



Early Modern Glass

Beth Bollwerk
Digital Archaeological
Archive of Comparative
Slavery

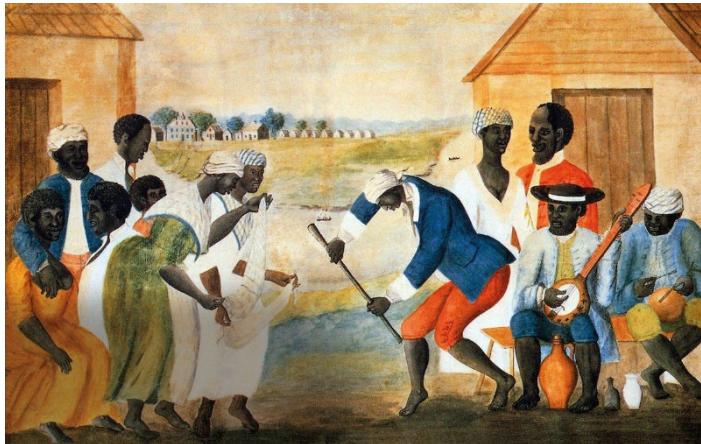
Glass

- vessel glass (containers and tablewares)
- window glass
- light bulbs
- lamp chimney
- insulators
- chandelier pendants
- jewelry parts
- beads
- marbles



Why Archaeologists Like Glass

- Personal objects
- Widely used as containers for a variety of substances



Inscribed glass vessel, Jodensavanne, Suriname

Why Archaeologists Like Glass

- Durable, like ceramics
- Changes in shape of forms and manufacturing techniques over time helps date assemblages



Why Archaeologists Like Glass

- Form, decoration, lettering can provide information on relative expense, manufacturers, and contents



Oil lamp burner with handle for carrying, Esthersrust Site

Maker's Mark for York Glass Co., York England (1830-1930), Esthersrust Site



Glass Composition/ Material

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



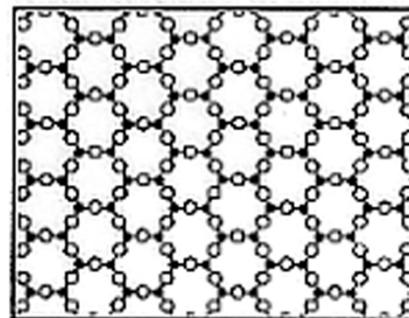


Glass Composition/ Material

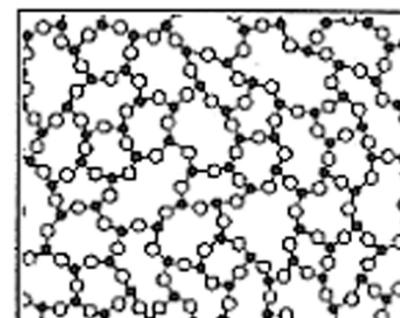
- **Flux** is a material added to lower the melting temperature of the another substance.
 - A flux is added to a batch of glass to facilitate the fusing of the silica.
 - Soda ash (Sodium carbonate, marine plant ashes) and Potash (Potassium carbonate, burned wood ash), both alkalis, are common fluxes.

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

Glass Color

- Can tell you something about the composition of glass/function of the object, but use with caution



Olive green cylindrical wine bottle from Mount Vernon House for Families, Aqua Soda/Mineral bottle with conical base from Esthersrust, Suriname Colorless cut stemware from the DNA site, Suriname

Colorless Glass

At least four types of composition:

- Leaded (added lead oxide, also known as potash lead)
- Soda lime (soda as flux, lime as stabilizer)
- Potash lime (potash as flux, lime as stabilizer)
- Manganese decolorized glass



Leaded stemware,
West Kitchen Yard,
Dry Well, & MRS 1,
Monticello



Leaded, Fluted Tumbler,
West Kitchen Yard,
Monticello

Leaded Glass

- Added to colorless glass to improve clarity, increase strengthen 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)
- To enter into DAACS glass must fluoresce “ice blue” (not purple blue)



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

Leaded Glass Forms

- Tablewares (late 17th through 19th century)
- Pharmaceutical bottles/vials (18th-19th century)
- Lighting (lamp chimney, globe etc. – 19th century)
- Plate glass

Colorless Glass

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18BC27 Federal Reserve,
Jefferson Patterson
Maryland Archaeology
Conservation Lab

Decorative motif
common on drinking
glasses from 2nd half of
18th century



Colorless Glass

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Manganese Decolorized Glass

- Silica can have iron impurities that give glass a green tinge/cast
- Manufacturers added manganese dioxide 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



Glass with Color

- Other additives include metallic oxides that can change the glass color
 - Iron – aqua, dark green (is often a natural component)
 - Copper - light blue
 - Cobalt - dark blue
 - Gold - deep red, like rubies (1820s)
 - Various metallic oxides - Opaque white (pre-1870), yellow, ivory, greens, blues, turquoise, black (post-1870)



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 alternate 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



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



Fragment Form to Artifact Type

How do we take a small glass fragment and identify the larger artifact form and type from which it came?

It is hard, and sometimes not possible, but the clues related to form and manufacturing technique are crucial to solving the puzzle.

Clue #1? Consider Color



SORTING EXERCISE 1

– GLASS COLOR

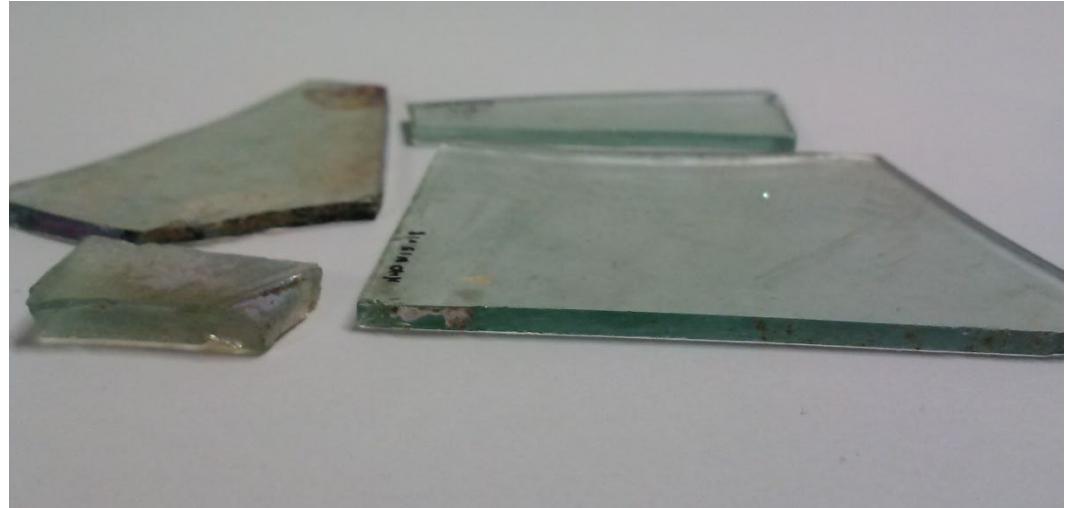
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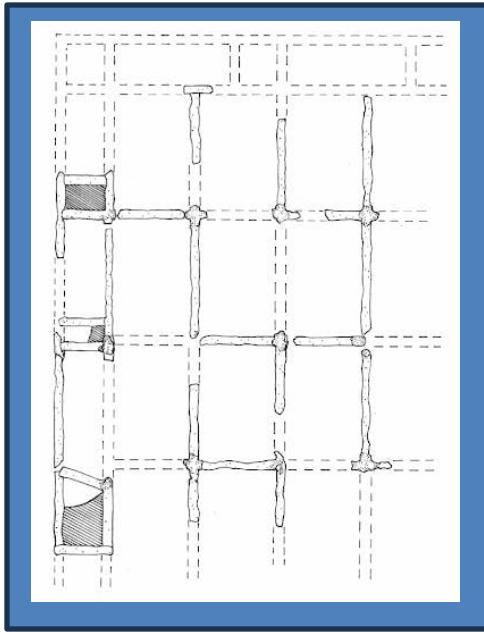
Clue #2? Determine if you have flat or hollow glass.

Flat vs. Hollow Glass



- Flat fragments are consistent in cross section and don't "rock" when put on a flat surface
- Window glass, pressed glass plates, mirror glass

Example – Casement Windows



Reconstructed window from the St. John's Site. Second Half of the 17th-century. Drawn by Henry Miller

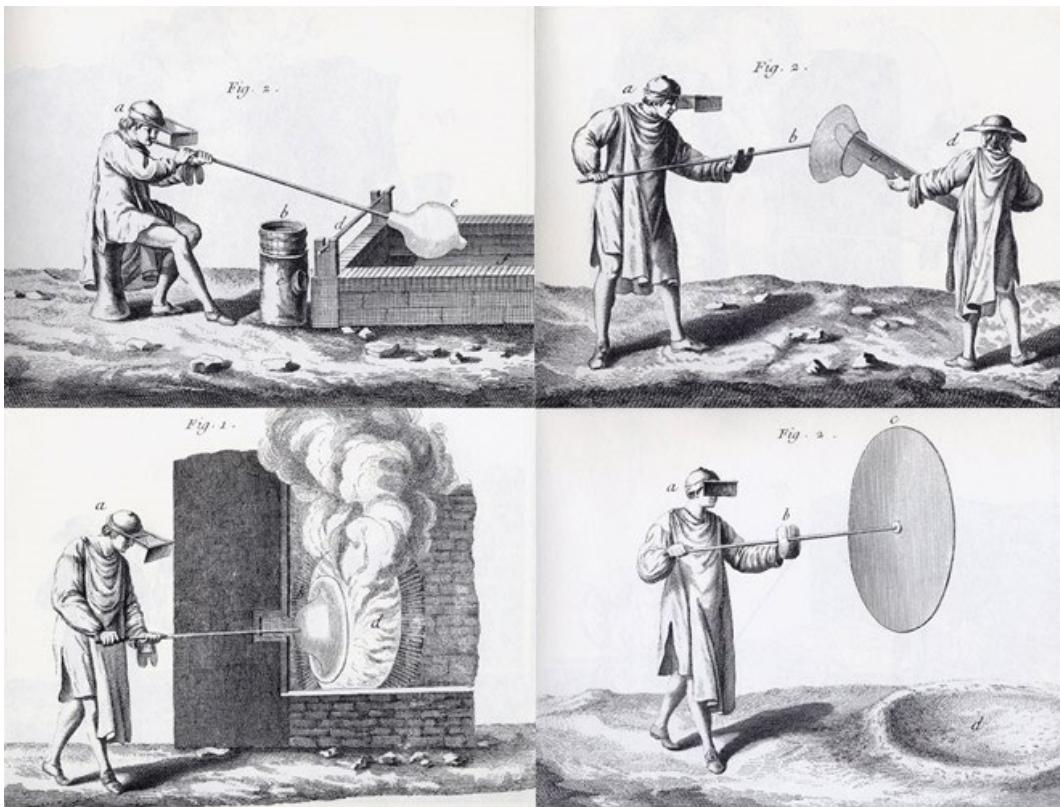
- Small panes of diamond or rectangular shaped glass called quarrels held together by lead cames in an iron frame (casement)
- Can be colored green on early 17th c. sites! Be careful not to confuse with case bottle



HSMC Reconstruction of 17th-Century Window

Reconstructed Glass Window at St. Mary's City, showing the soldered turned lead strips holding the glass panes. Photograph by Donald Winter

Window Glass Manutech – Crown Glass



Technique
commonly used
from 1500s until
about 1850

Glass crown
disk with
panes
laid out



Individual panes were cut after a glass crown cooled. The best panes were near the edge, where the glass was thinnest.

Flat vs. Hollow Glass

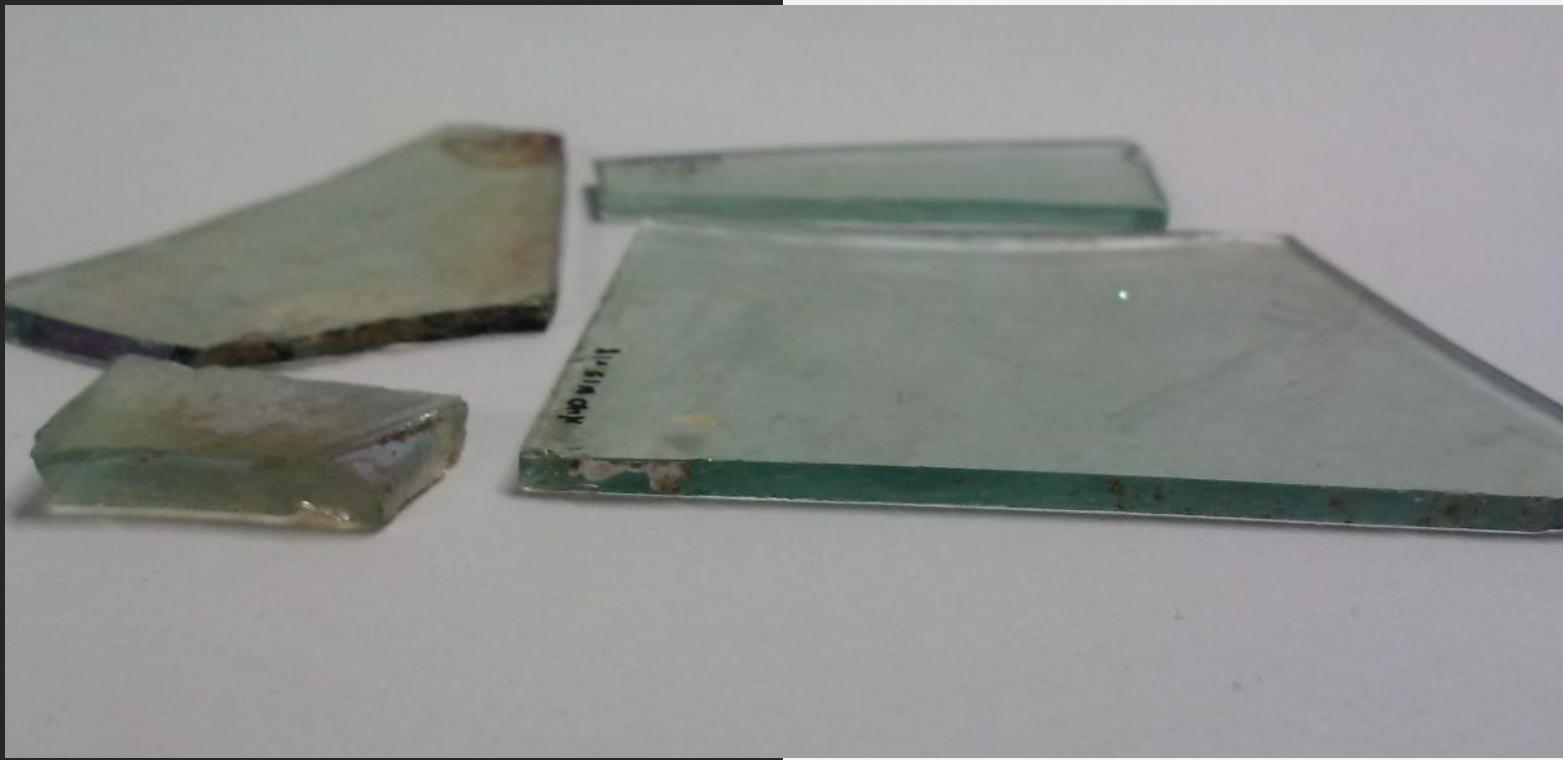


- Vast majority of what you will see is hollow
- Exceptions:
 - Salvers (handle-less tray for drinks/desserts)
 - Pressed glass plates (sandwich plates)

Vessel vs. Non-vessel Glass

- Glass beads and buttons are cataloged in their respective tables
- Utilitarian glass objects such as:
 - window glass
 - mirror glass
 - furniture inlay
 - light bulbs
 - lamp chimney
 - insulators
 - chandelier pendants
 - jewelry parts
 - marbles, etc.

are cataloged in the **General Artifacts** module



SORTING EXERCISE 2: HOLLOW OR FLAT

Identifying a fragment

How do we take a small glass sherd and identify the larger artifact form and type from which it came?

Clue #3? Determine manufacturing technique



L'INDUSTRIE DU VERRE.
Le soufflage des bouteilles.

Voir au verso.

MANUFACTURING TECHNIQUE

Glass Manutech: Free Blown

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

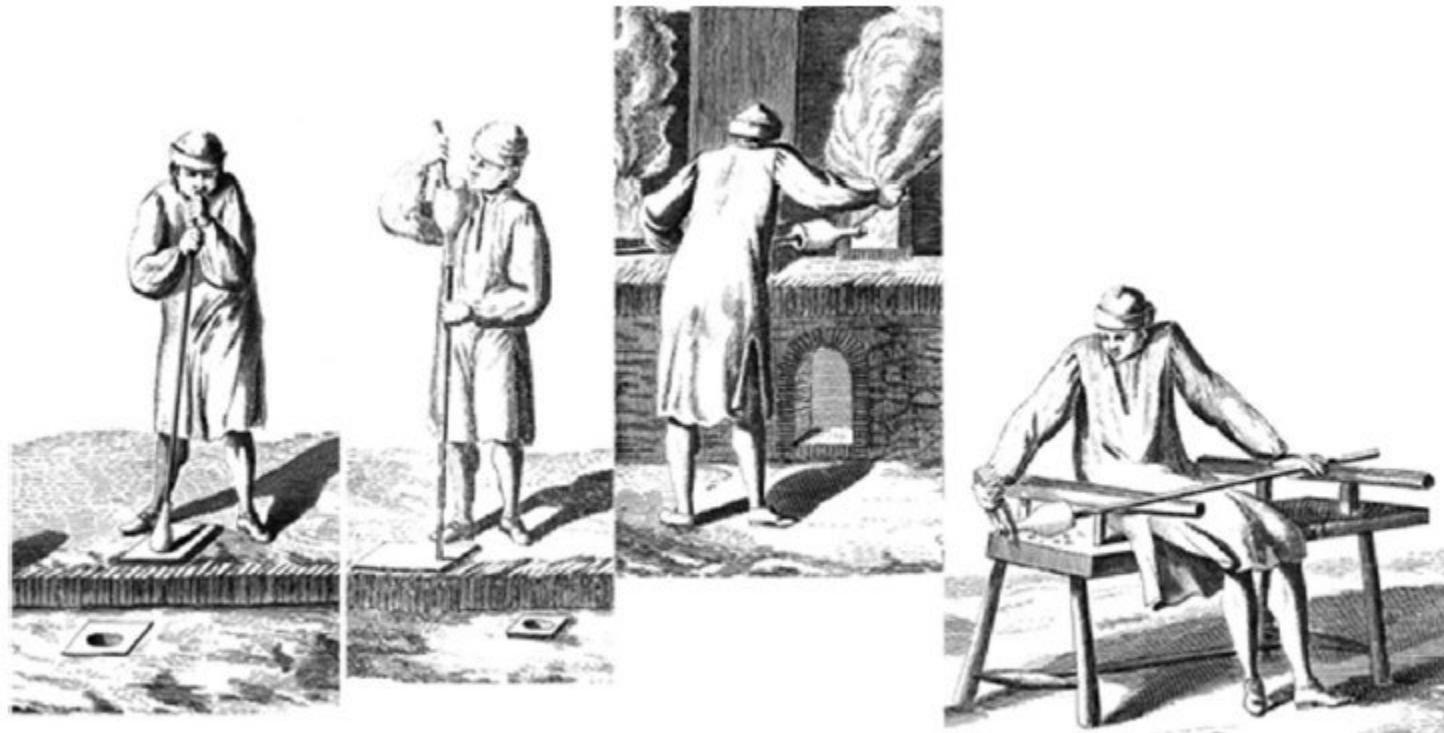


FIG. 2. The manufacture of free-blown bottles. From left to right: the glassworker inflates the parison (note the simple one-piece or dip mould at his feet), the kick or pushed in base is formed, the string rim is applied, and the neck finished (from Diderot's *Encyclopaedia*).

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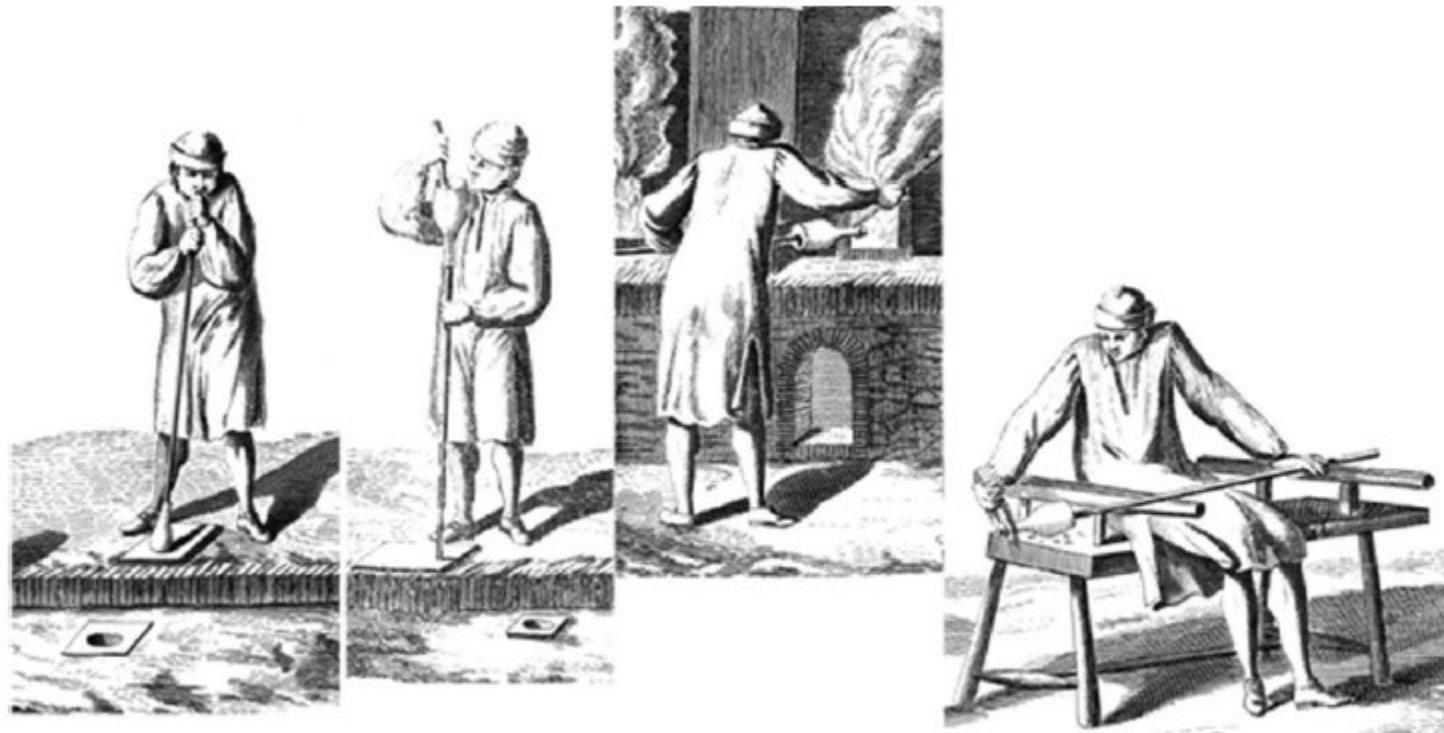


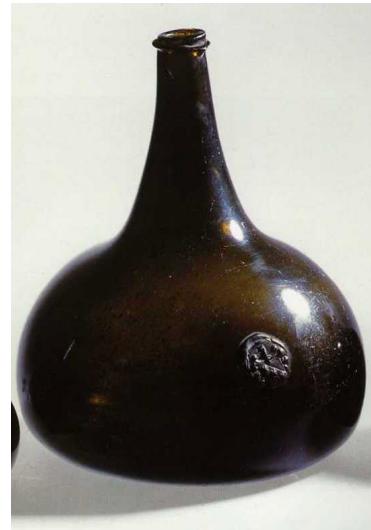
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Glass Manutech: Free Blown

- Identifiers: General lack of symmetry, no mold seams, simple globes, elongated shapes



Shaft and globe wine bottle
(middle 17th c)



Onion wine
bottle
(late 17th c)



Onion-shaped wine bottle,
Jodensavanne, Suriname

Glass Manutech: Free Blown

Tools used for
manufacturing impart
those shapes on vessel
forms

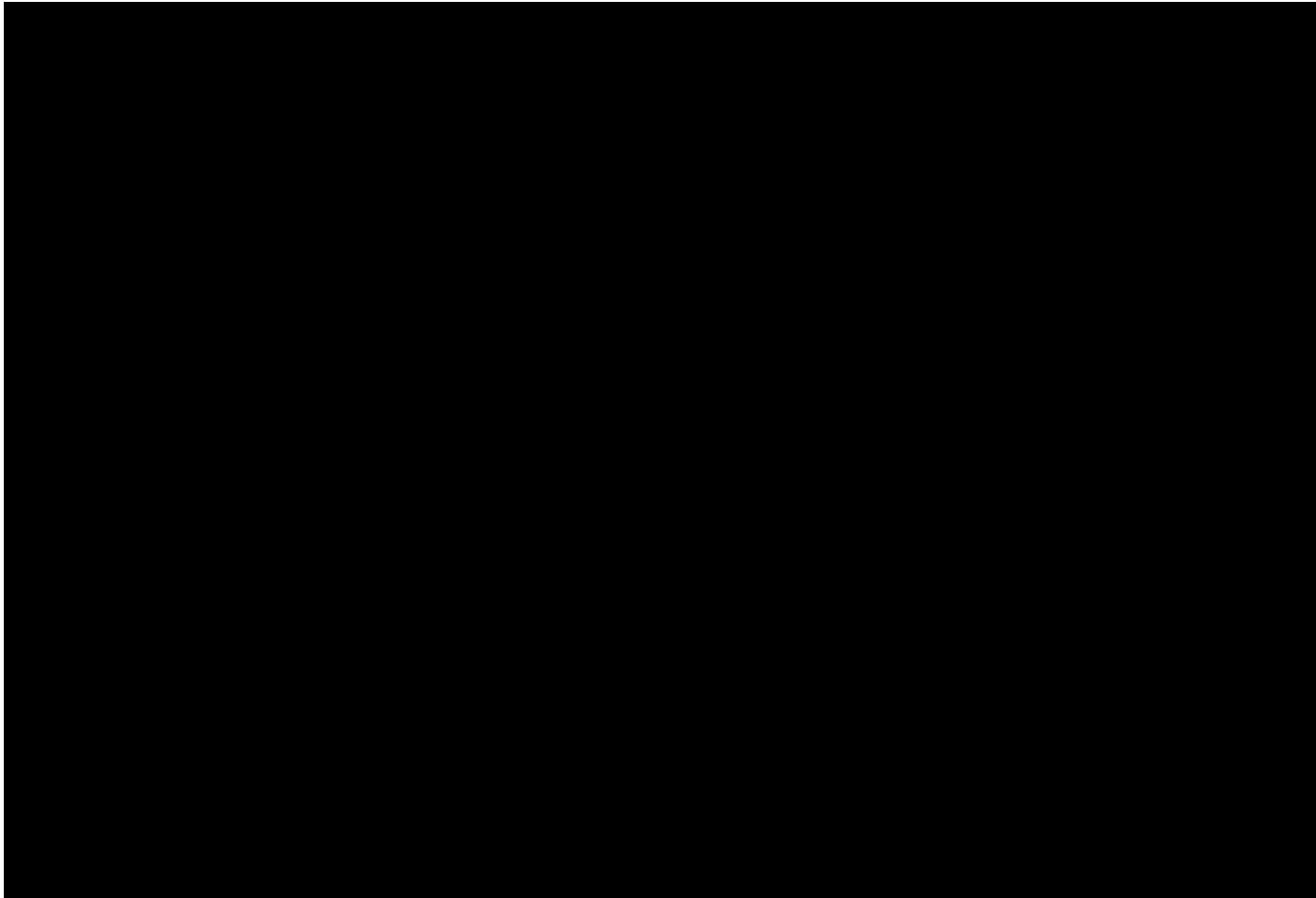


Glass Manutech: Mold Blown

- Glass may be blown by mouth into a wood, clay, or metal mold to give it form, decoration or both.



Glass Manutech: Mold Blown



Glass Manutech: Mold Blown

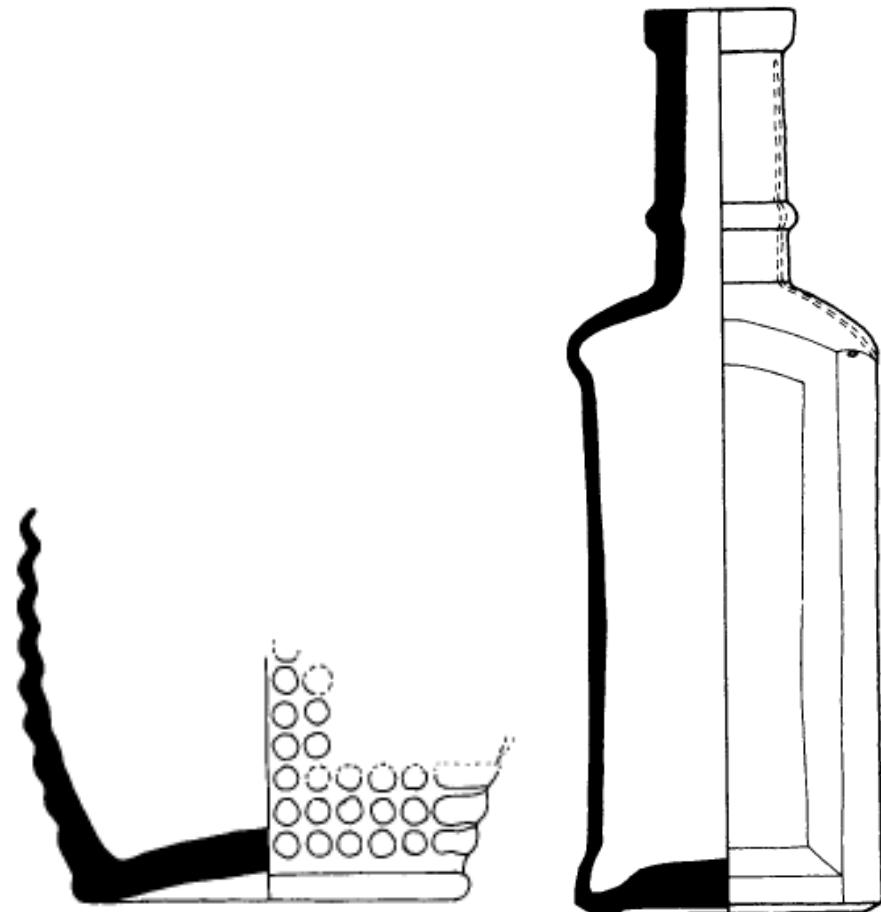
- Characteristic mold attributes:
 - Presence of a mold seam
 - Presence of molded lettering
 - Regular body shape, sharp corners angular side and bases (e.g. case bottles)



Bottle with molded ribs

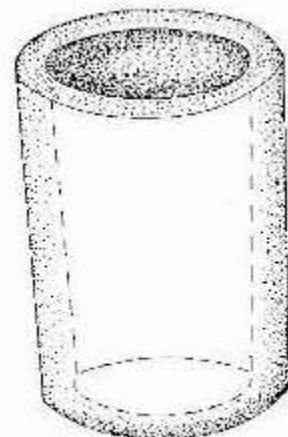
Mold Types: Contact Mold

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



Mold types: Contact Mold

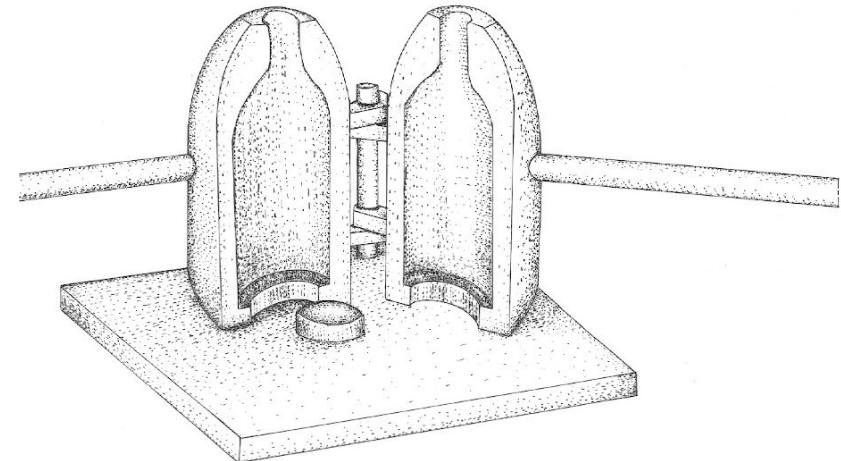
- Dip mold – dip glass into 1 or 2-part mold and pull out vertically
- Common 18th/early-mid 19th c., virtual disappearance late 19th c.



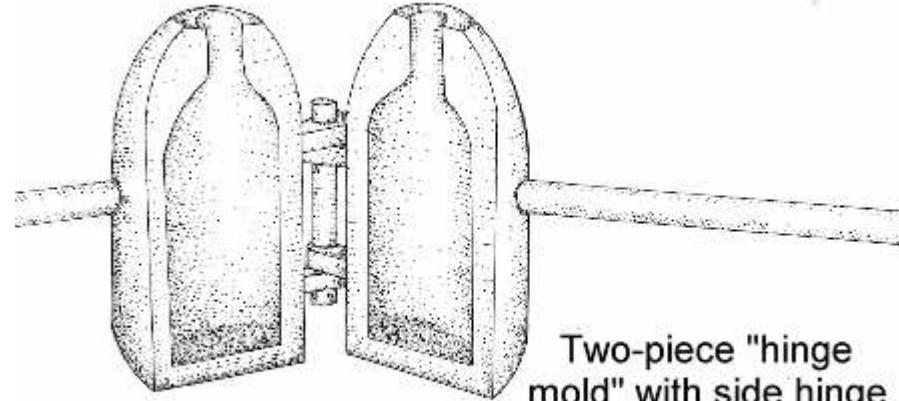
Dip Mold

Mold types: Contact Mold

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



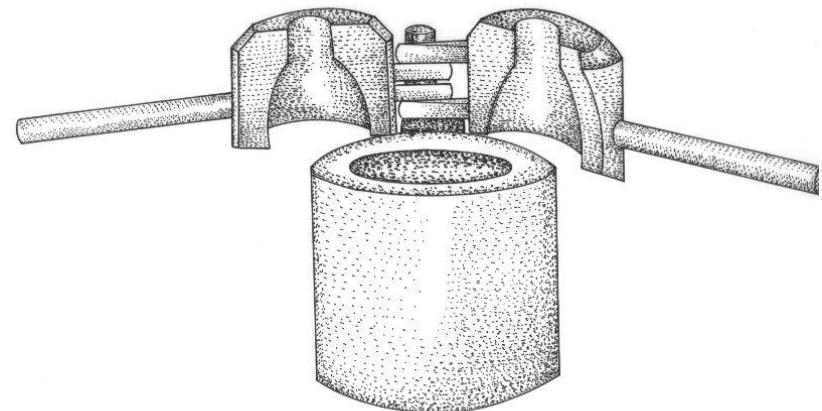
Two-piece "post bottom" mold with separate base plate.



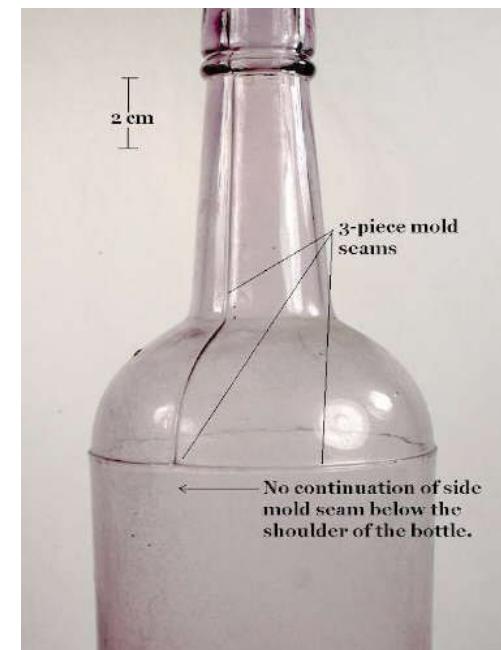
Two-piece "hinge mold" with side hinge
(there were also bottom hinge versions)

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





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

Mold Types: Contact Mold

Turn/Paste mold

- Bottle is rotated in the mold to erase seams and give bottle a glossy sheen
- “Paste” was a mix of resins, oil and sawdust
- Also called a paste mold since the interior mold surface had a lubricant added to facilitate rotation
- Turn-mold bottles date at least as early as the Civil War through the later mouth-blown bottle era as they were still listed as late as 1911 in glass manufacturing catalogs (Putnam 1965).



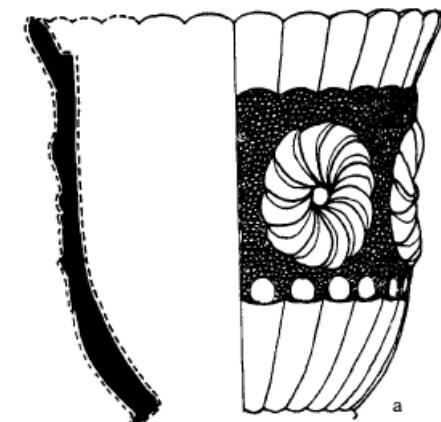
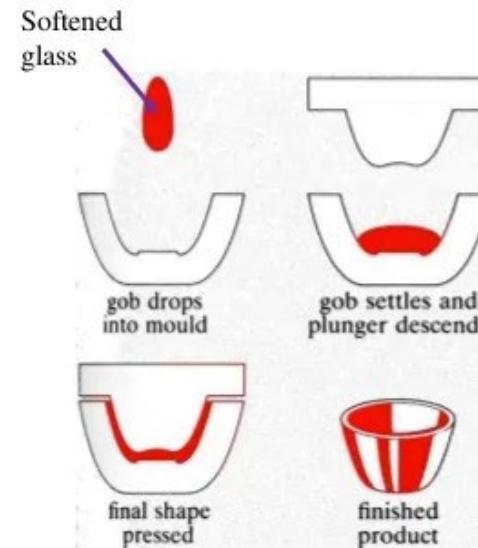
Turn/Paste
molded bottle
from Esthersrust
Site, Suriname

Mold Types: Press Mold

- Introduced in 1740, popular for tableware mid-19th/20th century
- Use of a hand- or steam-operated press/plunger to force hot glass into mold

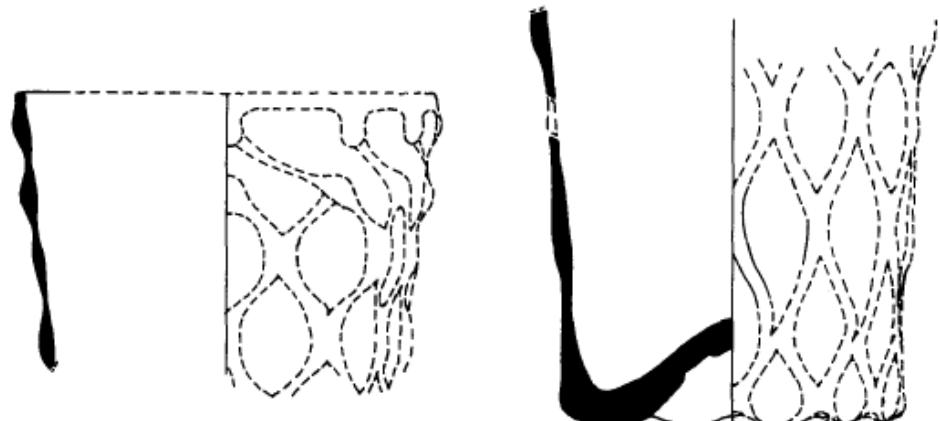


Pressed Glass Processing



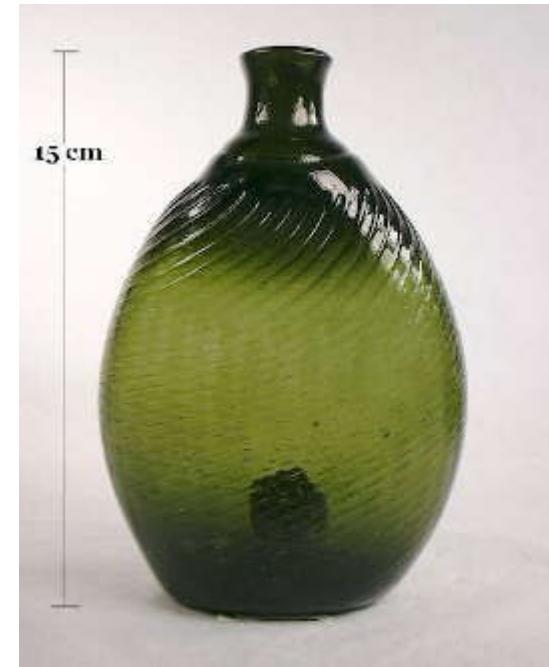
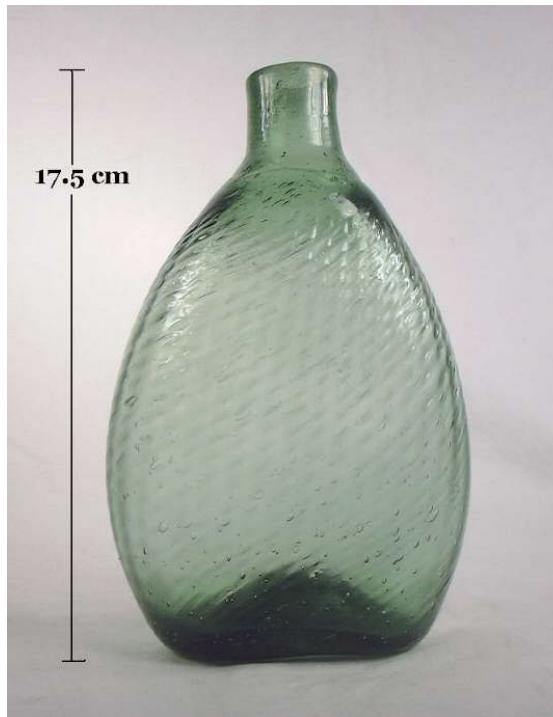
Mold Types: Pattern Mold

- Pattern on inside of mold transferred to vessel surface
- Glass vessel removed from mold and either blown out or twisted
- Used from Roman times up to present



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



Pattern-molded finish,
Esthersrust Site,
Suriname

Pontil Marks

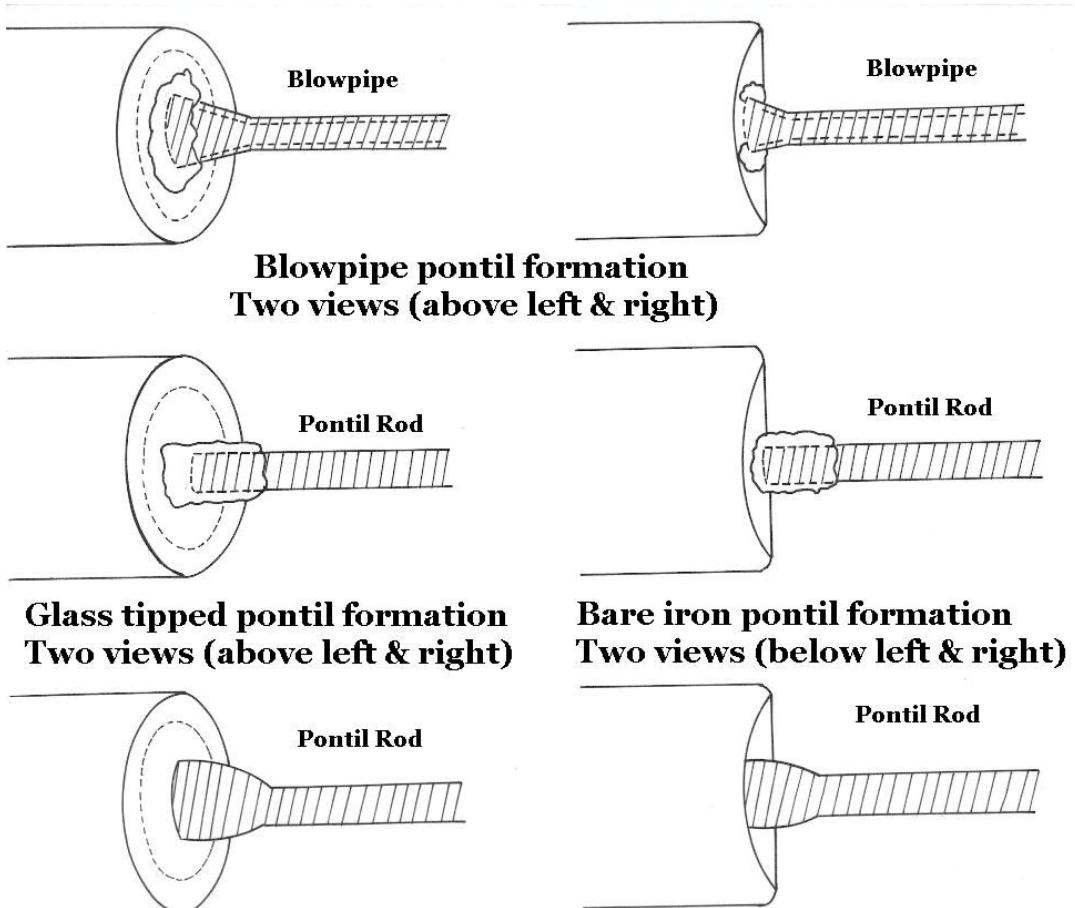
- Mark made by pontil rod
- Rod is attached to base of vessel to enable tooling of rim/finish



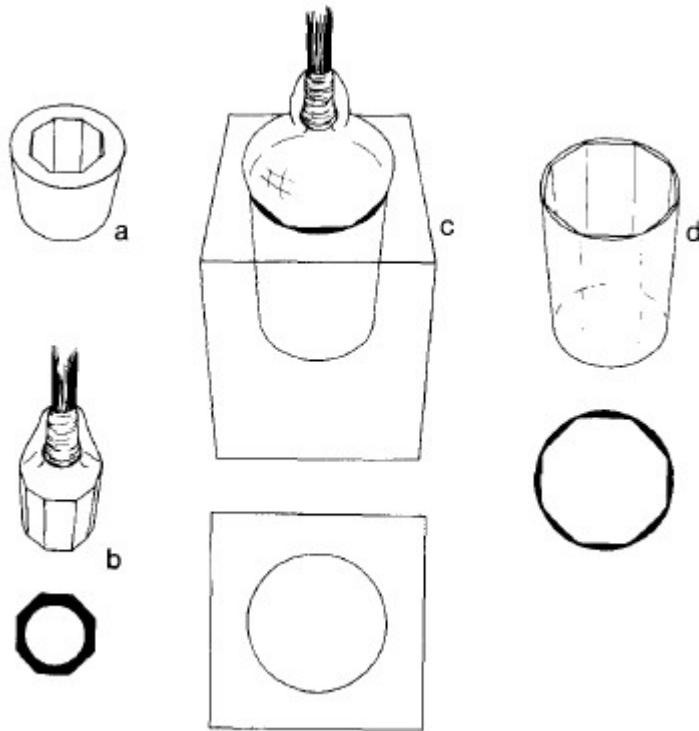
Case bottle base with pontil mark from DNA site, Suriname

Pontil Marks

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



Mold Types: Optic Mold



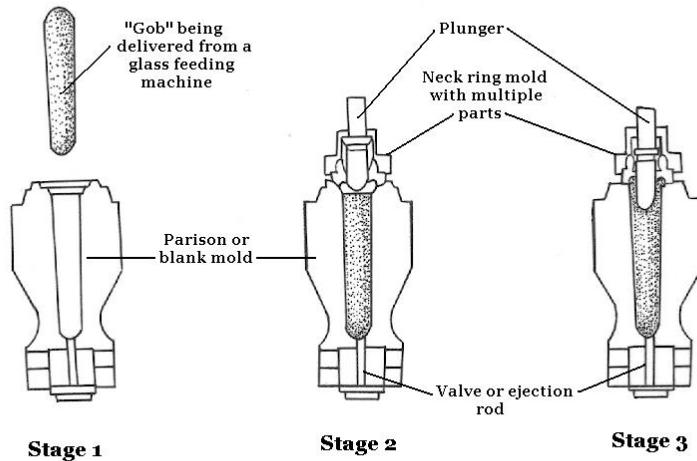
- Least common,
typically found on
tumblers
- Smooth exterior
and molded interior



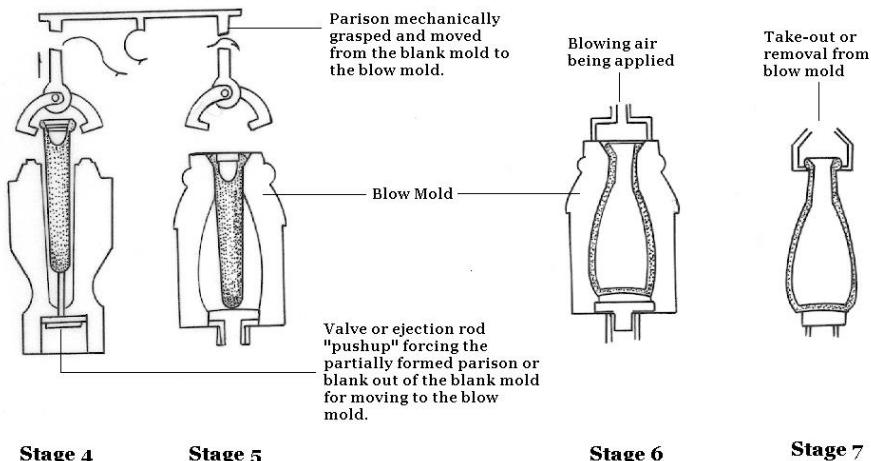
Glass Manutech: Machine Made

- 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)**

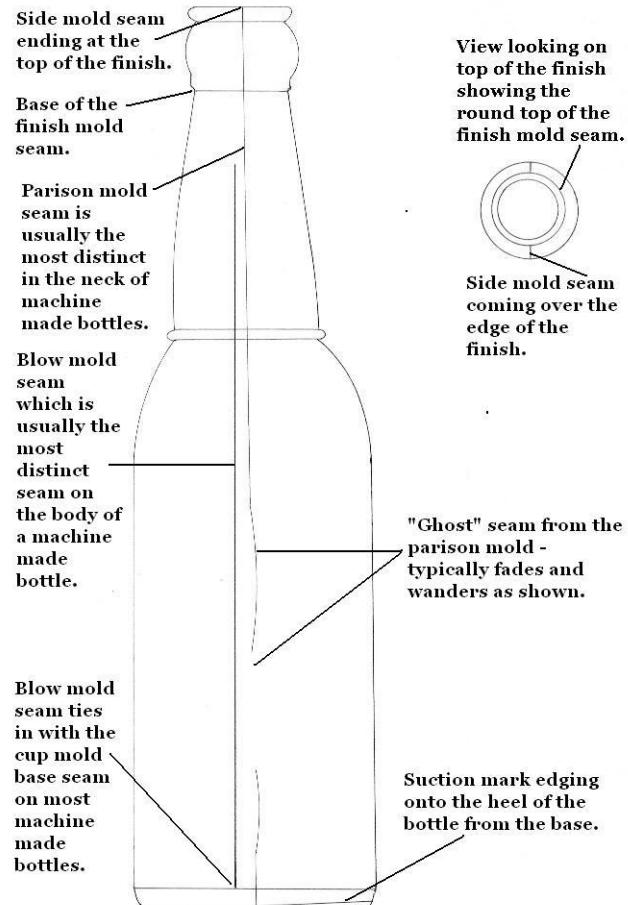


**Press and Blow Machine - Final four stages
(Lynch Milk Bottle Machine - after Tooley 1953)**



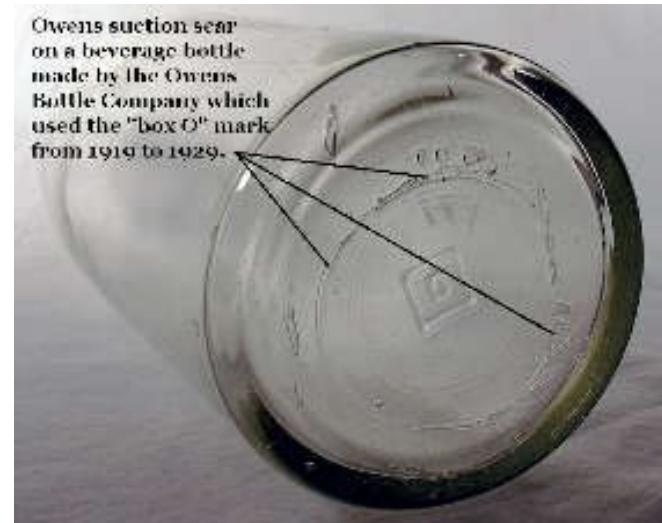
Glass Manutech: Machine Made

- Mold seams found on all parts of the vessel; including the neck, finish, and seam at lip



Glass Manutech: Machine Made

- Owens suction 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

SORTING EXERCISE 4:

MANUFACTURING TECHNIQUE

Options:

- Free Blown
- Mold blown
- Machine Made
- Missing Information

Fragment Form to Artifact Type

How do we take a small glass shard and identify the larger artifact form and type from which it came?

It is hard, and often not possible, but the clues related to form and manufacturing technique are crucial to solving the puzzle.

Clue #4? Determine completeness and form



GLASS VESSEL FORM

CROWN BRAND
OLIVES
S. S. PIERRE &
CO. NEW YORK

Flat vs. Hollow Vessel Glass



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

Flat vs. Hollow Vessel Glass



- Differentiate from window/mirror glass:
 - Vessel glass is less consistent in cross section
 - Will rock
 - Presence of decoration

Glass Vessels in DAACS

Tableware

- Tumbler
- Decanter
- Drinking vessel
- Sandwich plates
- Stemware
- Salver
- Candy dishes
- Bowls
- Vase

poison, pharmaceutical,
perfume/cosmetic, ink)

- Vials
- Jar
- Lid liner
- Flasks
- Bell Jar

Lighting (goes in Gen Arts)

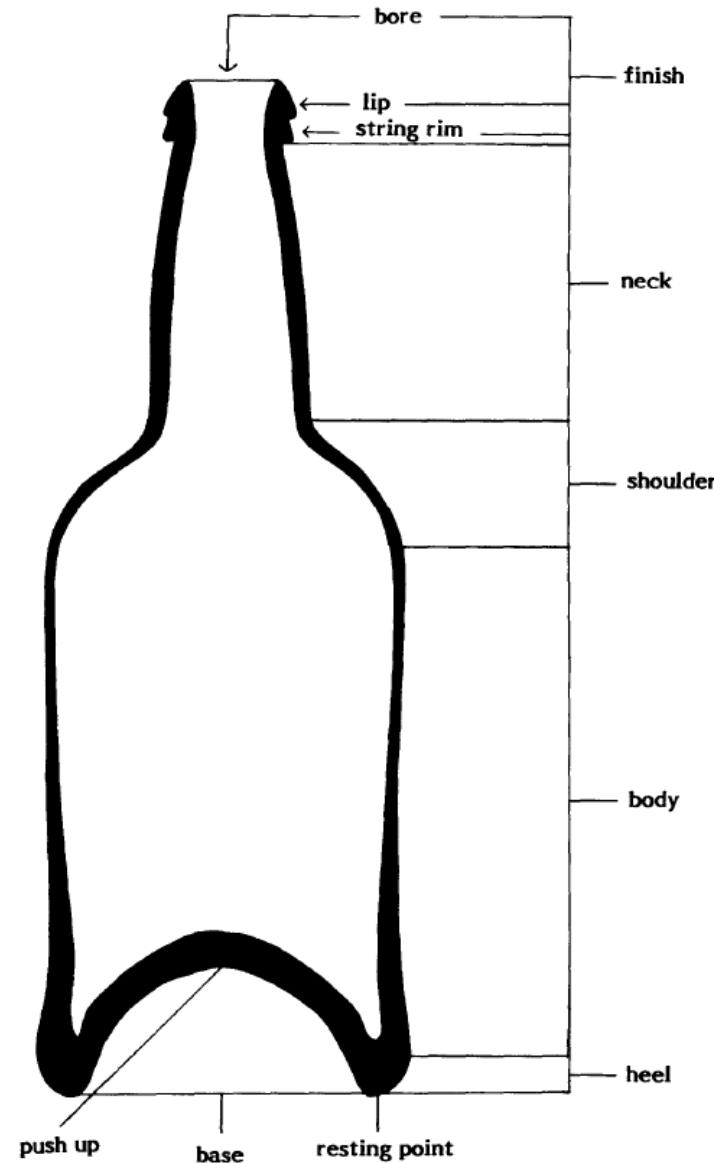
- Oil lamp burner
- Lamp chimney

Container

- Bottles of all sorts (alcohol,
soda/mineral water, medicine,

Glass Forms - Bottles

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



Glass Forms – Wine style Bottles

- Olive green bottle glass that likely held wine, spirits, or other consumables
- Shape changes over time – shaft and globe, onion, cylindrical
- Distinctive finishes/string rims

Mid 18th/Early 19th c.



Late 17th/Mid 18th c.



Mid/Late 17th c.





Glass Forms – Case Bottles

- Stored in wooden cases
- Also held liquids/spirits
- Used 17th – 19th c.
Depending on century can vary dramatically in size
- Mold blown – Squared off corners, flat sides
- Short cylindrical neck, can have a variety of finishes

Case bottle, Estersrust site,
Suriname



Case bottle, Estersrust
site, Suriname

Glass Forms – Case Bottles

- Case bottle – flatter base (vs. more conical kick ups with WBG)
- There can be a gentle concaveness, especially for pointed ends but still tends to be more flat
- Shoulders have less of a gentler curve than wine, more abrupt
- Neck is squat
- Flat side vs curved
- Uneven taper across flatter fragments

Glass Forms – Alcohol/Spirit Bottles

- Other types of alcohol bottles
- Be aware of the ambiguity of extracts

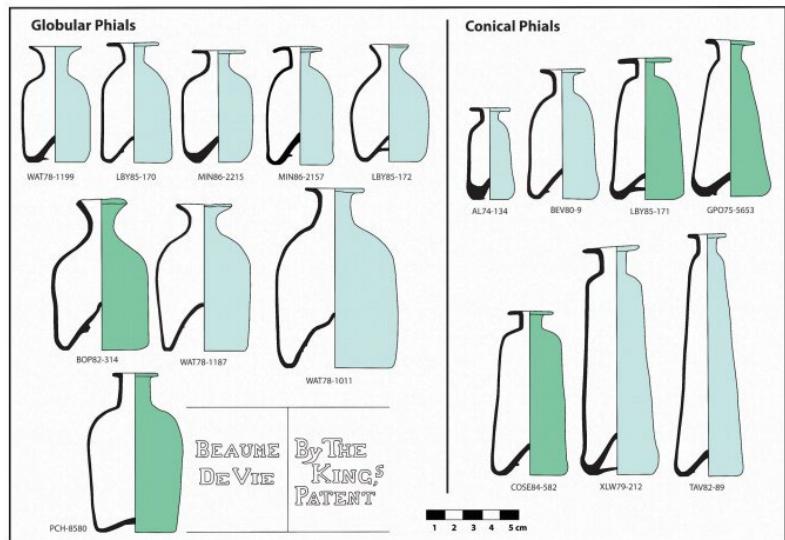
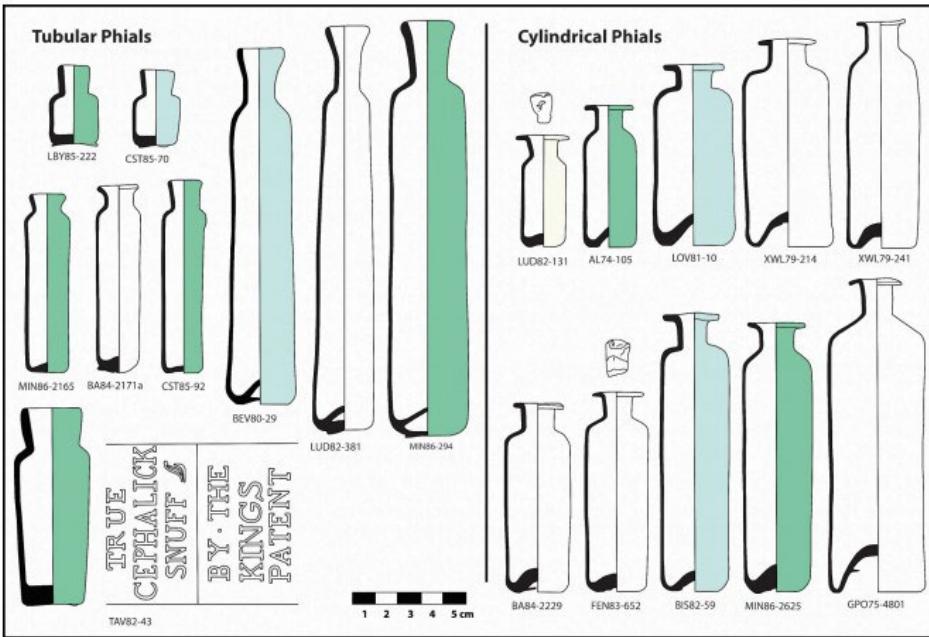


Glass Forms - Bottle/Vial, Pharmaceutical

Containers for medicinal substances



Pharmaceutical vial,
Jodensavanne Site, Suriname



Glass Forms – Bottle/Vial, Pharmaceutical

- Containers for medicinal substances, patent medicines, druggist/prescription bottles (bitters, tonics, sarsaparilla, balsams)



Glass Forms – Mineral, Water, Soda Bottles

- Blob finishes (for internal stoppers – popular 1840s-70s)
- Hutchinson stoppers – popular mid-1880s-1910s
- Round/torpedo bottoms (popular 1800s)
- 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:** Decorative, Historical common 1815-1875 in the States
 - Designed to be portable/easy to carry
 - often “figured” (historic figures or scenes)



Glass Forms - Flasks

- Shapes change over time
 - Late 18th (1765-) /early 19th century
 - Pattern molded flasks common



Glass Forms - Flasks

- Shapes change over time
 - Mid-late 19th century
 - Scroll
 - Union oval
 - Shoo-Fly & Coffin
 - Barrel



Non-bottle Forms – Canning Jars

- Mason (1858 onward), Ball, and other brands.
- Forms and color change over time but also coexist at the same time.
- Different closure types from metal screw tops to glass “lightening” closures. Often a combination of materials in a closure (rubber and glass, metal and glass).



Canning Lids



More Canning Lids



**Not Porcelain! Milk
Glass!**

Jelly Glasses



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)

Glass Forms - Lighting – Oil Lamps



Lamp chimney with oil lamp burner



Oil lamp burner with handle for carrying --
Esthersrust Site, Suriname

Glass Forms - Tableware

- **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



Stemware, leaded glass
from



Roemer, Esthersrust
Site, Suriname

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



Cut stemware from DNA site, Suriname

- **Wheel engraved**

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



Table and Bottle Decoration

- Molded
 - Lettering, some sources use the term “embossed”
 - Molded patterns



Molded tableware
vessel stopper,
Esthersrust Site,
Suriname



Tableware and Bottle Decoration

Applied Color Label (ACL): Also known as enameling or painting (among other terms).

-Post 1933. Most often found on soda, milk, and beer bottles, jelly and peanut butter jars, and drinking glasses.



SORTING EXERCISE 4: COMPLETENESS AND FORM

Possibilities:

- Bottle
- Jar
- Stemware/Tableware
- Container, unid.