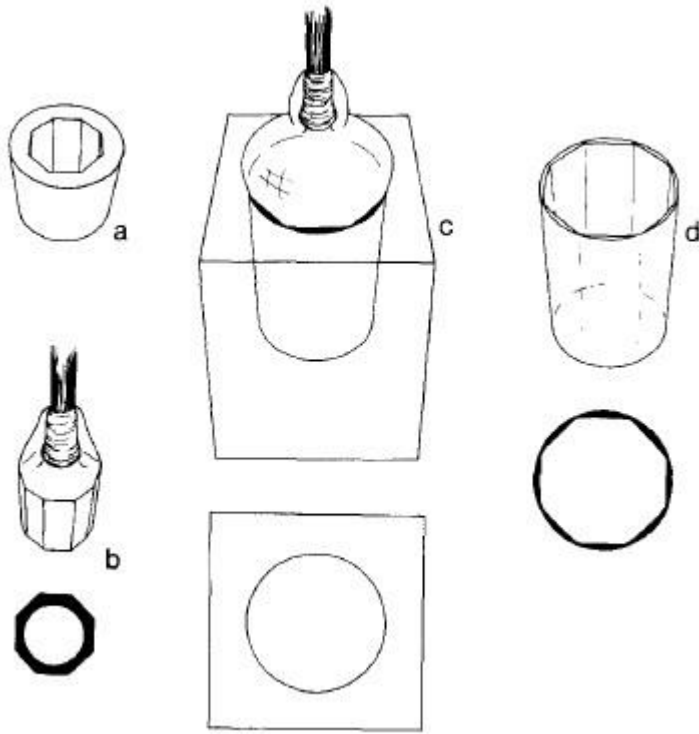


Mold Types: Pattern Mold

- Typically found on tablewares or flasks, but also used on bottles frequently in 1st half of 19th century
- Often ribs, ribs/flutes, or rib/panels



Types of Molds: Optic Mold



- Least common, typically found on tumblers
- Smooth exterior and molded interior

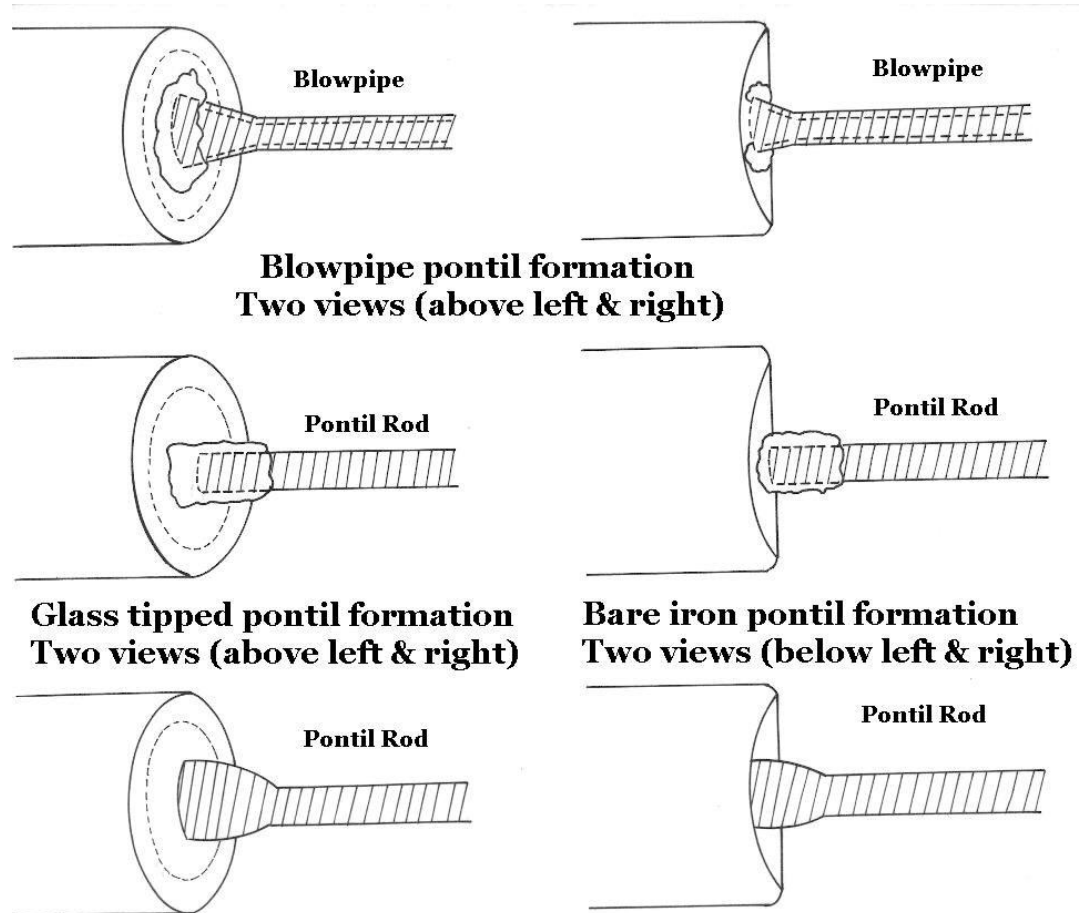


Glass Manutech: Mouth Blown

- Given the difficulty in distinguishing the use of some molds and the finishing (reheating) of parts of vessels, the term “mouth blown” is used
 - No diagnostic free-blown, mold-blown, or machine made characteristics
- For example, given that many wine bottles had mold blown and free blown elements, at the sherd level we use “mouth blown”

Pontil Marks

- Mark made by pontil rod
- Rod is attached to base of vessel to enable tooling of rim/finish



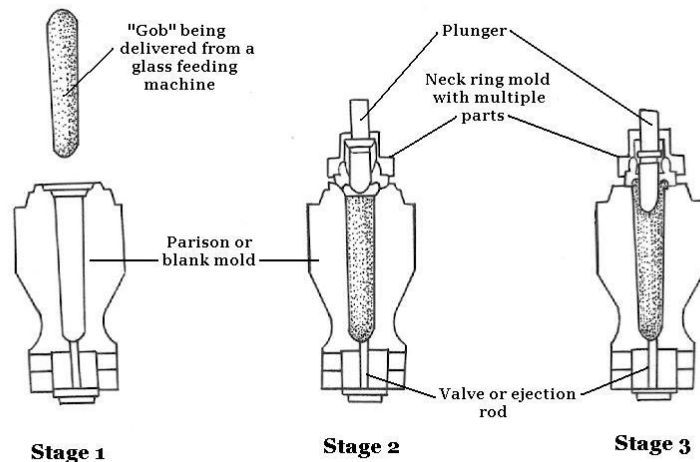


OPEN PONTIL SCAR

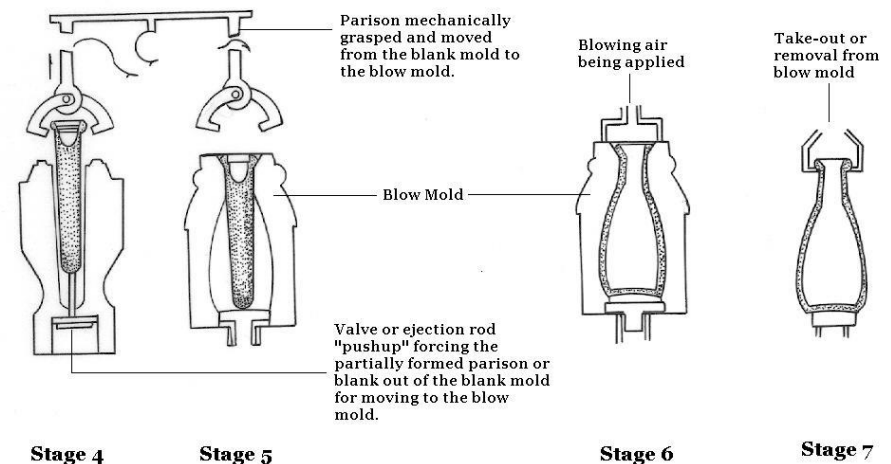
Glass Manutech: Machine Made

- Shaped by air pressure supplied by a machine
- Three main phases:
 - Earliest machines 1880-1905
 - Owens and other automatic machines (1905-50)
 - IS machines (1950+)

**Press-and-blow machine cycle - first three stages
(Lynch Milk Bottle Machine - based on Tooley 1953)**

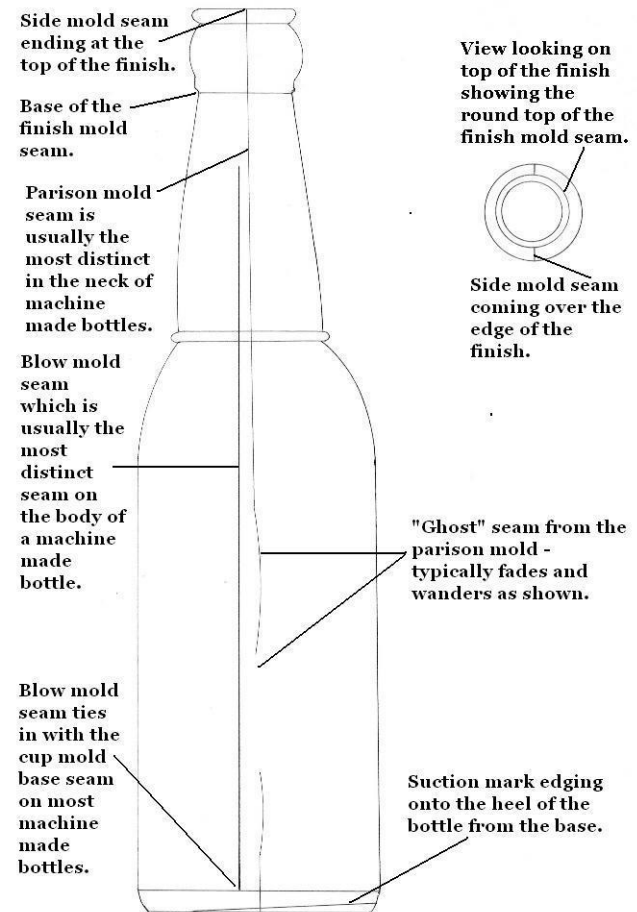


**Press and Blow Machine - Final four stages
(Lynch Milk Bottle Machine - after Tooley 1953)**



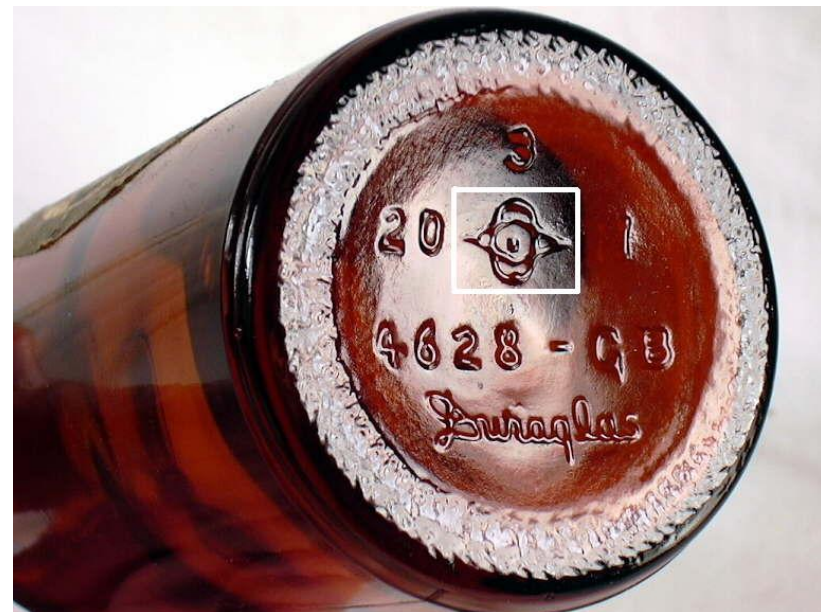
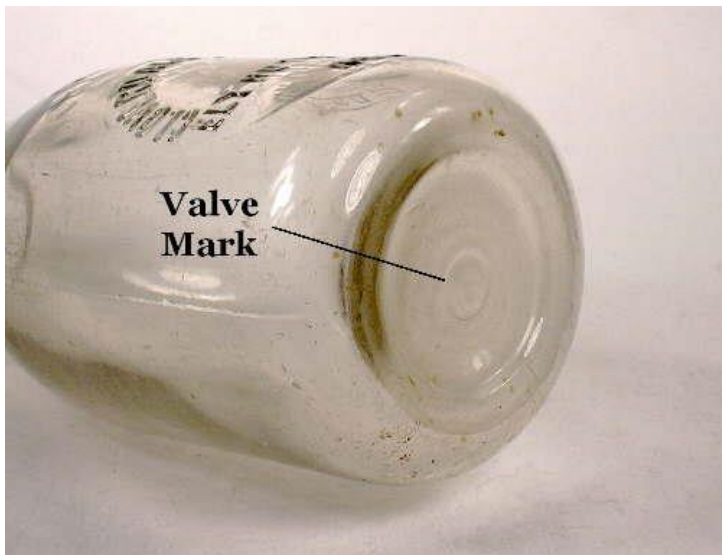
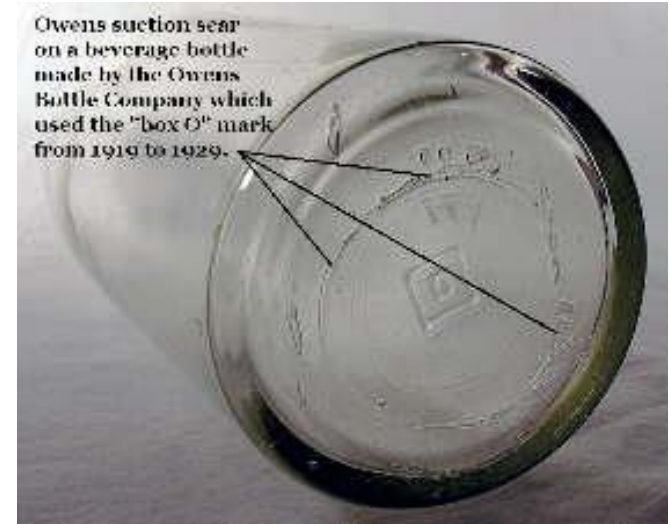
Glass Manutech: Machine Made

- Generally uniform in thickness
- Finishes are uniform
- Mold seams found on all parts of the vessel; for bottles this includes the neck and finish (horizontal seam at junction), and seam at lip
- Owens scars, valve marks, stippling on base (similar to modern beer bottles)



Glass Manutech: Machine Made

- Owens scars
- Valve marks
- Stippling on base (similar to modern beer bottles)



Glass Manutech: Machine Made, Likely

- Use this term to record fragments of glass that are lacking diagnostic characteristics of machine manufacture but exhibit other attributes that are suggestive of machine-made glass including:
 - the uniformity of the vessel thickness
 - lack of free or mold-blown characteristics
 - exhibiting modern glass colors (i.e. sprite green).
 - it is also relevant to consider if the fragments are found contextually with lots of other glass that is diagnostically modern

| MANU TECH | MOLD TYPE |
|------------------------|---|
| “Mouth Blown” | “Missing Information” |
| “Free Blown” | “Not Applicable” |
| “Machine Made” | “Contact Mold” |
| “Machine Made, Likely” | “Contact Mold” |
| “Unidentifiable” | “Not Applicable” |
| “Mold Blown” | <p>Bottles: “Contact Mold”</p> <p>Other vessels: Identify Mold Type from the following list: “Contact Mold,” “Optic Mold,” “Pattern Mold,” or “Press Mold” (see Jones et al. 1985:31-41 for descriptions), or “Unidentified.”</p> |

Lamp Chimney

- Machine made or mouth blown, look for uniformity (machine-made) or inconsistencies (mouth blown) to tell the difference
- Tends to be non-leaded because it had to be so thin (lead is too clunky to be blown very thin in curved shapes)
- Globes tend to be pressed - held kerosene - introduced in 1849, replaced whale oil or camphene, body and crystals are leaded, chimneys usually not leaded, base of kerosene globe is very narrow



Lighting vs. Vessel

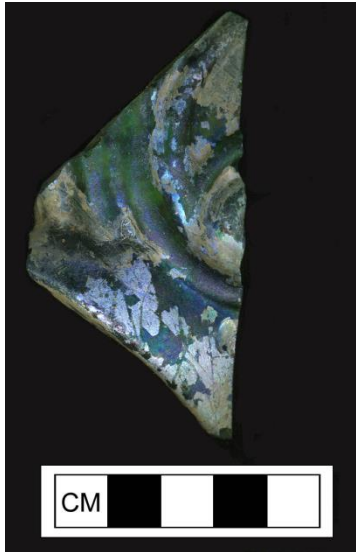
- If you aren't certain that a colorless fragment is lighting or vessel (lacks diagnostic characteristics of lighting – thin, globular shape etc.) then enter into vessel table and use “unid” for form, and put in the notes that it could be lighting

How we sort

- We suggest sorting your glass fragments in the following order:
 - Manufacturing Technique – Machine Made vs. Non-Machine made (Mold Blown, Free Blown etc.)
 - For Machine-Made fragments
 - Batch all sherds regardless of Color, Category, Form
 - For Non-Machine Made fragments
 - Next sort by decoration (present/absent)
 - Within each group, sort by Glass Color, Category, Form, and Manufacturing Technique

Table and Bottle Decoration

- Molded
 - Lettering, some sources use “embossed”
 - See notes on press, pattern, and optic molds



Sorting Glass for Gold-Level Cataloging

- **Glass Color:** Basic Colors sheet
- **Material:** Lead vs. Non-lead (colorless glass)
- **Manufacturing Technique:** Mouth Blown, Mold Blown, Machine Made, Unidentifiable
 - If Mold Blown, separate by Mold Type
- **Form:** Many types of bottles, “wine style,” stemware, tableware, lamp chimney etc.
- **Completeness:** e.g., finish, necks, shoulders, bodies, bases
- **Decoration?** Yes/No
- **Burning?** Yes/No
- **Size:** DAACS cataloging mat (mm), by 5 mm increments

Sorting Glass for Bronze-Level Cataloging

- **Glass Color:** Basic Colors sheet
- **Manufacturing Technique:** Free Blown, Mouth Blown, Mold Blown, Machine Made, Machine Made, Likely, Unidentifiable
- **Form:** Many types of bottles, “wine style,” stemware, tableware, lamp chimney etc.
- **Decoration?** Yes/No
- **Size:** No size categories, just weight

Tableware Glass Decoration

- **Cut**

- One of the more expensive since done by hand
- Look for irregularities in decoration (e.g., flutes of different widths)
- Edges tend to stay sharp



- **Wheel engraved**

- Design does not go deep into surface
- Look for striations visible within design



Tableware Glass Decoration Cont.

- **Acid etched**
 - Relatively rare
 - Wax or oil applied to non-etched surface
 - Patterns used so design should be more uniform



Window glass

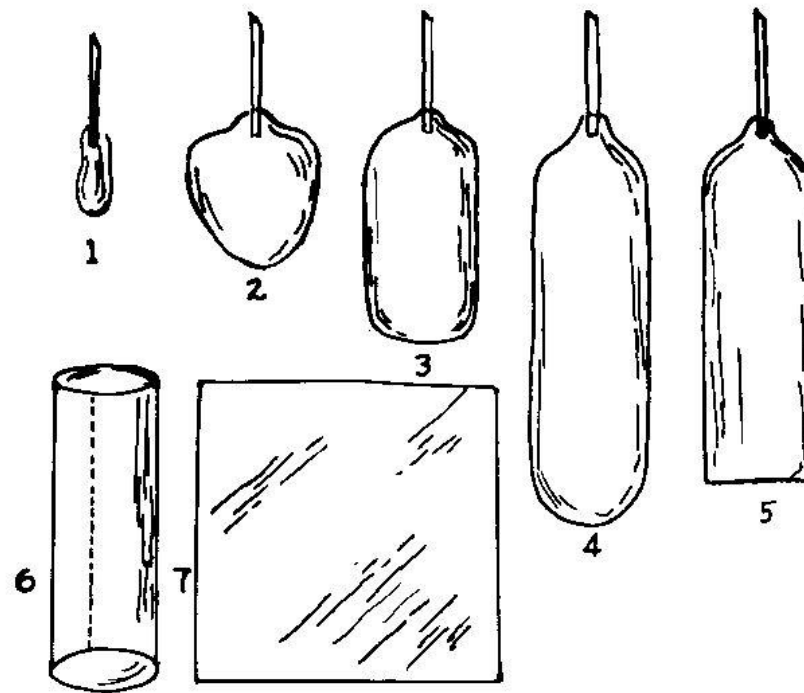


FIG. 41 Steps in the process of making window glass by the cylinder-glass method. A cylinder about five feet long and one foot in diameter was blown; then the end was cut off, the blowpipe was cracked off, and the cylinder was slit and opened out into a flat sheet. (Photo by The Corning Museum of Glass, illustration copied from K. M. Wilson's drawing in *Glass in New England, an Old Sturbridge Village booklet*)