TRADITIONAL BLOWING AND FORMING


Many of these vintages continued to be advertised throughout the nineteenth century. Occasionally, examples of bottles with such seals are found, particularly on early sites such as First Government House in Sydney, Regentville, Port Essington (Ref. 83), the Northern Territory and on wrecks. Figure 19 shows seals from bottles that contained the Bordeaux wines Chateau Lafitte and Margaux Medoc Rauzan from the First Government House site in Sydney.

![Wine bottle seals](image)

**Figure 19.** Wine bottle seals from First Government House site in Sydney.

One of the easier shapes to form from the natural shape of the viscous glass parison was the onion-shaped common wine bottle (Fig. 20). This shape was gradually ousted by a straight-sided, squat bottle that could be laid on its side in the cellar thus saving space and keeping the cork wet and airtight. These first ‘straight siders’ or mallets were probably blown in the normal way using cup or block tools. (Fig. 5). They were then rolled on the marvering table to give the generally vertical body (Fig. 2). Some bulging of the wall near the base would result from forming the push-up or from slumping in the annealing chamber.

From c. 1750-80, these bottles became longer and narrower with high, round shoulders like a heavy version of a modern port wine bottle (Fig. 20). The bulging of the base only disappeared between c. 1820-30. Whilst **cup** or **block** moulding tools were used to effect these changes (Fig. 5), there was also an increasing use of dip-moulds. After c. 1820 three-piece moulds were introduced.
Figure 20. The development of the wine bottle. (Largely based on Noel-Hume, 'The Glass Wine Bottle in Colonial Virginia', Journal of Glass Studies, V3, 1961, pp. 99, 100.)

Using evidence from published details of named and sealed bottles and the extensive study by Noel-Hume (Ref. 27), the general changes in shape over time are illustrated in Figure 20. In Australia, shapes of these types are observed most notably on wrecks in West Australia. Using Figure 20, bottles found on the Zeewijk (1727) correspond closely with shape ‘g’, on the Rapide (1811) with shapes ‘k’ and ‘l’ and on the James Mathews (1841) with shapes ‘l’ and ‘m’.
Up to 1,800 measurements on dated sealed bottles (Ref. 22) indicate that three bottle sizes were used side by side in Britain:

<table>
<thead>
<tr>
<th>Bottle Type</th>
<th>Capacity</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reputed quart</td>
<td>26(\frac{2}{3}) fluid ounces</td>
<td>(approx. 758 mL)</td>
</tr>
<tr>
<td>Queen Ann wine quart</td>
<td>33 fluid ounces</td>
<td>(approx. 940 mL)</td>
</tr>
<tr>
<td>Imperial quart</td>
<td>40 fluid ounces</td>
<td>(approx. 1140 mL)</td>
</tr>
</tbody>
</table>

Table 1. Bottle measures and capacities used in Britain in the early 1800s.

By the early 1800s the **reputed quart** was the size commercially preferred. In Australia, the contents of wine bottles were reported to be 24-26 fluid ounces (681-738 mL) at that time (S.G. 22.3.1817, p. 4). In 1824 the **reputed quart** was eventually recognized legally as one sixth of the new Imperial gallon (i.e. 26\(\frac{2}{3}\) fluid ounces, 758 mL).

The characteristics of common ‘black’ wine and beer type bottles found on early sites from c. 1800-20 would include:

- **Colour**: Green to very dark-green (‘black’) or amber
- **Reinforcing Collar**: Up to 20 mm (\(\frac{3}{4}\) inch)
- **Capacity**: 681-711 mL, (24-28 fl oz.) to a point 25-50 mm (1-2 inches) below lip
- **Height**: Below 292 mm (11\(\frac{1}{2}\) inches)
- **Diameter**: Below 102 mm (4 inches)
- **Shape**: May have base corner sag due to annealing or pontil attachment
- **Pontil**: Glass-tipped or sand-pontilled
- **Push-up**: Present in some form
- **Mould seam**: Absent

Table 2. Characteristics of common ‘black’ beer and wine type bottles c. 1800-20.

Two main types of ‘black’ bottle occur: the low-shouldered wide ‘beer’ shape and the taller narrower high-shouldered ‘wine’ shape. Longer bottles for some German wines appear to be the first departure from the
normal shapes. A bottle from the James Mathews wreck of 1841 is 310 mm high (12\(\frac{1}{4}\) inches) and 80 mm (3\(\frac{1}{8}\) inches) wide.

From this brief outline on wine/beer bottles, it is evident that the characteristics of cheap ‘black’ glass products contrast markedly with those of clear and pale-green bottles. Up to c. 1840-50 mould seams are often absent, that is, the bottle has been blown by traditional methods. During the remainder of the nineteenth century, the three-piece shoulder markings are less easy to detect than the two-piece and base-plate markings of clear glass artefacts. Also, up to c. 1890-1920 the body of the majority of common glass bottles is rarely embossed. This aspect is discussed in detail in Section 4.4.

2.3.5 Re-use of bottles. From the outset only a small proportion of the early shipments of wine, of the order of ten per cent or less, came in bottled rather than cask form. An empty bottle was a valuable commodity. Consequently, there are numerous references to used bottle sales and part payment for returned empties.

Up to six shillings per dozen were offered for empty wine bottles during the Napoleonic wars (e.g. S.G. 13.11.1813, p. 2). Prices remained high at four shillings per dozen over thirty years later (S.H. 23.11.1843, p. 4). Also, as now, good wine was bottled for long periods and it appears from early newspapers that it was at times sold in Sydney over twenty years after being imported. This frequent re-use of bottles needs to be considered if any attempt is made to date a site by its glass artefacts.

2.3.6 Summary. The above outline on early, selected examples of tableware, apothecaries’ glassware, food containers and wine/beer bottles, highlights the potentially wide differences in the development of shapes and styles, embossing of names, dates and trade marks, and of mould and other marks which result from varying manipulative techniques. These possible dating criteria are **not necessarily the same** for luxury products and for common ‘black’ glass bottles.

3.0 EFFECTS OF BRITISH EXCISE DUTIES, 1746-1845

Flint glass development differs from that for common bottles because of the effects of the imposition of duties on glass in Britain briefly in the 1600s but more particularly during the one hundred years between 1746 and 1845. In the latter period, these duties virtually separated the ‘flint’ and common bottle trades by the application of strict excise laws and regulations (Ref. 3). The excise duties for the two types of glass were very different. Between 1770 and 1845, the tax for flint glass, which after 1777 included phials, varied between 9 shillings and 4 pence to 98 shillings per hundred weight. The tax for common ‘black’ bottle glass was much lower, but still excessive, and ranged from 2 shillings and 4 pence to 8 shillings per hundred weight (Ref. 32).

This tax was a crippling imposition in relation to the value of money at the time and made colourless and pale-green bottles a luxury. The excise regulations were equally Draconian. Up to three excise men were allocated to each glasshouse, twelve hours notice was required (sometimes in writing) to fill a pot and advise the weight of materials used, while the grating of the annealing arches had to be securely locked after all the glassware had been deposited (Ref. 28).

A phial was defined as having a capacity of 170 mL (6 fluid ounces) or less, and makers of common bottles did not go below this limit. The revised Act of 1811 set this limit at a reputed half pint (178 mL, 6 1/4 fluid ounces) but as attested by Apsley Pellatt and William Powell to the 1835 Commissioners, they were effectively not allowed to make under 6 ounces (170 mL) in common black glass.

In effect this was also a direct tax on apothecaries. At its highest level, between 1815 and 1834 after the end of the Napoleonic Wars, the tax amounted to approximately six pence on each bottle compared with a labourer’s weekly wage.

<table>
<thead>
<tr>
<th>Year</th>
<th>Crown, Flint Plate &amp; White per cwt</th>
<th>Crown &amp; German Sheet per cwt</th>
<th>Broad per cwt</th>
<th>Common Bottle per cwt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>s. d.</td>
<td>s. d.</td>
<td>s. d.</td>
<td>s. d.</td>
</tr>
<tr>
<td>1770</td>
<td>9 4</td>
<td></td>
<td></td>
<td>2 4</td>
</tr>
<tr>
<td>1775</td>
<td>9 4</td>
<td></td>
<td></td>
<td>2 4</td>
</tr>
<tr>
<td>1780</td>
<td>18 8(plate)</td>
<td>19 7.3(flint)</td>
<td>7 4.8</td>
<td>3 7.2</td>
</tr>
<tr>
<td>1785</td>
<td>21 5 1/2</td>
<td>15 8</td>
<td>7 10</td>
<td>3 11.4</td>
</tr>
<tr>
<td>1790</td>
<td>21 5 1/2</td>
<td>16 11/2</td>
<td>8 0 1/2</td>
<td>4 0 1/4</td>
</tr>
<tr>
<td>1795</td>
<td>32 2 1/2</td>
<td>24 2</td>
<td>8 0 1/2</td>
<td>4 0 1/4</td>
</tr>
<tr>
<td>1800</td>
<td>32 2 1/2</td>
<td>24 2</td>
<td>8 0 1/2</td>
<td>4 0 1/4*</td>
</tr>
<tr>
<td>1805</td>
<td>38 2</td>
<td>24 6</td>
<td>8 2</td>
<td>4 1*</td>
</tr>
<tr>
<td>1810</td>
<td>49 0</td>
<td>36 9</td>
<td>12 3</td>
<td>4 1*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Flint &amp; Phial per cwt</th>
<th>Phial per cwt</th>
<th>Phial per cwt</th>
<th>Phial per cwt</th>
<th>Phial per cwt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1815</td>
<td>98 0</td>
<td>98 0</td>
<td>73 6</td>
<td>30 0</td>
<td>8 2*</td>
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<td>1820</td>
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<td>30 0</td>
<td>8 2*</td>
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<tr>
<td>1825</td>
<td>84 0</td>
<td>60 0</td>
<td>73 6</td>
<td>30 0</td>
<td>8 2*</td>
</tr>
<tr>
<td>1830</td>
<td>84 0</td>
<td>60 0</td>
<td>73 6</td>
<td>30 0</td>
<td>7 0</td>
</tr>
<tr>
<td>1834</td>
<td>78 7.6</td>
<td>60 0</td>
<td>73 6</td>
<td>30 0</td>
<td>7 0</td>
</tr>
<tr>
<td>1840</td>
<td>19 7.3(?)</td>
<td>63 0(?)</td>
<td>73 6</td>
<td>8 9</td>
<td></td>
</tr>
<tr>
<td>1844</td>
<td>19 7.2</td>
<td>63 0</td>
<td>73 6</td>
<td>8 9</td>
<td></td>
</tr>
<tr>
<td>1845</td>
<td>13 0(?)</td>
<td>63 0</td>
<td>73 6</td>
<td>8 9</td>
<td></td>
</tr>
</tbody>
</table>

* Rate for Ireland - 1s. 3 1/4d.
FORMING AND MOULDING AIDS

of approximately five shillings. As the Statute 51 c68 by George 111 so aptly states;

"The manufacturers of glass are prohibited from making any sort of glass or glassware other than flint glass in any glasshouse entered [listed] for making flint glass." (Ref. 28)

As a result of these limitations and excise laws between 1746 and 1845, there was almost a complete separation in Britain of the luxury clear flint glass from the common ‘black’ glass trade.

Innovative methods of moulding, embossing or deep cutting were introduced for flint glass bottles and crystal tableware between c. 1750 and 1850. In contrast, older cheaper methods, using wooden moulds and push-ups, were only completely displaced for common wine/beer bottle manufacture between c. 1820 and 1860-70.

Examples of this dichotomy of development between clair and common ‘black’ glass will be considered in the assessment of changes in manipulation techniques and equipment in the following discussion of forming and moulding aids and methods (Sections 4.0, 5.0, 6.0).

These severe manufacturing limitations and the marked differences in excise duty between different forms of glass up to 1845 also serve to explain the dearth of colourless and pale-green glass artefacts on early Australian sites. They also highlight the need to consider such finds separately from the ‘black’ or amber glass.

4.0 FORMING AND MOULDING AIDS

Throughout the nineteenth century, much of the evidence for identifying and dating glassware will depend not only on recognising changes in shape, style and embossing designs, but also on the surface markings and mould seams created by the different forming and moulding aids.

4.1 Push-ups

One of the main features of glassware such as tumblers, flasks and bottles, however they are made, is that the base is not flat. The centre of the base is pushed up to some degree into the body of the article. The push-up is usually deep when the article is traditionally made, as it is the area where the pontil is applied to hold the glassware for the shaping of the rim or for the application of an additional reinforcing collar.

The main purposes of the push-up are:
To ensure that the article stands upright, without wobbling, if the base is not flat. This applies to early and late bottles.

To keep the roughened or adhering glass from the pontil away from the surface on which the article stands.

Possibly to distribute and cool the hotter and thicker glass which collects at the bottom of the shape during traditional manipulation.

To prevent cracking-off in large bottles by undue leverage on the pontil during finishing.

To provide a means of readily turning bottles in a stack using the fingers and thumb. This procedure is still followed in traditional champagne manufacture.

In traditional methods of making glassware, the craftsman is at liberty to choose any tool, piece of wood or metal, hand-held or fixed mould, or even, in recent years, dampened sheets of newspaper to shape hot glass to form a push-up. It is not always possible to define the method used from the appearance of the base of the article. Thus, the value of the push-up for identification and dating may be limited.

The shape and form of push-ups and pontil marks were described in 1968 by J.H. Toulouse (Ref. 31) and Olive Jones assessed the dating of these different forms in 1971 using examples from Canadian sites (Ref. 18). The task here is to relate their and other findings to the Australian context, as it is known at this stage, and also to link the markings with changes in equipment.

Different types of tool or moulding equipment appear to have been used to form push-ups. Each has typical characteristics useful for identification and dating and are as follows:

4.1.1 **Shaped metal or wood piece.** The usual forms used to shape the push-up appear to have been either a hand-held piece of shaped metal plate, a mollette (Ref. 18), or a shaped piece of wood - even the wooden handle of a glass-making tool such as a paddle. The shapes formed by pushing these tools into the rotating, hot base of the shaped bottle are shown at the stage of pontil attachment in Figures 21 and 22.

The rounded conical profiles (Fig. 21) are usually associated with narrow glass-tipped pontil marks 25-35 mm (approximately 1-1\(\frac{3}{8}\) inches) diameter, often used in early wine bottles up to c. 1750. The hemispherical/dome shaped profiles (Fig. 22) are usually shaped in order to accommodate much wider sand-covered pontils 40-70 mm (approximately 1\(\frac{3}{8}\)-2\(\frac{3}{4}\) inches) and were used extensively for English wine bottles between c. 1720-1870. By this time holders came into wide use - even for common bottles.

4.1.2 **Pointed metal or wood piece.** Very sharply pointed push-ups were apparently formed by a spiked piece of wood or metal. Their use was
largely confined to the narrower medicine bottles, phials and oil bottles where it was necessary to avoid distorting the bearing surface (Fig. 17). The steep cone formed also reduced the pontil contact area.

**Figure 21.** Typical form of bottle base and pontil mark resulting from a glass-tipped pontil.

**Figure 22.** Typical form of bottle base and pontil mark resulting from a sand-pontil.

Moulding and holding techniques appear to have been adopted more quickly for expensive 'medicals' than for common bottles. Thus, this sharp type of push-up may well apply more to such bottles prior to c. 1800. Pointed push-ups are not a feature of the many tall narrow oil bottles of the gold rush period c. 1850-70.

### 4.1.3 Metal rod. A metal rod, similar to a pontil, was sometimes used to push up the centre of the base. The end of this rod may be flat or divided into quadrants (Figs 23, 24). Examples of these rods are still in existence.

Distortion in the base profile and either a faint, or quite clear quatrefoil impression 15-50 mm (approximately \( \frac{3}{8} - 2 \) inches) diameter are often visible within the pontil contact area. Again (Fig. 24), the grooved quadrant reduces the area of contact when attaching the pontil, the difficulty in cracking-off and the roughness of the pontil mark. This form of push-up and pontil mark (Fig. 24) is found in many English wine/beer type bottles from c. 1700-20 onwards until holders were adopted for these common bottles c. 1830/40-1860/70.

Generally, as narrower, taller, cylindrical bottles became popular between c. 1750-1800, narrower rods were used giving smaller quatrefoil impressions.
4.1.4 Ricketts' push-up device. This device, together with a lettered metal ring, formed the base of Ricketts' mould equipment for the manufacture of 'black' (dark-green) wine and other bottles to accurate dimensions (Fig. 25). The first patent to this Bristol company was granted in 1821 in British Patent No. 4623 (Ref. 17). Bottles with 'H. Ricketts & Co., Glassworks, Bristol' embossed on their bases can be dated 1821-53 when the company amalgamated with another Bristol company, Powell & Filer (Appendix 2).

The distinguishing features of this type of bottle, embossed on the base with Ricketts or other trade-names are:

* the ring of embossed lettering around the base (occasionally remains unembossed)
* the slightly raised circular mould seam on the outer resting edge
* the corresponding raised inner circular mould seam
*the area inside the lettered ring where the marks caused by the attachment of the pontil remain.

The Ricketts type bottle is one case where moulded lettering appears on the base of a bottle at the same time as a pontil mark.

Although the cheaper wooden moulds and the simpler three-piece moulds remained in much wider use for common bottles, Ricketts moulds were used by some companies in Britain, the U.S.A. and France up to c. 1900 (Ref. 17).

**Figure 25.** Appearance of bottle base formed from Ricketts' push-up device, lettered metal ring and moulds.

### 4.1.5 Shaped push-up tools.

As late as 1857, in a British patent, the South Yorkshire glass-maker, Breffit, confirmed that wooden push-up tools were still in use in Britain for forming common 'black' bottles. The patent was concerned with the impregnation of wooden moulds with water glass (sodium silicate solution) to prevent wear.
The push-ups of a number of bottles from the 1851 wreck of the *Eglinton* were probably formed by these specially shaped tools. (*Eglinton* Artefact Catalogue, types 755, 892. Ref. 84).

The formation of the push-up tended to cause the heel of the bottle to bulge outward. Continental, but not English glassmakers, appear to have reamerized their bottles to eliminate the bulge (Ref. 17). By the 1830s the bulged heel of common 'black' English wine bottles ceased to be a feature even for those blown in dip moulds. It is not clear how this was achieved but Barret and Clay, the London wine merchants, state that in 1842 the rounded base was ‘...pushed in afterwards by means of a conical mould.’ (Ref. 17).

It can be inferred, from a close study of the markings on the bottle base, that different forms of shaped push-up tool were used between c. 1820 and 1870.

![Cross section of bottle base showing push-up tool impression.](image)

**Figure 26. Possible forms of hand-held push-up tools.**

The two common types in Figure 26 are identifiable first by a faint impression of the lower edge of the conical wooden tool, part way up inside the push-up and secondly, in some specimens, by a dome shaped point or cap at the apex of the push-up.

Three different types of tool appear to have been used. The two common types were evidently simple uncapped or capped wooden cones which could be replaced when worn (Fig. 26). The push-up could then have been formed by rotating the hotter fluid glass in the base of the bottle against the point of the conical tool, without the glass-blower leaving the chair.
Some bottles with the above characteristics sometimes have a reddish/black deposit distributed over the base of the bottle - the so-called ‘graphite pontil’. This name arises because it was thought that graphite/oil suspensions (the glassmaker’s ‘oil-dag’) may have been used at that time (c. 1840-60) as a high temperature lubricant to prevent hot glass sticking to the metal cap or completely metal push-up tool. Such parting agents leave black deposits on the glass on first application in metal moulds. Analysis of these black deposits by J.H. Toulouse has shown however, that these deposits are usually ferrous or ferric oxides caused by the high temperature oxidation of the metal parts of the push-up tools.

The more complex markings of a third type of push-up do not appear to have been satisfactorily explained. These markings are similar to the simpler forms shown in Figure 26, but with an additional mark or mould seam right on the outer circumference of the heel of the bottle. Figure 27 illustrates the most likely form of a three-part push-up tool which would cause the markings - a wooden cone held between a metal cap and a partially shaped 3-6 mm (1/8-1/4 inch) metal base-plate.

This suggested design would be a cheap renewable push-up, capable of being easily manufactured from wood and sheet metal without expensive machine shop facilities. For common bottles it would go some way to competing with the more precise but dearer three-piece all metal moulds being introduced by Ricketts and others between c. 1810 and 1860.

Cross section of bottle base showing likely push-up tool impression.

- metal cap
- wooden cone
- metal base-plate

Figure 27.
Likely form of a three part push-up tool used as the moveable base of a dip mould.
The characteristics of this third more complex type of base are:

* Glass distribution is often very uneven, presumably due to the uneven cooling and 'parting' properties of a metal/wood tool.

* The dome shaped impression, located at the tip of the push-up, may be slightly square or pointed.

* Iron oxide may be present in the impression as would be expected if a small metal tip penetrated the hottest, thickest part of the glass shape.

* A clear seam line may be visible as a slight projection around the outer surface of the bottle base.

* A rounded ridge, presumably corresponding with the lower possibly worn edge of a wooden cone, often occurs on the push-up surface close to the bearing surface. As would be anticipated if a tool like that in Figure 27 was used, this ridge is at a much lower level than similar impressions formed by a simpler conical tool.

4.2 Pontils

In addition to the reduction in area of the pontil scar by the preceding changes in shape of the push-up profile, the scar was also modified by the type of pontil. There are four emportilling techniques, each with its own characteristic surface effects.

4.2.1 The glass-tipped (plain or open) pontil. This pontil is formed by dipping 16-19 mm (5/8-3/4 inches) diameter rod into hot glass. The pontil leaves adhering glass or pieces broken out over a base surface area up to approximately 30 mm (1 1/4 inches) diameter depending on the size of the rod used. (Fig. 21). Larger sized rods were used for heavier articles.

Glass-tipped pontils were used with early onion-shaped wine bottles with deep push-ups (Fig. 20) but are not found after c. 1720 in common 'black' English wine bottles (Ref. 31). This pontil was more commonly used for lighter tableware, flasks, medicine and toilet bottles. It is still often used in preference to a holding device for hand-made crystal, when the pontil scar is usually ground away. This method has the advantage of allowing the article to be precisely centred during manipulation (i.e. made to rotate on its axis). Centring is achieved by delicate adjustments to the rotating article just before the glass on the pontil sets.

4.2.2 The sand-pontil. This pontil consists of a gather of glass, lightly dipped in sand and shaped to 'seat' on the domed or other shaped push-up (Figs 22, 24, 26).
Unless the push-up is specifically shaped to form a dimple or quatrefoil impression, almost the whole of the base surface between approximately 40–77 mm (1\(3/16\)-3 inches) diameter is roughened by small glass chips and, sometimes, adhering particles of sand. However, the appearance of the sand-pontil mark is more acceptable than that formed by the glass-tipped pontil.

Sand-pontil marks are the commonest form of ‘improved’ pontil mark and are often found in English wine and other bottles between c. 1720 and 1870. Sand-pontils are still used for hand-made crystal glass.

4.2.3 **The blow-pipe (or ring) pontil** used the blow-pipe and the glass left on it (the ‘moyle’) after an article was cracked off as a pontil rod. When the ring-shaped mark (about the same size as the cracked-off neck of the bottle) is formed on the base any mould seams or embossed markings inside or outside the ring are left undisturbed (Fig. 28).

![Appearance of pontil mark on bottle base](image)

![Cross section of bottle base](image)

![Blow-pipe](image)

![Bare iron pontil](image)

**Figure 28.**
The blow-pipe used as a pontil and the typical appearance of the base.

**Figure 29.**
The appearance of the bottle base due to the bare iron pontil.

Clearly, a similar mark may also arise from a wide glass-tipped pontil applied to a deep push-up such as a sharply shaped conical push-up.
However, the ring shape resulting from a glass-tipped pontil would not be so clear.

The ring pontil technique was described by Diderot (Ref. 1) as placing the shape in a ‘V’ shaped stand whilst attaching the blow-pipe. Also, Olive Jones states that it often occurs in French ‘flower-pot’ shaped bottles in the eighteenth century. Typically, the ring pontil can occur in ‘case’ bottles, champagne bottles, flasks, apothecaries’ bottles and phials. It is generally associated with bottles of European origin and is not found in common ‘black’ English wine bottles after c. 1720 due to the extensive use of the sand-pontil.

4.2.4. The bare iron pontil leaves a circular depression in the centre of the push-up in the base of the bottle. This is caused by the red hot, suitably curved end of the iron pontil being pressed into the stiff glass surface (Ref. 31). Some distortion of the push-up tends to occur (Fig. 29), as it does when a similar metal rod is used to form the push-up itself (Fig. 24). The red hot iron may leave some reddish/black ferrous or ferric oxide deposit in the depression.

It is generally agreed that this type of pontil mark is found in more luxury bottled products of colourless or pale-green glass, such as carbonated drinks, preserved fruits, flasks etc, rather than in large common ‘black’ wine bottles. It appears to be confined to c. 1845-70.

4.2.5 Summary. From the work of Toulouse (Ref. 31), Jones (Ref. 18) and others, it appears that push-up shapes and pontil marks only provide an aid rather than a decisive guide to dating glass bottles. In some instances, their interpretation is also dependent on some knowledge of the type, size and source of the glassware, notably common ‘black’ bottles or more luxury products from Continental, British or American sources.

This Section serves to emphasise the need for a technical assessment of the forms of push-up and pontil marks of a large number of known dated Australian artefacts.

4.3 Holding Tools

The introduction of holding tools for the manufacture of glassware finally eliminated the use of pontils and their unsightly pontil marks - the exception being hand-made tableware where the pontil mark was usually ground away. Various holders designed for specific shapes of glassware exist (Fig. 30). The following are typical:

4.3.1 The Sabot is a modified pontil tipped by a four-fingered holding device and was in use in France in 1830/1840 (Ref. 44) 1840 (Ref. 44). The cross pieces in the base of the tool and the pushing of the article into the fingers can leave surface markings (usually quite light) if the base of the bottle is placed into the holder before the glass is sufficiently cold.
The effects of using the tool are indicated in the heavily marked square gin bottle in Figure 31. In this example the extent of the distortion and the deep central impression in the base are so unusual that in all probability the tool used was too small for the bottle.

4.3.2 The snap-case or gadget, a spring-operated holding device, appears to have been first used by Pellatt in England c. 1830-50. In 1868 Bontemps describes a similar device (Ref. 44).

4.3.3 Disappearance of pontil marks. The adoption of holders and the disappearance of pontil marks appears to extend from the 1830s to the 1870s with the period of change probably depending on the type of glassware or bottle.

J.K. Baldwin provides an extensive illustrated summary of patent and proprietary medicines in which details concerning bottles used for packing are placed alongside the dated advertisements of the product. The information provided by Baldwin has been collated to show that a change to a non-pontilled base for this group of bottles takes place effectively between c. 1850-60. Statistically, there is less than a one in ten chance of an un-pontilled medical bottle occurring before c. 1850 and also a similar probability that a pontilled bottle will be made after c. 1860 (Fig. 32).
Figure 31. Dark-green square gin bottle and its base, showing distortion of the lower sides and deep markings on the base. (Reproduced by the kind permission of the Trustees of the Museum of Applied Arts and Sciences. MAAS A6893-7.)

Figure 32. Graph showing change in pontil marking of American medical bottles between 1820 - 1900. Total sample size 300. (Based on information in Baldwin, Ref. 42.)
FORMING AND MOULDING AIDS

For common wine bottles, it is generally agreed that holders replaced pontils for the finishing process between c. 1840-70 and largely superseded them by the 1870s (Ref. 31).

Clearly, holders would have to fit the base of a bottle precisely so that the neck could be rotated without wobbling on its axis whilst applying the finishing collar of hot glass (Figs 3, 4). Such a precise fit would be possible with moulded bottles such as those formed in three-piece metal moulds. Manufacturers making more expensive products in metal moulds, as distinct from common ‘black’ bottles formed in wooden moulds, would also be more likely to adopt these new techniques.

It is not surprising therefore, that there appears to be direct evidence of these changes occurring as early as c. 1830-40 in well-moulded luxury products such as pale-green food bottles. Several tall, circular, three-piece, moulded, pale-green preserve jars, and a fluted pickle jar, from the 1841 wreck of the James Mathews, have well-formed basal profiles, sometimes with a mamelon, and have no pontil marks (Ref. 92).

Considering that finishing tools were said to be in use in English and Scottish factories in 1828 (Ref. 44), it is probable that holders may have been used in high class colourless and pale-green moulded glass bottles and tableware as early as c. 1830-40 or even earlier.

4.4 Moulds and mould seams

The major departure from traditional methods of blowing and forming was the introduction of different forms of mould. It is important to note the necessity to differentiate between flint and common ‘black’ glass when considering different forms of moulding and mould marks.

No matter how carefully moulds are made, a seam is left in the glassware corresponding with the junction of two separate parts of the mould. This seam takes the form of a slightly raised ridge either on the surface or pressed into the surface of the glass. Even a scratch or lightly scaled mould surface will be accurately mirrored in the surface of the finished glass. Mould or tool marks formed in the early manipulation stages (Fig. 2) may be retained in a blurred form on the surface of the finished glass. Chipped corners of metal moulds, often due to trapped, cold glass, are accurately reflected by small pimples of glass at some point on the glass mould mark - such as just below the reinforcing collar in a three piece moulded bottle. The cyclic heating and cooling of adjacent metal mould parts and non-uniform temperatures along their edges disturbs the alignment and alters the small gap between the mating mould parts. This warping is faithfully reflected as very slightly broader mould seams corresponding with the outer colder mould parts. In modern glass moulds, the effect is offset by hollow-grinding of matching mould parts.
body or collar, or are circumferential marks around the base, heel, shoulder, rim or around the area immediately below the reinforcing collar.

By inspecting and identifying the position and extent of the mould seams in glassware or glass artefacts it may be possible to infer the mould form used (dip, two-piece, three-piece, pressed or machine-made) and thus infer their period of manufacture. It may not be possible to identify the mould material, its use or construction.

4.4.1 Dip moulds. The use of simple internally tapered one-piece dip moulds appears to have commenced in Britain in the early 1700s (Fig. 33). This type of mould is illustrated in a 1750 wood-cut of a French glasshouse. Many early dark-green/amber cylindrical, octagonal and square bottles were made in this manner and tapered down from the shoulder so that the shaped body could be lifted out of the earthen, wooden or metal moulds.

![Examples of one-piece dip moulds and shapes produced from them.](image)

Figure 33. Examples of one-piece dip moulds and shapes produced from them.

Interesting examples of the use of the dip mould are square ‘case gin’ bottles. Among the earliest square ‘case’ bottles in Australia are four intact examples and several broken pieces from the 1727 wreck of the Zeewijk (Ref. 58). Although these bottles have been fairly accurately formed, presumably to fit into the framework of a case, they appear to have been shaped by paddles or squared wooden block tools rather than dip moulds (Fig. 5). Immediately after the Napoleonic wars (which may have restricted the import of these Dutch ‘case’ bottles) ‘Schedam’ gin was imported (S.G. 27.7.1816, p. 2) in ‘4 gallon cases’ (S.G. 14.12.1816, p. 2) and in “cases containing 15 half-gallon bottles” (S.G. 14.12.1816, p.2; S.G. 6.2.1823, p.4). These square bottles became quite a selling feature and were specifically mentioned in the manifest of the ship, the Governor Phillips (S.G. 19.6.1823, p. 4).
There are also many examples of common dip moulded wine bottles up to c. 1870. Figure 34 illustrates a sealed example made for the Kirklands vineyard, probably around 1850.

Between c. 1750-1820 specially shaped dip moulds were introduced as a means of obtaining fluting effects in hand-blown crystal glassware (Fig. 33, Ref. 67). These moulds were used to obtain the characteristic base fluting of Irish decanters (Ref. 79 and Fig. 10). Similar effects were obtained in Spanish (Ref. 81), Scottish (Ref. 51) and other British factories at that time (Ref. 78).

Bottles formed in solid dip moulds are characterised by:

* An absence of mould seams in the body and base
* Unseamed, free-blown (often asymmetrical) shoulders
* Faint circular mark or slight bulge and change in glass thickness corresponding with the position of the top of the dip mould (depending on the degree to which the craftsman blows up the bottle against the side of the mould) (Refs. 31, 68).

![Figure 34. Dip moulded sealed wine bottle made for James Busby’s Kirkton Estate. (From: J. Vader & B. Murray, Antique Bottle Collecting in Australia, Ure Smith 1978, p. 58.)](image)

Note the faint horizontal blow-over mould mark at the arrow near the shoulder and the absence of other mould seams.
This faint circular mark is usually on the upper body or right on the shoulder and is not as obvious as a normal mould seam (Fig. 34). It may only amount to a slight change in reflectivity where the hot glass has touched the mould compared with the highly reflective fire-finished, free-blown shoulders and neck. Careful inspection with a light behind the piece of cleaned glass, or even inside the bottle, may also be needed to detect any change in glass thickness at a line corresponding with the top of the dip mould.

Such 'blow-over' dip mould marks on the shoulder of a common bottle usually imply that it has been made, at the outside, before c. 1860-70. For better class flint phials, food and chemist bottles, this limitation may well prove to be before c. 1840-50. In high class tableware, the technique is usually associated with the production of base flutings between c. 1760-1860. Like most simple hand processes, the technique still remains in use.

4.4.2 Two-piece moulds. The use of the two-piece mould is one of the most obvious ways of forming glassware. In fact, in a modified form, with the addition of base-plates, it is the modern method of final moulding of machine-made bottles.

Simple two-piece moulds can be bottom or side-hinged and full or shoulder-length (Figs 35, 36). They give rise to vertical mould seams up to a blow-over mark in the shoulder (Fig. 37a) or right into the neck (Fig. 37b) (Refs 31, 68). They have the disadvantage of forming a seam diametrically across the base of the bottle, the unevenness of which may cause instability.

Figure 35. Two-piece bottom-hinged moulds. (A. Pellatt, Curiosities of Glass-making 1849, p. 103.)
These seams are easy to see in modern machine-made bottles where high pressure air is used for blowing. However, in hand-blown glassware, the slightly raised ridge of glass corresponding with the gap between the mating faces of the mould parts or the slight change in glass thickness or level where two parts do not fit perfectly, may be difficult to identify. A spotlight behind the glass may be needed to pick up the location of the mark particularly when the glass has not been fully blown up against the mould halves.

In Britain, the use of two-piece moulds appears to have been confined to the flint and phial glassworks and initially not to have been applied to common bottles.

In tableware manufacture, ‘open and shut’ moulds have been used in Britain and Europe for several centuries (Ref. 17). Moulded lion mask stems from 1650-1750 were made in this manner (Refs 23, 38). The silesian wine glass stems of the first half of the eighteenth century were also made in this way (Refs 11, 15). Completely moulded small phials and tumblers were being made in two-piece moulds by 1750 and possibly earlier (Refs 26, 29).

Early examples of two-piece moulded glassware appear to be mainly tableware, early imported carbonated drink bottles after c. 1835, food and apothecaries’ bottles and phials as in Figure 18b. There are several such artefacts from wrecks in West Australia - the 1841 James Mathews and the 1852 Eglinton. All are pale-green, not ‘black’ glass, and are well-moulded or embossed, implying that the majority was probably made in metal moulds.

The use of split wooden moulds for plain phials, for which no embossed lettering was needed, may have been cheaper than heavily hinged metal moulds. Careful inspection of the drawing of a two-piece mould which formed part of a set of glass manufacturing tools in 1817, indicates that the artist appears to have sketched a wooden mould with locating dowel pins and light hinges (Fig. 36, Ref. 52).
Wooden moulds continued to be used extensively for common bottles at least to c. 1860 as indicated in E. Breffit's 1857 patent on the impregnation of wooden moulds with alum and sodium silicate solutions. These wooden moulds, which are dipped in water between successive use, carbonise on the inside and give quite a smooth moulded glass surface. The glass is readily moved or spun backwards and forwards during blowing which reduces or even eliminates mould marks. The obvious advantages of simple wooden dip moulds for common bottles would be low initial cost, ease of shaping, repair and replacement - all very important considerations for small companies with inadequate engineering facilities making a relatively cheap product.

![Diagram of two-piece moulded bottles showing seams.](image)

**Figure 37. Two-piece moulded bottles showing seams.**

These considerations of cost and convenience, as well as the separation of the flint and common bottle trades by the excise laws and regulations, may well explain why more sophisticated methods of moulding were not widely adopted for common bottles until the introduction of chilled cast iron moulds allowed cheaper high quality engraving in 1866 (Refs 48, 66).

The characteristics of simple two-piece moulded glassware are:

- Two diametrically opposite vertical seams in the body
- A diagonal seam across the centre of the base (Fig. 37).
In addition, an important feature is that this two-piece moulded glassware can have embossed designs and lettering in the body. The mould halves move apart after blowing is completed, allowing the use of engraved mould surfaces. In contrast, dip moulds have to be smoothly tapered to enable the shape to be withdrawn.

Figure 38. Bottom-plate construction and typical mould seams obtained in two-piece moulds.
Simple two-piece moulding appears to be confined to shaped food and carbonated drink bottles, apothecaries' bottles and phials in flint or coloured glass from c. 1750 on, and was only fully replaced for these purposes as semi and fully automatic machines were adopted in c. 1890-1930. Effectively, it does not appear to have been generally used for common 'black' bottles prior to c. 1890.

The more complex forms of two-piece moulds have post-bottomed (Fig. 38a) and cup-bottomed (Fig. 38c) base-plates. These plates form an additional circular seam in the base of the bottle (Fig. 38a) or just above the base of the bottle wall (Fig. 38c). The typical full diagonal seam across the base of simple two-piece moulding is eliminated. The main advantage of using the post-bottomed mould is the extension of the base-plate, like a post, into the two halves of the mould that forms the body, which thus ensures correct closing of the mould.

Where the base-plate fits precisely into the cylindrical body of the mould (Fig. 38b), as in the Ricketts design applied to a three-piece mould (Fig. 25), the seam is right on the heel of the bottle. The glass in this mould seam is rapidly chilled, giving rise to micro-cracks, so that these bottles often show extensive chipping of the sharply angled base corner.

These complex methods of two-piece moulding are identified by the circular base or lower body seams in conjunction with two opposing vertical mould marks on the body, frequently extending right up into the neck. The body and base can be embossed with designs or lettering.

Figure 39.
Aire & Calder patent bottle from the 1852 wreck of the Eglinton with special lip and cap seat bore, horizontal mould seam at the body with shoulder junction and opposing vertical seams on the body.: Aire & Calder Bottle Works owned by E. Broffitt & Co., S. Yorkshire, Ref. 20. (WA Maritime Museum EG 888, EG 908.)
These moulds appear to have been developed first in the flint glass trade about 1790-1820, probably for pictorial and historical flasks in America and for the crystal glass trade in Britain. The bottom-plate construction by Ricketts in 1821 appears to be the first direct reference (Refs 17, 52). Despite these earlier developments, examples in early artefacts in Australia are likely to occur in high quality bottles after c. 1840 - such as the pale-blue Aire and Calder patent bottle with straight sides, opposing vertical body seams and embossed basal surface from the 1852 Eglinton wreck (Fig. 39).

Owing to the general adoption of three-piece moulding for common ‘black’ wine bottles in the latter half of the nineteenth century, the identification of two-piece moulding with base-plates for common bottles will usually imply that they were machine-made by semi or fully automatic methods after c. 1900-20.

4.4.3 Three-piece moulds. Several sealed and dated bottles from the early period of the nineteenth century have been found with three-piece mould seams. However, it is always possible that the seals on the bottles relate to the vintage rather than the date of the bottle manufacture (Ref. 52). Although some early experimentation with three-piece moulding may have taken place, detailed research by Olive Jones (Ref. 17) concludes claims (Refs 67, 80) that Charles Chubsee of Stourbridge perfected this system in 1802 appear to be difficult to substantiate. Chubsee was '... a good mould maker, principally for diamond mould.' (Ref. 17).

Nevertheless, the three-piece construction, which was essentially a dip mould for the body with two hinged shoulder moulds, was not claimed by Henry Ricketts as part of his major breakthrough in the manufacture of common bottles in his British Patent No. 4623 of 1821. This patent provided a mechanism for the opening and closing of the shoulder moulds and for the insertion and retraction by a 'knocker-up' of a ‘punt’ or ‘pricker-up’ which formed the push-up in the base of the bottle. The ring-plate, which fitted around this push-up, was engraved with the maker’s name in reverse and was also adjustable in thickness making it possible to readily vary the height and capacity of the bottle. Ricketts states:

'By this sole invention, the circumference and diameter of the bottles are formed nearly cylindrical, and their height determined so as to contain given quantities or proportions of a wine or beer gallon measure, with a great degree of regularity and conformity with each other ... ' (British Patent No. 4623, 1821).

All the major features required to make the bottle a precisely sized package were included in this patent, except the important control of glass weight and thickness, even though the change over from free-blowing, dip moulds and the use of wooden moulds evidently took another forty years to complete for common ‘black’ glass bottles (Refs 17, 52).
Figure 40. Henry Ricketts' improved mould and moulding mechanism. (British Patent No.4623 of 1821.)

Figure 41. Simple three-piece mould and corresponding mould marks on the bottle.

Many early three-piece moulds are thought to have been of a much simpler form with the shoulder moulds fitted with long handles (Fig. 41). The base of the solid tapered body mould was evidently sometimes fitted with some form of push-up vent.
Two examples of a foot operated form were illustrated by Apsley Pellatt in 1849 (Ref. 70). A development of this type often used in the latter half of the nineteenth century is shown in Figure 42 (Refs 52, 67).

![Foot press and mould](image)

**Figure 42.** Foot-operated three-piece bottle mould. (Modified from: R. Morgan, Sealed Bottles, p. 20.)

The characteristic features for all these different types of three-piece moulding equipment are the same - three distinct and readily identifiable mould marks on the bottle - one encircling the widest part of the shoulder where it joins the body, the other two vertical and on diametrically opposite sides of the shoulder and neck (Fig. 41).

An important additional feature is that embossed designs or lettering are not possible on the body and base, only on the shoulders. The lower solid mould is tapered, as in a dip mould, so that the moulded body can be lifted straight out.

In many instances, these three-part moulded bottles also have a dimple like basal shape, often called a mamelon, in the centre of the moulded push-up and corresponding with some form of push-up vent.

Such a vent allows any air entrapped between the hot glass and the mould base to escape and so ensures full glass contact and moulding in the otherwise solid mould. The appearance of this mamelon may be similar to the shape probably formed by a capped push-up tool (Fig. 26) in an otherwise unmoulded bottle.

The dating of two and three-piece moulded glassware differs considerably for clear flint and common ‘black’ glass.

Three-piece moulding is the commonest form of moulding for common ‘black’ wine bottles which form the bulk of glass artefacts found on Australian sites. However, effectively it was not used for high quality
shaped flint glass bottles, except for the simplest unembossed designs. Examples may well be found over a period as wide as c. 1820-c. 1920.

The change over to improved methods differed considerably for flint and ‘black’ glass. For example, all the clear flint glass food bottles in the wrecks of the 1841 James Mathews and the 1852 Eglinton appear to have been two-piece moulded, except for plain round unembossed bottles where three-piece moulding can be used. In contrast, over four-fifths of the ‘black’ glass wine/beer bottles on these wrecks were still traditionally made or formed in dip moulds and the remainder three-piece moulded.

After c. 1900 even common bottles were made using complex two-piece moulds with base-plates. Nearly half of all American bottles were moulded on the Owens suction machine by 1917 (Ref. 16) and corresponding changes in Britain, Europe (Refs 33, 66) and finally Australia (Refs 33, 34) took place by c. 1920-25.

Black glass artefacts are likely to occur in a three-piece moulded form from c. 1860-c. 1900. In contrast, flint glass artefacts will generally be of two-piece and complex two-piece form from c. 1830 onwards.

The interpretation of one of the main types of glass artefacts, the broken base, is thus entirely different for those composed of common ‘black’ glass and flint glass. Although the outside possibility has always to be borne in mind that circular mould seams in the base or heel can be found from c. 1820 onwards if Ricketts’ methods were used, normally their appearance would imply that a common ‘black’ or amber bottle was manufactured after c. 1890-1910. On the other hand, diagonal or circular mould seams in pale-green or colourless bases are common, at least from c. 1830.

4.4.4 Turn and paste moulding is the forming of a glass article by continuously rotating the blow-pipe and turning of the hot glass shape while it remains in contact with a previously wetted circular dip, two-piece or three-piece mould. This method produces seam-free glassware (Fig. 43).

This method is sometimes stated to be a development taking place from c. 1880 onwards (Refs 52, 68), but the increased use of turn-moulding for bottles at the time was only an extension of the traditional practice of hand-blowing and turning in wetted moulds (Refs 48, 65). This method facilitates turning the glass on the blow-pipe by providing a layer of steam between the hot glass and the mould. Evidence of mould seams is obliterated and a high surface polish, very similar to that obtained during free-blowing, is produced.
Although highly polished, there is always some evidence of turn. There may be light rotational markings on the smooth surface such as those found on a domestic light bulb viewed in reflected light (Fig. 6). In bottles, it is usually possible to identify such circular markings and link these with the absence of mould seams on the body and shoulder.

Lamp chimneys, apothecaries’ show globes and some forms of tableware and lamp bulbs, were, and still are, made by these techniques. Prior to c. 1880, bottles were not usually moulded in this manner. However, over one-hundred turn-moulded wine bottles were found on the 1852 wreck of the Eglinton - artefacts similar to EG 755, 892, and 893a in the Eglinton Artefact Catalogue of the West Australian Maritime Museum.

The ideal bottle for the application of a label was one without mould seams. Thus, the need for the hand-labeller to turn the bottle to the smooth surface between the seams before labelling was eliminated. The three-piece moulded bottle was suitable for this purpose as the body is free of mould seams (Fig. 41). However, following the introduction of labelling machines in the 1870s, these bottles had the disadvantage that the body was slightly tapered to allow the bottle to be removed from the mould.

In April 1879, G. Evinson invented a method of modifying metal moulds (Ref. 52). He achieved this by ‘ ... lining moulds with a mixture of plumbago [graphite] and oil or tallow by which combustion produces gas and forms a cushion enabling the bottle to be easily rotated in the mould.’ In a later development, these paste-moulds were made by painting the
inside surface of the cast iron shape with thickened linseed oil, spraying with a medium-sized cork powder, and pre-heating at about 400°C and burning-off (carbonising) before use.

Although three-piece moulding continued to be popular, there was a rapid expansion in paste-moulding of bottles between c. 1870-c. 1920, after which both methods were superseded by two-piece moulding of machine-made bottles. Where there is other supporting evidence, it is usually a fair assessment to place turn-moulded bottles in this period, as long as the earlier use of wooden moulds for bottles and other forms of glassware, and the continued use of paste-moulds for the latter are fully appreciated.

4.4.5 Engraved moulds are widely used to form embossed designs and lettering on glassware. This embossing can provide evidence for dating in various ways:

* By the limitations in embossing of the different parts of the surface in each form of moulding, as previously discussed for dip, two and three-piece methods.
* From the known period of the introduction of embossing, particularly as this applies to imported British and locally manufactured clear flint and common ‘black’ bottles.
* Directly from the information provided by embossed names, trade marks, designs and dates.

It is useful to have a clear understanding of the limitations of each method of forming.

Seals can be applied to glassware made by any method of forming, including free-blown glass. They are impressed by a hand-held engraved plate on a blob of molten glass on the surface of the bottle. Examples are known in Europe from c. 1650 onwards. Initially, seals were placed on the side wall between the shoulder and the base. More modern examples, usually in two and three-piece moulded bottles between c. 1860 and c. 1910, often have seals on their shoulder. E. Fletcher of the British Bottle Collectors Club provides a useful summary of about six-hundred seal designs found on wine bottles, ‘case’ gins, schnapps and bitters bottles, together with an index of firms’ names (Ref. 53).

Figure 44 illustrates the relative direction of movement of the grooved metal and the glass after moulding places a major restriction on the use of engraved moulds. The engraved groove also has to be tapered outwards to ensure that the moulded glass does not touch the metal as the two move apart after moulding is complete.

As a result of this limitation Figure 44 shows that only certain surfaces can be embossed for different methods of moulding.
a. Embossing for this movement is possible and will not crack off.

b. Embossing for this movement is not possible and will crack off.

Figure 44 a, b. Embossing - its dependence on the relative movement of the glass and mould.

When inspecting an embossed piece of broken glass, it is thus also essential to carefully identify the shape of the embossed surface. If concave, the embossing is on the push-up or base. If flat or convex, with one direction of curvature only, the embossing is on the body. If convex, with two directions of curvature, the artefact is from the shoulder of the glassware. Using Figure 45, it is then often possible to identify the moulding method - dip, two-piece or three-piece and thus provide a guide to age.

Engraved moulds were in use as early as the first century A.D. and possibly earlier (Ref. 31). They have been used for tableware in Europe and Britain for several centuries (Refs 11, 15, 17, 23, 29). An extract from Felix Farley's Bristol Journal of August 15th 1752 confirms the early use of metal moulds for bottles:

'On Thursday James Watkins was committed (and Afterwards acquitted) to Newgate for stealing one brass bottle mould value 18s.[shillings], the property of Mr. James Warren, from the glasshouse in St Thomas St, Bristol.'
Figure 45. Surfaces which can (and cannot) be embossed using various moulding methods.

The introduction of embossed bottles appears to have been largely confined at first to two-piece apothecaries’ bottles (Refs. 10, 29). No doubt this occurred because the larger, cheaper common bottles were initially traditionally made, then dip, or three-piece moulded in which embossed designs were not possible on the body (Fig. 45). The finding of a violin-shaped Turlington’s ‘Balsam of Life’ bottle (Fig. 46 a) embossed with a date in 1750, in an early Williamsburg (U.S.A.) well, supports this early adoption of metal moulds and engraving for apothecaries’ bottles (Ref. 26).

Although mould engraving was known in Bristol and other areas by c. 1750 and was clearly established in the Stourbridge crystal tableware trade by c. 1800 (Ref. 17), much of our detailed knowledge comes from Margaret Ellison’s investigation of the account books of the engravers Beilby and Bewick (Ref. 10). These books relate to the cutting of brass and iron moulds among the glassmakers of the north-east coast of Britain between 1767 and 1848. Most of this engraving was for Shortridge & Co., South Shields and for the Northumberland Glass Co. The bulk of the bottles produced in the north-east at that time were shipped to the London bottlers and distributed via colliers from Newcastle-upon-Tyne. The records confirm that this engraving was mainly for the apothecaries’
luxury clear glass trade. Moulds known to have been engraved in Britain between 1786 and 1829 are listed below, alongside the known dates between 1817 and 1847 of imports of the corresponding products to Australia.

1786-1805 Daffy’s Elixir imported to Australia (S.G. 13.3.1823, supp. p. 1). Empty bottles were resold (S.H. 2.2.1842, p.3).

1816 Turlington’s Balsam of Life (S.G. 11.9.1819, p. 4)

1815,1816 Dalby’s carminative (S.G. 19.7.1817, p. 4)

1811 Macassar Oil, A. Rowlands & Sons, Hatton Gardens (S.G. 31.7.1830, 15.5.1834, p.1.)

1817 James Atkinson, London, probably for their Bear grease (S.G. 7.4.1847).

1820-29 Price Gosnell, Perfumers to His Majesty (Australian 4.8.1825, p.1).

Figure 46. Examples of early pontilled apothecaries’ bottles from engraved moulds. (Ref. 13)

a. Turlington’s Balsam of Life. Approx. 76 mm high (3 inches), 45 mm (13/4 inches) wide and 13 mm (1/2 inch) bore.

b. Fluted rectangular Daffy’s Elixir. 108 mm (41/4 inches) high, 67 mm (25/8 inches) wide, 38 mm (11/2 inches) deep, 13 mm (1/2 inch) bore.

c. Dalby’s gel. Sydney 114 mm (41/2 inches) high, 51 mm (2 inches) base diameter, 13 mm (1/2 inch) bore.

d. - f. Three apothecaries’ bottles. All pontilled. Sydney. Probably c. 1830-50. Approx. 76-127 mm (3-5 inches) high, 38-45 mm (11/2-13/4 inches) maximum diameter, 13 mm (1/2 inch) bore.
Early pontilled bottles from engraved two-piece moulds of this general type have been found recently in Sydney (Figs 46 c-f). As usual, such bottles, below six fluid ounces (170.4mL) capacity, are in clear glass to conform to British excise regulations of the time.

Examples of embossed bottles used in New South Wales from c. 1835 onwards are illustrated in Figure 47. Prior to c. 1850, plain shaped and fluted food bottles (Figs 18b,c) and simply lettered ovate soda-water bottles (Fig. 47a), such as those of J. Neilsen (S.G. 29.7.1837, p.3) and J.C. Russel (S.H. 3.1.1840, p.1), have all been found in Sydney.

Figure 47. Examples of embossed bottles from engraved moulds used after c. 1835.

c. Batty & Co., London, Salad Oil. Registered 1853, 349 mm (13¼ inches) high, 72 mm (2¾ inches) diameter, c. 1850-70.
d. Batty & Co., London, Capers. (S.H. 5.8.1840, p.3) 160 mm (6½ inches) high, 38 mm (1½ inches) square, c. 1850-70.
e. A.F. Moore, Newcastle (1873-1950), Base embossed BGW, Botany Glass Works (1890-1907), Dark-green, 260 mm (10¼ inches) high, 80 mm (3¼ inches) diameter.
4.4.6 **Engraved plate-moulds.** A modification applicable to many forms of metal mould, but usually applied to the body of two-piece type moulds, is an arrangement for the insertion of interchangeable, rectangular, circular, or even oval, engraved parts into the wall of the mould (Fig. 48). This principle was used and patented by Apsley Pellatt for tableware from 1820-50 for the moulding of intricate designs such as regimental badges. The designs were moulded from plaster casts covered with diatomaceous earth/brick dust and inserted, after preheating, into the mould wall.

![Diagram of engraved plate-moulds](image)

**Figure 48.** Interchangeable inserts into a mould wall. (Apsley Pellatt, *Curiosities of Glass-making*, p. 118.)

These ‘plate-moulds’ were more widely adopted by manufacturers after a patent for them was taken out by David Barker in the U.S.A. on 3 June 1879. The same basic mould could be used with individual engraved plates for different distributors, suppliers’ names or trade marks on, for example, medical flats (Ref. 42), soft drink and milk bottles (Fig. 49).

The identifying feature of these moulds is an additional rectangular, circular or oval mould seam surrounding the name and address or trade mark. As the plate and mould are usually a very close fit and the join is often incorporated in the engraved design, this seam is not always easy to identify.

Extant examples of ovate ‘Hamilton’ type bottles from c. 1840-70 were evidently made from moulds with similar engraved metal inserts (Fig. 49).
Figure 49. Typical appearance of plate-moulded bottles.

a. Ovate soda water bottle. Pounds, Ross, Waterford, Ireland. 200 mm (8 inches) long. c. 1850-70. (Drawn from ABR 1978 4 (23), p. 6.)

b. Medical flat. J.H.Foot, Chemist, 314 Oxford St, Paddington, N.S.W. Approx. 160 mm (6 1/4 inches) long. (Drawn from AABC 1985, 3(9), p. 13.)

4.4.7 Sandblasting. Although not a moulding procedure, a further method of showing the ownership of bottles was by sandblasted designs and lettering. The first use of sharp angular grained sand impelled by a jet of air, water or steam, was by B.C. Tilgham in two British Patents, Nos. 2147 and 2900 in 1870. This technique was so successful that the patents were made worldwide and the process was demonstrated in an exhibition in Vienna in 1873.

This simple sandblast process was soon applied as a cheap way to label bottles using a cut-out curved metal template covering the body of the glassware to be sandblasted. The method had the advantage that it could be cheaply applied by the bottler before use. It was used c. 1885-1910 to label beer bottles, particularly in Victoria.

4.4.8 Dating by embossed marks and mould seams. Embossed glass artefacts, from engraved moulds and engraved plate-moulds, can be a very useful guide to age.

Highly decorated figured ‘historical’ flasks were made in the U.S.A. as early as c. 1790-1830 (Refs 63, 68). However, apart from some forms of moulded tableware (Figs 10, 11, 13) and luxury bottled products (Fig. 46) such as apothecaries’ and early soft drink bottles, the full impact of
the engraving of metal moulds seems to have occurred in Australia with the appearance of beautiful designs of oil and pickle bottles during the c. 1850-70 gold rush. Many of these designs were registered under the 1842 patent regulations. Figured designs in bottles became more common in Britain and Australia after the introduction of the easily engraved and cheaper chilled cast iron moulds in 1866 (Fig. 47. Refs 48, 66).

As appears in the case of two-piece moulding (at least up to c. 1870-90) the bulk of embossed glass from engraved moulds will usually be found in clear and coloured glass as distinct from common ‘black’ glass.

Apart from early soft drink bottles and medical flats, most examples of the use of plate-moulds will be from c. 1870-1960. Since 1960, there has been a gradual reduction in embossing, as the use of high speed filling and labelling machines and standardised containers has increased.

The difficulties of identification and dating early Australian glass artefacts from observations of mould seams, or embossed names and trade marks, can be highlighted in two ways.

A simple calculation of relative surface areas will show that if a bottle is broken up into 20 mm x 20 mm square pieces, the frequency with which a piece would have a mould seam, or other identifiable mark, would be low:

- Traditionally made bottle: 1 in 50 and confined to the pontil mark on the base.
- Dip moulded bottle: 1 in 25 from the circular shoulder blow-over mark.
- 3-piece moulded bottle: 1 in 12 from the circular and two vertical shoulder seams.
- 2-piece moulded bottle: 1 in 6 from the circular base and vertical body and shoulder seams.

Table 4. Probable frequency of identifiable marks on pieces of early Australian glass.

These mean frequencies would be increased for artefacts of larger size and decreased if less than 400 sq.mm. in area. Although embossed names and trade marks of suppliers, distributors and glass manufacturers often provide the most valuable dating information, similar difficulties relating to frequency of occurrence exist at present. Only about forty of seven-hundred and seventy trade names cited in the Sydney papers prior to 1850 appear at present to be associated in any way with identifiable glassware. The true position for broken glass artefacts is even worse. Only a small part of each bottle, or other glassware, is usually sealed or embossed and can provide markings. Also, early consignments of common ‘black’ bottles were often up to several hundred times the quantity of embossed luxury products. Thus, potentially datable features may only be found once in several thousand pieces. Although this difficulty may be overcome by directing attention to clear and colourless
artefacts, they only form a minor proportion even though they constitute about one-third of the names advertised at that time.

Apart from this practical difficulty of identification, it is essential to have the necessary historical background to be of value in dating. Three tables have been compiled to illustrate the scope of the information needed:

APPENDIX 1. This is a survey of one type of bottle: carbonated beverages, now referred to as soft drinks, throughout Australia. The appendix consists of a tabulated reference list summarising shapes, forms of closure and embossed trade marks. It includes approximately twelve-hundred bottles and covers the period c. 1830-1930. (Refs 30, 40, 60) The trade marks or names are usually on the body or shoulder of the bottle.

APPENDIX 2. This is an indicative table summarising some sixty useful glass manufacturers trade marks appearing usually on the base of Australian glassware and bottles from c. 1860 onwards. The Appendix also includes tabulated details of the British registration marks used between 1842 and 1883 and the registration numbers used from 1876 to 1920. These marks are occasionally found on the body or base of tableware or bottles.

APPENDIX 3. This is a referenced table summarising approximately 1,300 trade names associated with glass imports, which appeared in the Sydney Gazette or Sydney Morning Herald prior to 1900.

Australian Glass by Marjorie Graham (Ref. 55) and the Crown Corning collection of glassware, glassmaking equipment and their mail order catalogues (c. 1930-60) at the Museum of Applied Arts and Sciences are valuable sources particularly for Australian tableware (Ref. 37).

The complexity of the suppliers’ and distributors’ trade marks, even for one type of bottle given in Appendix 1, the sparseness of the published information on Australian glass manufacturers in Appendix 2, and the small proportion of trade names associated with glassware in Appendix 3, highlights the urgent need for much further detailed research.

5.0 BOTTLE FINISHING AND FINISHES

5.1 Purpose

The main purpose of attaching the partially moulded glass shape to the pontil rod (Figs 3, 21, 22) or placing it in a holding (or cradling) device (Fig. 30), is to enable the craftsman to reheat and shape the part of the glass where it has been detached (cracked-off) from the blow-pipe (Fig. 21 and m). In the case of a bottle, this is the sharp, fractured end or lip. As it is the last part to be shaped in a
hand-produced bottle, it is traditionally referred to as the finish even though in modern machine production it is now the first part to be moulded from the hot glass.

The finish, and associated method of sealing, are important features. Even early designs were for specific functions:

* The flared lip - used where pouring was important, such as in a carafe or phial.

* The holding collar (or string-rim) with a varying amount of added glass reinforcing the lip, used where it is essential to wire down the cork and prevent leakage.

* The heavily reinforced rounded finishes, often referred to by collectors as 'blob-tops', for soda and carbonated mineral waters where the cork and finish are subject to considerable pressure.

The different forms of finish have been summarised below. For ease of reference and to assess their period of application in Australia, they have been grouped chronologically, and/or by forming method or use.

5.2 Early forms of finish

5.2.1 Cracked-off finish. This type may be found up to 1920. A sharp lip remains when the glass is cracked off with a wetted stick or cold iron. Although this may be an indication of an early bottle, supporting evidence is usually needed. Many cheap inks and sauce bottles were left in this dangerous unfinished state even up to 1920 to avoid the additional cost of a 'finisher'. The sharp edges may be rounded by fire-finishing - that is, by an additional reheating and glazing at the mouth of the furnace or 'glory-hole'.

Figure 50. Cracked-off finish.  

Figure 51. Burst-top finish.

5.2.2 Burst-top finish or lip. This form may be found up to 1920. It is a variant of the cracked-off finish and is formed when a bubble is blown in the neck above the top of the mould. The shape is then readily tapped off with the shattered glass leaving a thinner and even more dangerous edge.
This method is still used extensively for paste-moulded lamp-ware prior to cutting, grinding and other processing within a factory. They are no longer marketed in this form.

5.2.3 **Sheared-lip.** This is a smoother variant of the above. The warm glass is cut with shears (Fig. 2n) and left with, or without, glazing over by fire-finishing.

5.2.4 **Flared-lip.** The sheared-lip is splayed out to form a lip suitable for pouring. This form was used up to c. 1850 for bottles but it is still in use for some types of tableware, notably for carafes. In early bottles, the flared shape was also used at times to anchor the string or wire by which the cork was held in position. This form of finish was favoured in apothecaries’ phials and ‘case’ bottles, presumably to aid pouring. When the lip is splayed over horizontally, it is often referred to as a flanged-lip (Ref. 62).

Figure 52. Flared-lip finish.

Figure 53. Pewter-fitted flared-lip. ( Artefact 3319, wreck of the *Batavia*, 1629, W.A. Maritime Museum.)

5.2.5 **Metal-fitted flared-lip.** Figure 53 shows an early pewter fitting cemented to a flared-lip. This form of fitting was retained well into the present century for decorative items such as ink wells.

5.2.6 **Ground glass stoppers** for apothecaries’ display and storage bottles, and for scent and some sauce bottles were used overseas from c. 1799-50 and in Australia from the earliest period of occupation. Narrow stoppers were used for liquids, wider ones for specimen jars and powders.

The common glass stopper has three parts - the lower tapered shank, ground-in to give a good fit, the neck (if any), the upper thumb piece or grip, called a ‘finial’ and usually approximately 190 x 32 mm (1\(\frac{1}{4}\) x \(\frac{3}{4}\)
inches) in size. The base of the plug may show a pontil mark, if this has not been ground off.

![Diagram of bottle parts]

**Figure 54.** Narrow and wide-mouth ground-in stoppers and pressed stopper with mould marks.

Moulded stoppers made in two-piece moulds were introduced in Britain about 1850 by York City Glass Co. Unless ground off, they have a diagonal mould mark. These ground-in stoppers are still in use, for example, for storing acids.

5.3 Traditionally formed collars.

The need to modify the sharp, cracked-off end was soon recognised (Fig. 50). Apart from being dangerous, cracking caused by pressure of the cork or other fitting, had to be prevented. While the whole shape was supported by a pontil, additional hot glass was applied to the cracked-off neck from a separate steadied iron and formed with traditional tools (Figs 3, 4). Consequent changes in appearance, due to the addition of a collar or collars, provide a major guide to dating, particularly of common ‘black’ bottles over an extended period from c. 1600 up to c. 1900.

Much of our knowledge of these changes rests upon the detailed assessment of Colonial wine bottles in Virginia, U.S.A. by I. Noel Hume summarised in Figure 20 (Ref. 27) and the work of Olive Jones (Ref. 61). Jones has statistically analysed the dimensions of 211 cylindrical English wine and beer bottles of known dates from Canadian sites between 1735 and 1850.

While further investigations of Australian artefacts may give rise to modifications, both of these works provide a basis for dating wine and beer type bottles to about twenty years but are not relevant to clear and coloured bottles.
5.3.1 **Single collars.** These were often referred to as string-rims and were first used up to c. 1700-20 solely for wiring on the cork. The position of the narrow collar tends to be further from the cracked-off lip in earlier bottles (c. 1600-60) (Figs 20, 55) than in later bottles – such as in the very large Dutch artefacts from the wreck of the *Zeewijk* in 1727.

![Figure 55. Single anchoring collar up to c. 1700-20.](image)

![Figure 56. Broader and higher single collars c. 1710-c. 1790.](image)

There appears to have been some practical recognition of the need to reinforce and fire-polish (Ref. 61) the sharp lip in the period c. 1700-20 – c. 1780-1800 to prevent leaking and cracking by cork pressures as the single collar becomes broader and nearer the lip and may even extend over the cracked-off end (Fig. 56).

![Figure 57. Single collar as found in high quality, wide-mouth food containers c. 1750-c. 1830.](image)

Particularly for higher quality clear and coloured bottles, the additional glass was often tooled to protect the cracked-off end while still retaining a single collar (Fig. 57). This is noticeable in wider mouth food bottles, soda water bottles and apothecaries’ phials. It is possible that this practice commenced earlier in high quality bottles as a high standard of finish was common practice for wine glasses and tumblers between 1700-50.
5.3.2 **Double Collars.** In wine bottles, the need to reinforce the lip appears to have been clearly recognised by c. 1790-1820 when the additional glass was tooled to ensure the protection of the cracked-off end and form a double collar (Fig. 58).

From c. 1820-30 on, the depth of the glass reinforcing and protecting the cracked-off lip was gradually increased to a maximum of approximately 25 mm (1 inch) by c. 1860 (Fig. 59). This move possibly commenced with the deep finishes adopted by Ricketts for bottles moulded by his patented equipment in 1821. By this means, the effectiveness of the seal would be improved as it would depend almost entirely on the increased area of contact of the cork with the smooth bore of the relatively thick added reinforcing glass in the finish. It would not be affected by any micro cracks or inner folds in the bore of the original cracked-off lip.

![Figure 58. Double reinforcing and anchoring collars found in wine bottles c. 1790-c. 1820.](image)

![Figure 59. Increased depth of reinforcing collar in wine bottles c. 1820-c. 1860.](image)

The demarcation between the original cracked-off lip and the additional reinforcing glass is an important identifying feature of such hand-formed finishes. (These finishes are often referred to as applied or added finishes or applied lips.) This demarcation line can usually be seen by holding the neck and finish up to the light. Alternatively, the rough join can be identified by rubbing the finger carefully inside the mouth of the bottle.

5.4 **Moulding by finishing tool**

Moulding of the finish by a finishing tool (Fig. 60) was practiced in English and Scottish factories by 1828 (Refs 44, 62). These tools were in common use by 1844 (Ref. 62). However, Bontemps states that they were not much used in France, the source of some of our early wines, until c. 1860-70 (Refs 44, 62). Their use continued until machine moulding was introduced and it effectively ceased in Australia by c. 1925.
5.4.1 **Finishing tool.** The tool was usually a hand-held clamp with a central plug. The plug determined the size and shape of the bore. Two jaws of the clamp provided the contour of the external surface of the finish. The bottle, held by a pontil or holder, is continuously rotated on the arms of the glass-maker's chair. The hot soft glass of the previously applied collar is then moulded by the hand-held tool (or clamp) to form a smooth symmetrical external surface and a precisely shaped bore.

![Finishing tool](image)

*Figure 60. Finishing tool.*

5.4.2 **Features of a finish formed by a finishing tool are:**

* **Turn-marks** - essentially horizontal turn-marks on the finish as shown in the James Ross soda bottle (Fig. 8a). Some marks may also be seen just below the collar where the jaws of the tool may remove the mould seam, if any (Fig. 61).

* **A precise squared-off tidy appearance** - although excess glass may be squeezed out past the bottom of the finish and remain as a thin layer on the neck (Figs 61, 62).

* **Smooth lip, mouth and bore** - these can be quite smooth and the join with the original cracked-off neck may only be visible by looking down the bore.

![Spherical or 'Blob-top' finish](image)  ![Double collar formed with a finishing tool](image)

*Figure 61. Spherical or 'Blob-top' finish c. 1840-50 - c. 1940.*  *Figure 62. Double collar formed with a finishing tool.*
5.4.3 Basic changes caused by finishing tools. Finishing tools resulted in three basic changes which appear to have taken place in the following general order:

* The formation of a smooth external contour of the whole finish and smoothing of the lip and mouth (see Formed collars, Sections 5.5.1 - 5.5.6).

* The actual shaping of the mouth of the bottle to form a seating for special stoppers (see Shaped mouths, Sections 5.6.1 - 5.6.4).

* Moulding or forming grooves in the neck of pressure bottles for shaped plug or ball internal seals (see Ledge mouths, Sections 5.7.1 - 5.7.3).

These detailed changes, caused by the introduction of finishing tools, require very close inspection of the finish, mouth and neck of the bottle to be of full value in identification and dating.

5.5 Formed collars

The initial improvements in the external appearance of the finishes of some bottles occurred between c. 1830 and c. 1850, particularly in the higher quality food, medical, soda and carbonated drink bottles (Refs 30, 84, 85).

5.5.1 Single collars. This improvement may well have coincided with the introduction in Sydney of 'large patent jars' (S.G. 12.6.1834, p. 3), 'square pickle jars' (S.G. 22.9.1835, p. 3), and 'flint glass squares' (S.G. 7.5.1836, p. 3). These jars were used for the then luxury pickles, jams, jellies and bottled fruits imported by companies such as Wyatt, Gunther, Brown, Walkingshaw, Tingham, Jolly, Batty, Powell, Wybrow etc. (Figs 18d, 47d).

Figure 18c of an eight-fluted pickle jar from the 1841 wreck of the James Matheus is typical of the well-formed single collar finishes. Various forms and shapes of such single collar finishes were used in bottles up to c. 1900-20 when similar machine-made finishes (with finish-mould seams) appear.

The change to the use of similar single collars in common wine and beer bottles was much later (Fig. 20). The first adoption for this purpose probably coincided with the addition of 'silver foil' tops in the 1840-45 period (see Section 5.5.5).

5.5.2 Spherical finish (commonly known by collectors as a 'blob-top'). Following the introduction of soda and other carbonated drinks by Schweppes about 1800, the finish on the ovate bottles was usually a flat-sided single collar that extended to the lip (Fig. 56).
Although there are many variations in general appearance for individual soda bottles, De Gruchy’s bottle (Fig. 47a) and that illustrated by Olive Talbot (in Ref. 30) for Ray of Westminster (1833-39), indicate that the need to strengthen the finish of pressure bottles in this way was recognised at the time.

The more general adoption in Australia of the spherical finish (Fig. 61) for this purpose was technically possible after c. 1850/60. It may well have been a direct copy of early round-top stone ginger beer bottles. These were imported and also thrown on the wheel by our early potters such as Jonathon Leak (1822-38), John Moreton (1820-c. 1844), Ned Smith (c. 1834-40) and Enoch Fowler (1837-73).

This spherical form of finish was first used on ovate (Hamilton) bottles (Figs 47a, 49a) and Maughan type bottles (Fig. 47b) up to c. 1905. It continued to be used, rather as a tradition, on dump sodas and other cork-mouth carbonated drink bottles up to c. 1940-50.

5.5.3 **Double collars** (Fig. 62). These were formed using a finishing tool and gradually replaced the corresponding hand-moulded form (Fig. 57). This change appears to have occurred to a large extent between c. 1840-c. 1870.

The finish gradually lengthened up to approximately 25 mm (1 inch). The example in Figure 62 is similar to the finish of a Victoria Brewery, East Melbourne, lager bottle made by Mooney Valley Glassworks between 1896 and 1901. The smoother appearance, horizontal turn-marks and the greater difficulty in identifying the glass join in the finish are all typical of the use of a finishing tool. The main change was that the lower (anchoring) collar became narrower and more rounded and gradually ceased to be used, except for champagne bottles. A deep single collar was often used and is still in use for many spirit and cordial bottles, particularly gin and bitters bottles, which do not require an anchoring collar.

5.5.4 **Perry-Davis finish**, often simply referred to as a **cork-mouth** finish, is the modern machine-made equivalent and developed from the above single and double wine and beer collars from c. 1900 on (Fig. 63).
5.5.5 Champagne (and foil seal) also followed the introduction of the finishing tool.

In 1843 'tinselled', 'sealed' or 'foil-top' ale and beer bottles from Dunbars of London appeared on the Sydney market (S.H. 10.11.1843, p. 3), probably as a result of being able to make a more precisely moulded collar. These bottles were sealed down with lead foil, and crimped around the finish to prevent tampering with the cork and contents. Similarly, sealed food bottles from the Eglinton in 1852 have been found with both food and lead foil intact (Fig. 18 a). 'Long' German wine bottles were also announced at that time, presumably with sloping shoulders. Similarly shaped 310 mm (12\(\frac{2}{10}\) inches) long olive-green bottles with a typical champagne type finish (Fig. 64) also appeared on the Eglinton.

![Figure 64. 'Champagne' type finish or 'ring seal' - c. 1850 to date.](image)

These well-formed single collar finishes were used in a variety of common bottles up to c. 1900-20. Similar machine-made finishes (with mould seams) and crimped foil cover are still used for sealing wine bottles today.

5.5.6 Crown-cork. This finish eventually proved to be one of the most widely used inventions and is now used extensively for beer and carbonated drink containers.

In 1892, William Painter, the founder of the present Crown Cork and Seal Company, was granted an American patent for the crown-cork. The lip of the reinforcing collar on the neck of the bottle was moulded to very close tolerances so that the outside sealing lip was a quarter circle with the under side relieved (Fig. 65). A cork-lined crimped metal cap, resembling a crown, with a skirt or flange which acted as a lever was forced down under a pressure of about seven-hundred and fifty pounds per square inch. This compressed the cork liner and crimped and locked the skirt of the metal cap under the sealing collar (or 'ring') of the bottle. The approximately sixty-five per cent compression of the cork disc
maintains a good seal in pressure bottles through all normal variations of
temperature to which the bottle is subjected.

The size was standardised from the outset. The neck diameter just below
the finish is 25.4 mm (1 inch). This fact is useful in assessing the overall
size of crown-cork bottles from old photographs and advertisements.

![Figure 65. Crown-cork finish
using a finishing tool c.
1895-1920. Machine-made
with mould seams ex U.S.A.
c. 1905 and ex Britain and
Australia c. 1920 onwards.]

This form of finish could be made with a finishing tool as the shape of
the sealing surface is smooth. The glass and cap have to be moulded very
precisely to obtain good sealing. The present American specifications
call for some glass tolerances below 0.13 mm (five thousandths of an
inch).

Natural cork discs were used in the early crowns with up to one per cent
'leakers' normally occurring because of the holes present in the cork.
Linoleum discs soaked in paraffin were tried by the Bond Corporation in
the U.S.A. in the 1909-15 period. Composition cork discs were
introduced in 1915 and immediately overcame this problem.

For the above reasons the crown-cork was not widely adopted in
hand-produced bottles. The internal screw (Section 5.9.1), lightening
finish (Section 5.6.4) and internal sealing methods (Sections 5.8.1 -
5.8.4) such as the Codd marble bottle were generally preferred prior to
c. 1920. To highlight this point, only two crown seal bottles are cited in
Ken Arnold’s History of Bendigo Bottles from 1852-1930. In each
instance, the operation of the companies concerned (Cohn Bros Ltd
1910-24, Jones, Miller & Co. 1910-35) implies that the bottles could have
been manufactured after 1920.

A much wider adoption of the crown seal in the U.S.A. resulted from the
advent of the Owens suction machine after 1904 and its more accurate
moulding of the reinforcing and sealing collar under vacuum.
However, most of the bottles imported into Australia at that time were from Europe and particularly Britain. Consequently, the wider occurrence of the crown seal in Australia only arose after the adoption of Owens and other machines in Britain in 1915-25 and the corresponding introduction of fully automatic blow-blow machines in Australia between 1920-25.

The eventual wide acceptance of this closure was due to its simplicity of design and concept. In the majority of cases in Australia, the appearance of this type of bottle places the site after c. 1920.

5.6 Shaped mouths

The second modification in finishes which resulted from the use of finishing tools was the shaping of the mouth and upper bore of the bottle, as described in the following Sections 5.6.1 – 5.6.4.

5.6.1 Aire and Calder patent. One of the first examples of this shaping of the mouth was the development by E. Breffit of a finish in which the cap-seat was formed in the mouth and bore to take a small pressed glass stopper (Fig. 39). This ‘patent’ bottle was found in the Eglington wreck of 1852 (Ref. 84) but efforts to find a patent specification before that date proved fruitless (Ref. 93).

5.6.2 Stopper and cap seat. Similar to the Aire and Calder patent, this seating was formed, for example in sauce bottles (Ref. 20), by shaping the mouth to house a moulded glass stopper and cork insert as in Figure 66. A wide variety of such special seatings was formed by finishing tools and machine methods for many purposes.

![Figure 66. Stopper and cork insert in a sauce bottle.](image)

5.6.3 Milk bottle finishes. In 1884 in the U.S.A., Dr H.D. Thatcher patented the Thatcher Milk Protector which was a round, embossed bottle with a nickel-plated swing stopper. In 1886 this was replaced by a similar glass closure used in Britain and Australia after c. 1894. The first pressed cardboard disc finish was introduced by Dr. Thatcher in 1889 in the
U.S.A. However, it was not until the early 1900s that automatic bottle machines produced sufficiently standardised cap seats (Fig. 67) with a ridge inside the neck of a fairly wide-mouth bottle (38 mm, 1\(\frac{1}{2}\) inches).

In its various forms this card closure persisted until the 1940-60 period when the foil covered cap (Fig. 68), fitting into an outer recess just below the 25 mm (1 inch) internal diameter lip, was adopted in Australia.

![Figure 67. Disc top milk bottle c. 1920-30 onwards.](image1)

![Figure 68. Foil top milk bottle c. 1950 onwards.](image2)

Although a card disc milk bottle from Woodstock Dairy in Bendigo has been claimed to be dated c. 1890, the above facts suggest that this type would be unlikely before 1900, that it would be moulded by a finishing tool and likely to be after c. 1920 in a machine-made form (i.e. with finish-mould seams).

5.6.4 Swing or Lightening seal. This closure, invented by Charles de Quillveldt in 1875, had a porcelain stopper anchored to the reinforcing collar by a heavy wire lever. The lever could be pressed down against the bottle neck to lock and seal the cap in place (Fig. 69). The closure initially used a rubber ring placed over the porcelain stopper as a seal. This method, with the advantage of being resealable, became particularly popular when a vulcanised rubber stopper replaced the porcelain type. Its use for beer, ginger beer and carbonated drinks was only phased out in the 1940-60 period.

There are several versions of the Lightening seal:

* The Electric stopper — patented in 1889 in which the cap had two holes and was thus permanently attached to the wire lever.

* The Pittsburgh stopper which was patented one year before the Lightening with the clamping wire over the stopper.

* The Hutter patent of 1893 in which the sealing wire passed through the top of a porcelain stopper with a rubber ring seal.
H.V. Putnam's modification of the Lightening stopper for wide-mouth fruit jars similar to the type shown in Figure 70.

The earliest examples of Lightening seals in Australia date from c. 1880 onwards in narrow mouth bottles. Imported American and locally manufactured bottling jars date from c. 1890 onwards. Ross in Sydney and Melbourne Glass Company, followed by Australian Glass Manufacturers, were the first to manufacture bottling jars in Australia.

5.7 Ledge seals.

The third modification, resulting largely from the use of a finishing tool, was the shaping of the neck for shaped plug internal sealing and the formation of grooves in the bore for Codd (marble) and internal screw seals. All these seals were used for pressure-bottles used for carbonated drink.

The following summary places these seals in approximate chronological order of their development and application in Australia.

5.7.1 The Barrett or Hogben long-plug seal depended on the shape of the upper part of the bottle rather than the neck or finish to achieve a seal.

The British Patent No. 2708 to J. Adams and H. Barrett in 1868 and the corresponding Australian Patent No. 242 to E. Hogben and H. Barrett in 1870 (Fig. 71) were the first practical applications of an internally sealed pressure bottle to overcome the difficulties caused by the drying out of corks in cork-mouth carbonated drink bottles.
The long plug, of diameter slightly less than the bore, had a rubber washer fitted into the groove at the lower end. The plug was hollowed out just above the washer allowing it to be flattened down while it was being pushed through the neck. The inverted bottle was filled with a pressure pump. After filling, the heavy hardwood or lignum vitae plug fell into position in the neck of the bottle and remained firmly held there by gas pressure when the bottle was placed upright.

The bottles are tall and narrow and gradually tapered towards the neck so as to form a smooth seal with the rubber washer. The only other distinguishing feature is the hardwood internal stopper within the bottle.

Although the introduction of this seal is claimed to be as early as 1840 in one Australian text (Ref. 69), the generally accepted period of use in Australia is c. 1870-c. 1900 as Barrett established his branch here in 1876.

5.7.2 The Hutchinson patent also used a rubber washer (Fig. 72) which was attached to a thick, heavy wire spring which protruded above the lip of the bottle when sealed (British Patent 1170, W.R. Lake, 1883). It was more popular than the Codd (marble) bottle in the U.S.A. during the period c. 1880-c. 1910 but rarely used in Britain or Australia, with only three users appearing in Appendix 1. A very similar device, right in the mouth of the bottle and also used in the U.S.A., was the Baltimore seal.
5.7.3 **Ledge seals.** The spate of patents and the rapid application of internal sealing between c. 1870 and 1890 followed the development of a finishing tool such as that of Lamont (Fig. 73). With this finishing tool a central plug could be inserted through the neck of the hot bottle and then expanded to mould an internal ledge.

In the Lamont patent, the shaped rubber washer on the stopper formed a pressure resistant seal against the similarly shaped ledge-mouth (Fig. 74). The hard vulcanised rubber washer was forced down a special tapered tube and sprung over one end of the stopper while inside the bottle.

When the Leon Vallet type seal was used (Fig. 75), the elastic rubber was folded on the stem and recovered its position after the stopper was pushed through the neck into the bottle.

There are many variations of stoppers and ledge-mouths with their major identifying feature being the shape of the internal ledges found in the upper neck just below the finish. The ledges may be flat, inclined, curved or ridged. They may also be identified by the type of stopper in the bottle if it is available. In Australia many of these variations are classed by collectors simply as ‘Lamonts’. Detailed investigation of the ledge or stopper in relation to patent records may provide closer dating in their period of general use, that is, between c. 1875 and c. 1910.

5.8 **Spherical (marble) seals**

The well-known glass marble or Codd bottle, first described in British Patent No. 3070 of 24 November 1870 and later covered by several other patents, relied on
Figure 73. Internal ledge-forming tool after Lamont. British Patent No. 1923, 1874.

Figure 74. The Lamont type seal c. 1875-c. 1910.

Figure 75. The Vallet type seal. British Patent Nos 1210, 4863, 13158, 1879/1885.

Figure 76. Groove-forming finishing tool. Dan Rylands, British Patent No. 1486, 1882.

Figure 77. One way pour Codd in pale-green glass. Tooth & Co. Ltd Sydney, c. 1880-1900. (Reproduced with kind permission of the Trustees of the Museum of Applied Arts & Sciences).
the internal seal between a smooth spherical ball (preferably of glass) and a ring of cork, rubber or gutta-percha. The ring fitted closely into, and protruded from, a small annular groove in the bore.

5.8.1 Internal groove-forming tools. The Codd patent and a further patent with F. Foster on 29 December 1873, also outlined the finish-forming tool which was essential to mould the internal annular groove. D. Rylands in British Patent No. 1486 of 28 March 1882 and E. Breffit in Patent No. 4660 of 8 December 1877 also described similar improved tools (Fig. 76).

The early difficulty of the marble rolling back into the neck and throttling the flow while pouring, was overcome in British Patent No. 2621 of 3 September 1872 by narrowing the lower part of the neck and providing a semi-circular recess above this. The trapped ball was retained in the recess during pouring (Fig. 77). Projecting ridges inside the neck were also provided to guide the ball into the recess.

5.8.2 The original Codd bottle had a recess on one side of the neck. Early manufacturers are said to be W. Brooke of Hunslet and Alexander & Austin of Blandon in Britain (Ref. 30). Ben Rylands of Barnsley commenced manufacture at least by 1874 and went into partnership with Codd in 1877. There is good reason to believe that bottles before and after Ben Rylands death in 1881 were marked Ryland and Codd (1877-81) and Codd and Rylands (1881-84) respectively. The original patent expired after the fourteen year period in 1884 and the partnership with the son Dan Rylands was then dissolved. Reasonably close dating of such early bottles should be feasible although it has not been possible to cite examples definitely used in Australia before c. 1880.

5.8.3 The Gledhill patent. Although a patent No. 2882, similar and earlier than that of Codd, was provisionally registered in 1871 by Kilner Bros, who exported widely to Australia in the c. 1870-c. 1910 period, it was not upheld after a legal battle. The only reasonably successful competitor was the Gledhill patent in New Zealand (N.S.W. Patent No. 389, 24 November 1873). Gledhill used an elastic ball sealed against a spherically formed lower part of the bottle neck (Fig. 78). There appears to be no way of proving the exact date of such bottles; the period c. 1875-c. 1890 seems most likely.

Figure 78. G. Gledhill (New Zealand), Elastic ball patent c. 1875-c. 1890.
5.8.4. **Codd Variants.** Particularly after c. 1883, there were many Codd variants (Fig. 79) which have been the subject of books and articles by collectors and others (Refs 30, 53, 60, 81) – of whom Olive Talbot (Ref. 30) is the most authoritative.

After the partnership of Rylands and Codd was dissolved, Rylands bottles were marked Dan Rylands. The earliest variants were the so-called ‘bulb’ bottle by both the Rylands and separately by Codd, and the Rylands valve patent of 1882. The bulb type Codd was manufactured in Australia by Ross & Co., probably around 1890 (Fig. 80). Other developments were Rylands’ ‘Patent Safety Groove’ of 1885, the ‘Eclipse’ of 1886 and ‘Niagra’ of 1888 both of Barnett & Foster, the ‘Four-way’ by Chapman & Sons, the ‘Premier’, ‘Reliance’ and ‘Acme’ all by Rylands by 1888, and several others. Most of the changes related to minor alterations in the form of recesses and guiding grooves for which each supplier claimed advantages as the competition intensified.

![Figure 79. Summary of the main types of Codd variants, usually occurring after c. 1885.](image_url)

Overall, these variants, including the final adoption of the typical broad shouldered appearance of most Codd bottles, date from around 1880-85 and the majority found in Australia will be after the latter date.
5.8.5 Coloured finishes. In 1888, after the expiry of the Codd patents between 1884 and 1887 Ryland patented the concept of making the finish a different colour from that of the bottle thus defending his hold on the manufacture of Codd type bottles. These bottles are found from time to time in Australia and form a good datum benchmark of c. 1890-c. 1905. In the same period many manufacturers responded by colouring the whole bottle, amber, chrome green or cobalt blue.

By c. 1910 in both Britain and Australia, the Codd type bottle had completely displaced the ovate-shaped ‘Hamilton’, with the last advertisements for the Hamilton appearing in Britain around 1916. The Codd type itself was gradually replaced by the present crown-cork and other finishes after the introduction in Australia of automatic machines over the period 1920-c. 1935.

5.9 Screw finishes

5.9.1 Internal screw. The internal screw stoppered bottle was first suggested by Sykes and Macvay in 1877 in a patent in which an internal marble matched an internal screw stopper. In 1879 a patent was issued to H. Barrett for a stopper with a coarse pitched thread fitted into a cork or rubber sealing. This sealing screwed into the corresponding female thread formed inside the bore of the finish (Fig. 81).

The hand or machine moulding of an internal screw thread inside the finish of a bottle is more difficult than for a single groove. A modification of the finishing tool (Fig. 60) to provide a coarsely threaded plug was necessary. This plug had to be unscrewed from the glass when it was just
stiff enough to do so without the plug sticking in glass that was too hot or the glass cracking if too cool.

Examples in Australia appear to occur more than ten years after the original patent; for example O’Connor Bros Sydney, c. 1889-c. 1895. This finish, (with variations such as the ‘chisel-headed’ stopper, designed by Riley in 1885) competed with the more popular Codd (marble) patent in Australia and in Britain. In the U.S.A. it also competed with the Hutchinson and Baltimore seals. It remained in use for a longer period (c. 1890-c. 1960) possibly because of its advantage of resealing the bottle.

5.9.2 **External screw - wide-mouth** finishes were first used for bottling jars and their eventual extensive application is intimately linked with the introduction of semi-automatic and automatic glass-making machines.

Early methods of preserving fruit, meat, fish and vegetables consisted of covering the food with mutton fat and sealing the bottle with waxed paper. In 1855, Robert Arthur invented a metal lid with a circular skirt dipping into a wax-filled groove moulded in the broad upper surface of the glass finish. Bottling jars of this form continued to be made in the U.S.A. by the Star Glass Co. c. 1860-75 and Ball Bros 1888-1912. They do not appear to have been imported into Australia.

In 1842-43 both Goodyear in the U.S.A. and Hancock in Britain vulcanised rubber. In 1858 James L. Mason patented a zinc screw cap which forced a vulcanised rubber ring onto the ground glass lip of a fruit jar by engaging the male thread on the reinforcing collar (Fig. 82).
Like many ingenious devices it was not widely adopted because it was undesirable to have food in direct contact with zinc and possibly because it was more difficult to make an external screw than an internal screw finish with a finishing tool. In 1868-69, Hero Glass Co. adapted Mason’s patent by using a flat glass plate and rubber ring. This was followed by L.R. Bond of New York who adopted an opal glass or porcelain liner to hide seepage or prevent contact of the fruit juice with the rubber.

These American preserving jars were imported into Australia between 1875 and 1880 with porcelain-lined screw tops by S. Hebblewhite. In a sales advertisement he notes:

‘Cherries, gooseberries etc etc can be preserved very simply by boiling slightly sweetened water and then bottled while hot in the preserving bottles, with porcelain lined screw tops, and will keep for any time.’ (S.H. 1.1.1880, p. 7.)

He even took the trouble to have the previous year’s preserves on display.

This form of wide-mouth finish was widely adopted in Australia (Ref. 76) from c. 1880 onwards particularly as it could be precisely moulded on semi-automatic press-and-blow machines introduced about 1890 (Refs 21, 41).

5.9.3 External screw - narrow-mouth. F.J. Belzung of London patented a machine to form an external thread on the reinforcing collar of a pontil-held bottle in 1852, but it is very doubtful that this patent was ever practically applied. The external thread involved moulded ridges with a free release of the mould (Fig. 44) once the glass was effectively set. This made the smooth rotation of the glass in a hand-held finishing tool difficult. Also, although the earlier wide-mouth press-and-blow machines and the Owens suction machines (c. 1904 on in the U.S.A.) could produce this type of finish, it appears to have been more difficult to achieve with the narrow-mouth blow-blow machines used in Britain up to c. 1920.
Nash patented an external screw cap with a crimped skirt rather like a modern crown-cork in 1907. However, possibly for the above reasons, the now widely adopted narrow-mouth screw-cap (Fig. 83) does not appear in advertisements until after c. 1920.

5.10 Miscellaneous seals

There were between seven and eight-hundred British patents for carbonated drink bottles between 1871 and 1885 alone and at least a comparable number in the U.S.A. Thus, it is not possible to list all the different finishes marketed in Australia.

When unusual closures, finishes or bottles arise, the following sources of information are of value:

The Index of Letters of Inventions 1854-87 in the Attorney General’s Department (Australian Archives 1006/15-20).

The Index of Letters of Australian Inventions (Australian Archives CRS 84. Vols 2 and 4).

A Patents Summary of British Internally Stoppered Bottles 1868-1907 prepared by the British Bottle Collectors Club and published by E. Fletcher (Ref. 54).

The first two of these sources show that several additional finishes and closures were likely to be used in Australia including the following:

Horner Patent No. 607, 1877. This is a metal nozzle anchored to a rounded ‘blob-top’ finish into which a rubber-seated porcelain or lignum vitae stopper is pressed (c. 1880-1900).

Langley Patent No. 694, 1878 is a metal capsule screwed into the internally threaded bore of the bottle and sealing onto a rubber washer on the finish lip (c. 1880-1900).