RESEARCH REPORTS

Bottle glass: examination of a breakage pattern and two types of modification

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Bottle glass is one of the most common artefact types recovered from historical archaeological sites in Australia. With careful identification and analysis, post-depositional, cultural and behavioural information can be gleaned from the interpretation of glass bottle assemblages. This paper identifies a particular pattern in glass breakage and provides an interpretation for two types of bottle glass modifications. The information provided will assist archaeologists in their understanding of glass bottle artefacts.

INTRODUCTION

Accurate identification and classification of bottle glass attributes is essential for understanding bottle glass assemblages, especially in highly fragmented contexts, and for enabling consistency in comparisons between databases, reports and published literature. Careful analysis of bottle glass assemblages can be very useful in answering a range of archaeological questions including the processes affecting assemblage formation and issues relating to reuse and recycling.

This paper outlines the cause of a specific type of bottle glass fracture – the hinged break – and the information that can be gained from identifying such a break within an assemblage. In addition, two very different types of deliberately modified bottle bases found in Australian assemblages are examined and their most likely purpose identified.

The data for this article have derived from the analysis of glass from three Australian colonial-period sites: a Chinese-occupied fish curing site in Victoria's Gippsland region; the Casselden Place/Little Lonsdale Street site in Melbourne; and a site on Cunningham Street in Sydney.

BREAKAGE PATTERNS AND MODIFICATIONS

Ground disturbing agents such as erosion, ploughing or land development can make it difficult to determine the context in which an artefact or group of artefacts were originally deposited. Similarly, specific breakage patterns, evidence of reuse and adaptation or complex taphonomic processes may skew efforts to produce a functional classification or may distort attempts to characterise an assemblage. Whether an identified anomaly represents a past deliberate effort to produce a useable item such as Aboriginal artefacts made from bottle glass, or a depositional process such as a car tyre driving over a glass shard, modifications and breakage patterns represent an important and interesting area of artefact analysis that is often overlooked (see Stuart 1993). The following section discusses how the presence of hinged breaks in glass assemblages can be used to indicate the presence of a past rubbish dump.

Hinged breaks

Hinged breaks are generally considered as a flaking error that can occur during the manufacture of glass and stone tools. They are represented by a blunt rounded edge and are indicative of heavy, slow, outwards pressure (Cotterell and Kamminga 1990:146; Dibble and Pelcin 1995:429) (Figure 1).

A pattern of hinged breaks in bottle glass from a colonial-period Chinese fish-curing site in Victoria's Gippsland region has been used, in conjunction with other evidence, to suggest that artefacts found strewn across the length of the site by incoming tidal movements originated from one central shoreline position (Area 4 of the site). Area 4 is characterised by a section of increased bank erosion, a discarded broken hand-held pick of a modern style (probably left by artefact collectors), and a slight concentration of surface artefacts (Bowen 2012:82).

Approximately 45 percent of glass bottle shards recovered from the tidal zone display a hinged breakage pattern. It is hypothesised here that Area 4 was a rubbish dump containing glass bottles, and that as rubbish accumulated the glass was subjected to slow, heavy pressure that caused hinged breaks to form. Experiments conducted on flat plate glass by Cotterell and Kamminga (1990:146) and Dibble and Pelcin (1995:429) confirm that hinged breaks form through the application of heavy, slow pressure.

While Cotterell and Kamminga (1990) and Dibble and Pelcin (1995) experimented on flat plate glass in order to determine variability in flake morphology, experiments by the author were conducted on bottle glass in order to identify breakage patterns in discarded historical bottles. The long, slow, heavy pressure required to produce hinged breaks is consistent with the type of force applied to bottles in the middle or lower levels of a rubbish dump.

In controlled experiments, a number of nineteenth-century square and cylindrical glass bottles – obtained from local market stalls – were subjected to long, slow, heavy pressure. Some bottles were placed in a vice at differing angles and slowly pressured – sometimes for a few minutes and other times for days – until the glass broke. Other bottles had weight slowly but continuously loaded on top of them until they broke. Bottles were also thrown against walls, dropped on the ground or smashed with another object. While more scientifically controlled experiments are required to confirm the precise force necessary to produce a hinged break in bottle glass, examination of the glass fragments confirmed Cotterell and Kamminga's (1990) and Dibble and Pelcin's (1995) findings that hinged breaks occur in glass that has been broken through slow, heavy, outward pressure.

The hinged breakage pattern identified in 45 percent of the bottle glass fragments recovered from the site's tidal zone suggests that these artefacts have been dislodged from a

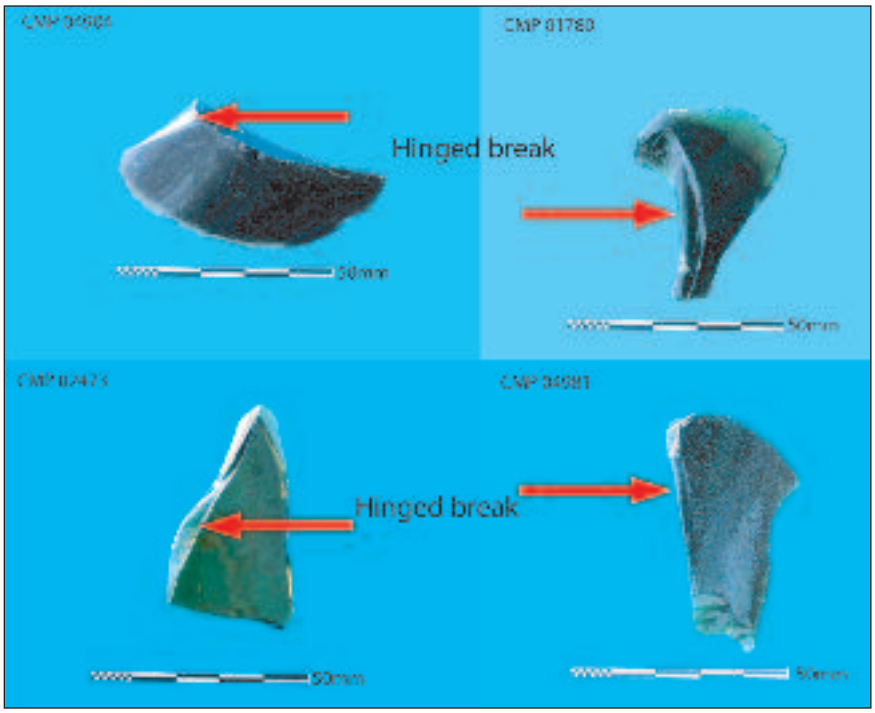

Figure 1: Bottle glass displaying hinged breakage pattern.

rubbish dump. This reinforces the notion that Area 4 was an area of discard containing glass bottles and the most likely area from where the artefacts originated. Artefact collectors appear to have partially dug out the dump, which increased the rate of erosion through tidal movements and washed artefacts across the site's frontage.

Modified bottle bases for lighting

Bottles were commonly reused to store a wide variety of items or purely as decorative objects for aesthetic appeal. The discussion here focuses on two distinct modifications that have not been noted previously in the published literature.

Excavations at the colonial Chinese fish-curing site in Gippsland produced a number of bottle bases that display signs of deliberate fracture. Thirty-six out of 85 cylindrical aqua-green bottle bases (only those with 75 mm diameters) show evidence that the entire base (the base rim and centre push-up sections) had been deliberately and carefully removed. Each base was detached through the use of a centre punch tool tapped at intervals around the bottle base rim, effectively removing the base and push-up section (Figure 2).

Similar bottle modifications have been found previously at two Chinese mining sites, one in New Zealand and one in Queensland (Ritchie and Bedford 1983; McCarthy 1986). In both cases these artefacts comprise only the bottle shoulder and neck portions (no body sections), with the researchers suggesting the items were improvised shades for opium heating lamps. Homemade opium heating lamp shades were also recovered from the Gippsland site. The bottle modifications discussed here, however, involve the removal of the base section only and would have left the bottle at almost full height (as opposed to just the shoulder and neck section), making the items too long to be used effectively for heating opium.

The Gippsland modified bottles may have been manufactured for the purpose of producing normal lamp covers. During the colonial period in Australia, domestic lamp bases and lamp chimneys were common household items used for general lighting. Lamp chimneys are made of thin and delicate glass, with a range of standard base sizes including 75 mm in diameter (Cuffley 1973:186). By using oil or kerosene lamp bases (or any form of solid container to hold a wick or candle), an aqua-green bottle without a base would have made a robust lamp chimney (Figure 3). The occupants of the Chinese fish-curing camp may have produced such items for general domestic lighting purposes and/or for fishing at night.

In Ward's (1954:198, 203) anthropological study of a Chinese fishing village, she noted that fishermen often worked at night using 'glass globes and mantles for the purse-seine fishermen's bright lights ... the bright kerosene lights are used to attract fish ...'. On 4 December 1873, the *Illustrated Australian News* reported on the Chinese fishermen at St. Kilda in Melbourne, stating 'The fishing is chiefly carried on at night ...'. This suggests the Gippsland Chinese fish curers participated in night fishing and therefore required some form of light to attract fish. With a rolling boat, cold water and flapping fish, glass light covers could have broken easily and needed replacing regularly. It is conceivable that the deliberately modified bottle bases represent the by-product from a candle, oil or kerosene lamp-cover making process.

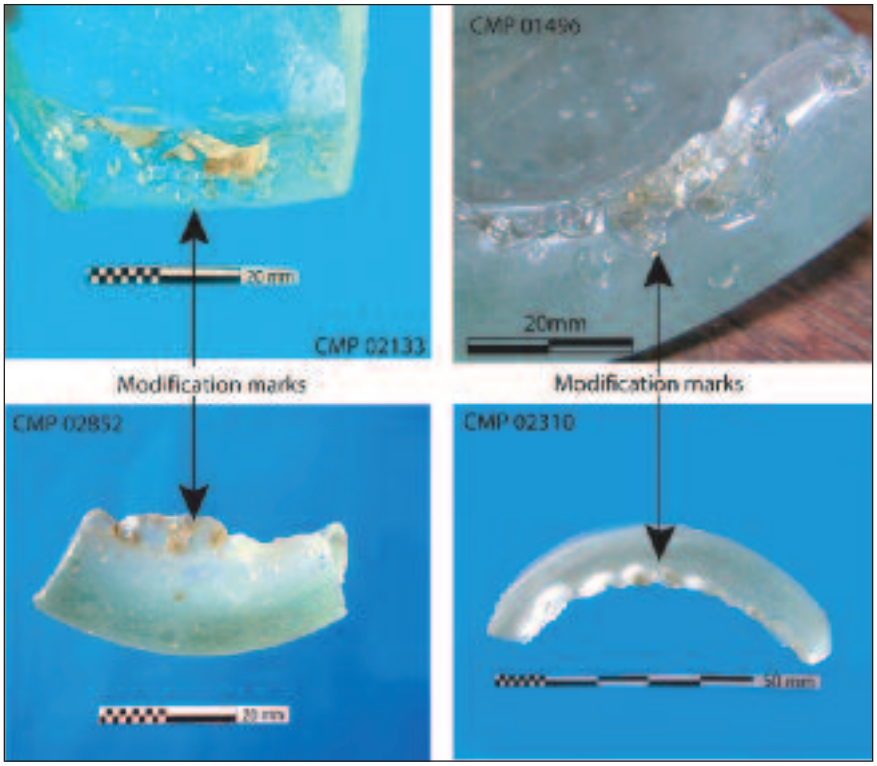

Figure 2: Deliberate modification marks are clearly visible on these bottle base fragments.

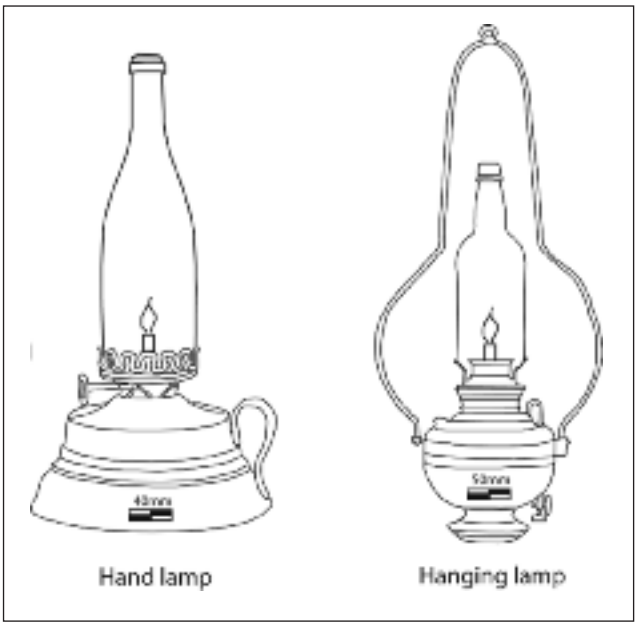

Figure 3: Reconstruction of oil lamps using modified bottles as substitute lamp chimneys.

Modified bottle bases for *opium smoking*

An opium user can obtain the desired analgesic effect through a variety of ways. Opium can be taken orally in pill, liquid, powder or raw form (snorted or mixed with water and injected intravenously). It can also be smoked through an opium pipe as pure resin or mixed with tobacco and smoked in a water pipe, dry pipe or as a cigarette. Smoking was the preferred Chinese method but the techniques for heating the resin and inhaling the fumes vary greatly. A number of distinctly modified bottle bases, likely associated with opium smoking, have been identified via a physical search of the artefact assemblages from each of the three previously mentioned Australian archaeological sites – i.e. the Gippsland site; Casselden Place/Little Lonsdale Street in Melbourne; and Cunningham Street in Sydney. Documentary sources and archaeological evidence indicate that each site is associated with Chinese occupation.

The common artefact to each site is a cylindrical dark green bottle base (base section only) that shows evidence of deliberate post-manufacture modification, most noticeably the push-up's centre section (the pontil) having been chipped away to create a small opening.

Excavation participants recall that approximately 30 of these bottle bases were excavated in 2003 from the Casselden Place/Little Lonsdale Street sites near Melbourne's Chinatown. At that time, 'an old Chinese man was interviewed' who suggested the bases had an association with opium smoking. This information, however, was not pursued and the particular attributes of the bottle bases were not recorded in the Casselden Place artefact catalogue, hampering their retrieval from an assemblage of over 300,000 items. Any mention of the modified bases is also absent from the 2004 excavation report. In June 2006, a physical search by the author through a portion of the Casselden Place/Little Lonsdale Street artefact assemblage identified one of these bases.

A further six examples were recovered in 2004 from the Cunningham Street archaeological excavation in Sydney, an area also known historically to have had a Chinese presence. The land developer for this project went into liquidation before the archaeological work was completed; therefore the artefact catalogue and archaeological report were not finished. In Galloway's (2005:112-113) examination of archaeological evidence for opium smoking, she observed the Cunningham Street bases, provided pictorial evidence, and gave an interpretation of their use in association with opium smoking. She states,

> ... the pontil was chipped away to make a small hole and the bases were simply broken from the bottle. There was no uniformity in the length of the bottle sides, some were broken at the base, others further up. They may have been used inverted over a tin of fuel with the wick protruding through the hole. The concave shape of the bottle base may concentrate the heat for cooking the opium.

This suggested method of use seems unlikely because the rough break would make the bases extremely unstable in an inverted position. It is more likely the bottles were used in a normal upright position.

Comparison of the bases from the three sites reveals several aspects of uniformity. Each modified base, for example, was produced from a dark green glass bottle with a deep push-up section. The centre pontil sections were chipped away to create a hole consistently between 10 mm and 20 mm in diameter. The broken bottle sides vary in length but they do have some consistency as each has at least one broken section that traverses to the bottle's base, which in some examples display a point of impact on the basal rim, clearly indicating a deliberate act of modification (Figure 4).

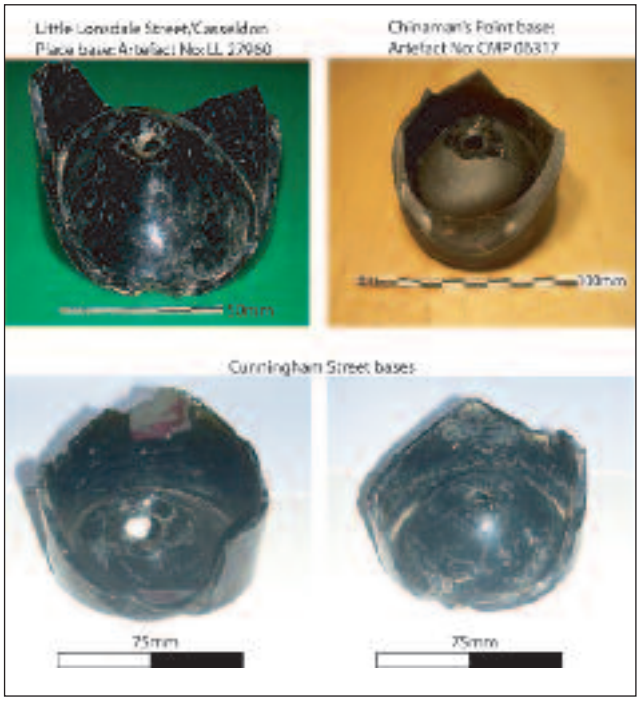

Figure 4: Modified bottle bases for the purpose of opium smoking.

An alternative to Galloway's interpretation is that these artefacts were used in a process called 'chasing the dragon'. This term today is associated with the smoking of heroin, a powdered derivative of opium. When heroin powder is placed on tin foil and heated from below, it turns a sticky brown and gives off smoke fumes. As the thick plumes of smoke rise – giving the appearance of a mythical flying Chinese dragon – they are followed (chased) by the smoker and inhaled through a rolled up newspaper, magazine or other cylindrical object, hence the term 'chasing the dragon' (http://www.trashed_training.org/heroin.html 2006). This same method can be used to smoke marijuana hashish resin and would also be suitable for smoking opium resin, which is very similar in appearance and consistency.

In the absence of a complete traditional Chinese opium smoking pipe and associated implements, the modified bottle bases would have made a very effective alternative for 'chasing the dragon'. A small oil lamp or candle could be placed under a base with the flame protruding through the hole. A piece of metal such as a 'reinforcing strip' from an opium can with opium placed on it could be suspended across the broken bottle sides and heated by the central flame. The section where the bottle sides are broken to the base level would provide easy hand access to position the metal support and opium. Once the opium resin became hot enough to produce smoke, 'chasing the dragon' could begin (Figure 5). The cost to produce one of these smoking devices would be minimal; they are robust and could be re-used indefinitely. This functional explanation is plausible but remains speculative and open to further interpretation.

Figure 5: Potential method of modified bottle base use (painting by baked beans design 2007).

CONCLUSION

Knowledge of the three specific artefact types discussed here has the potential to assist in the identification and analysis of bottle glass artefacts in Australian archaeology. The discussion of bottle glass breakage patterns indicates that careful analysis can reveal information concerning site formation processes, post-depositional influences and the existence of past rubbish disposal areas. Two very different types of deliberately modified bottles from Australian assemblages have been examined and their most likely purpose suggested. One of the modified bottle types is interpreted as a lamp cover for lighting purposes and the other as a device for smoking opium.

Glass artefacts have always been an important resource for archaeological study. The information presented here is intended to provide archaeologists with a better understanding of bottle glass artefacts, a greater knowledge of past human activities, and enhance our understanding of Australia's colonial past.

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