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Marshall Joseph Becker

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Chipped Glass Artifacts Made by Native People: Cultural Adaptations and Innovations

Marshall Joseph Becker
Professor of Anthropology, Emeritus
West Chester University of Pennsylvania
West Chester, PA 19383

R. Alan Mounier, Archaeologist
Vineland, New Jersey 08360

Abstract

Part of Native adaptation of European-introduced technology on three continents after 1400 CE involved the use of imported (industrially produced) glass as a raw material for tool making. Artifacts of traditional form but chipped from glass (replicative of traditional and formal tools), are extremely rare at North American archaeological sites. Opportunistic use of glass shards or flakes for scrapers are much more common, but difficult to identify and, therefore, largely not included in this analysis. The rapidity of Native adaptation to metals that also arrived from Europe may have superseded the use of glass. The presence of a few glass tools, however, attests to human abilities to experiment, innovate and improvise, particularly in lithic-poor areas. The occurrence of chipped glass tools in Late Woodland forms has been exaggerated, and often confused with expedient or opportunistic use of glass shards by Colonists and Natives alike. The evidence also suggests that Ishi in California, Native Australians, and perhaps other peoples around the world employed glass “tool” production at least in part for commercial purposes. The use and/or sale of Native-made glass artifacts enabled these groups to sustain cultural traditions and identity, while profiting from the employment of a new resource to participate in the tourist industry. The origins of this enterprise in Australia remain unknown.

Introduction

In northeastern North America, after 1500 CE, Native use of newly introduced glass in place of traditional lithic materials to replicate tools of traditional bifacial forms was a relatively rare phenomenon. True glass artifacts generally derive from bottles that became available to aboriginal populations after European Contact. Opportunistic use of glass shards from bottles or window glass for blades or scrapers appears to have been more common among Natives, as well as immigrants. This chance category of “tool” that has been discussed elsewhere (Becker and Mounier 2013). The use of plate glass commonly used for windows to form specific tools has not been documented among them. The few examples of glass mentioned in classic studies of the experimental replication of stone tools (Warren 1914; Ellis 1940; Johnson 1978) generally lack provenance. These overviews of experimental work, together with Clark’s (1981) brief but insightful paper on glass shards used as scrapers, reveal how little is known about the finds and distribution of glass tools deliberately chipped by Natives. Intensive searching for chipped glass artifacts within the material culture assemblages of cultures around the world has revealed the rarity of such objects fashioned from post-Medieval glass (Becker 2022).

Obsidian is a glass-like igneous stone formed naturally by volcanism and is related to rhyolites and granite. This material is very hard, but with an extremely predictably conchoidal fracture that makes it easy to modify through knapping. Obsidian, with a hardness ranging from 5 to 6 on the Mohs scale, has long provided a preferable medium for knapping but, like glass, it is brittle with a limited range of mechanical functions for the artifacts or tool implements produced. These artifacts are likely to have a short life expectancy, unless made as ornamental objects, such as Maya ceremonial forms (Moholy-Nagy and Coe 2008) or as items for

the tourist trade, such as that developed in Australia. In some applications, the aesthetic qualities of glass outweigh its functional deficiencies including 5.5 to 7 hardness on the Mohs scale. Not surprisingly, volcanic glass was eagerly sought by knappers in antiquity and was widely traded within and between regions. As a manufactured material, European bottle glass also provided an excellent material source substitute in place of stone and obsidian to repurpose in the manufacture of Native tools. Unlike tools made from obsidian, extremely few examples of traditional tool forms fashioned from chipped bottle glass are documented in the published literature. These examples have slightly increased in number over the past few decades but remain low. Indeed, the total number is so low and the distribution so sparse that even an intensive review of finds from any culture, or even any region, do not tell us much other than that opportunistic use seems to have been the rule. With the exception of the so-called Kimberley point tradition in Australia, a development that took advantage of plentiful raw material and cheap labor (see below), glass artifacts nowhere appear to have been incorporated into traditional stone tool industries in North America, South America, or Australia.

Many years ago, while excavating at the Printzhof Site (36DE3), a Swedish colonial site on the Delaware River (Becker 2011a), archaeologists recovered a single piece of European glass that had been bifacially chipped using Native techniques. The site lies on relatively high ground that, in earlier times, had been a location for a Lenape fishing station (Becker 2006). It is uncertain whether the single glass tool can be dated to the period of Swedish occupation (1643-after 1655), when Native visits were frequent, or to a slightly earlier Lenape occupation. Either group may have used window glass for expedient scrapers. At the time of the excavation, Becker heard several oral reports regarding native use of “bottle glass” to fashion artifacts, both in North America and

elsewhere. A small number of these reports have confirmed worked glass finds, such as from a Late Woodland site in Gloucester County, NJ, as well as at Morristown National Historic Park (McHugh and Cannon 2021).

In general, we have found that most of the oral reports regarding examples of glass tools supposedly in the gray literature cannot be confirmed. This suggests that this category of “items” is part of an archaeological “urban legend.” A parallel mythology claims that the opportunistic use of glass shards, by enslaved peoples or any other crafters, reflects knapping technology. The belief that any slaves who had been born in Africa and there learned stone knapping techniques, denigrates the long African history of iron use and other metallurgical skills that long since rendered stone tools of marginal value. Discoveries of glass fragments expediently selected for use, but minimally or incidentally chipped and not fashioned into identifiable tool forms such as blades, burins (Crabtree 1973), and knives (see Becker and Mounier 2013; cf. Blandford 1976), far outnumber finds of tools of recognizable forms fashioned from glass. In fact, published references to Native-made chipped glass artifacts in the Americas are as rare as the finds themselves. A collation of the extremely limited information on verifiable finds appears here with suggestions regarding what these data mean.

Two decades ago, Charles Cobb (2003) edited a volume of papers that specifically examine the European impact on North American chipped stone tool traditions during the Contact era (1500-1650 CE). Cobb’s excellent introduction concludes that there is no single explanation for either the decline or the persistence of traditional stone tool technologies during the period of contact. This might be expected among the varied and usually contentious cultures in the Americas, such as the Susquehannock and the collective Five Nations Iroquois. Each culture, and often each individual within any culture, had a way of evaluating the benefits and costs of

adopting the many aspects of introduced technology (Becker 2005b). Cobb's collection as a group provides an important backdrop to the story of Native-made chipped glass artifacts. These are defined as tools of a recognized traditional form but fashioned from glass. Despite the popular belief among archeologists, the presence of such projectile points and other bifacially worked glass tools are extremely difficult to verify. Broken pieces of glass modified through use as scrapers are not included in this category, although in some studies they are claimed to be chipped tools and confused with formal tools. The objects of specific interest are traditional artifact forms for which industrial glass has been substituted for natural, knappable lithic materials.

Methodology

The study of the use of glass as a variant material in a stone tool industry must consider discussions and references in the literature and make an effort to standardize basic terminology. The authors are inclined to describe deliberate working of stone tools as "flaking." The term "chipping" is more commonly associated with accidental breakage. Others agree, but numerous scholars separate these categories by size (Rosen 1997:30, Table 2.4) or define them based on the geometry of the "flake" or "chip" (Mee and Forbes 1996:48). Leakey (1971) uses the terms interchangeably, a convention that the authors follow in this paper with regard to worked glass processes. An extensive literature providing detailed information relating to the fracture of glass as well as ceramics has been generated in the industrial world (Dibble and Pelcin 1995; Speth 1972). These studies are much more common and generally far more reliable than the largely speculative efforts produced by those academics who live in the shadow of the Ivory Tower. A goal in our research is to differentiate between claims of pieces of glass being "used" as tools but not deliberately chipped for use as a tool (cf. Knudson 1979)

and those glass pieces that had been worked like a piece of raw material in order to fashion a tool of specific traditional form, such as normally utilized in the maker's culture (Tsirk 2010; Quinn 2007).

Historical Accounts and Archaeology

One of the earliest reports of an archaeological find of a tool chipped from glass was recovered from a 17th-century site near Tallahassee. John Griffin (1949:Figure 27) reported finding an intentionally made scraper fashioned from bottle glass. Griffin's skepticism regarding "chipped glass artifacts" was warranted. Griffin (1949:56) stated, "in view of the vast number of spurious glass artifacts known, it is of interest to note a genuine example which came to light recently in excavations in Florida." Unlike many so-called glass scrapers subsequently reported, which partially retain attributes of the shards' vessel shape rather than being completely transformed anew into the shape of a specific tool, Griffin's find had been knapped into an ovoid form with a distinct pattern of flake removals from approximately three-quarters of the object's perimeter. Both the form and the context strongly argue for this object as an intentionally and culturally modified product (Neil 1977).

While we had expected to find numerous examples of glass tools worked into forms representative of earlier stone tools, this proved to be an illusion. For all the chatter about finds of glass tools at state level and regional archaeological meetings, the reality proved far different. Griffin's 1940s find in Florida of a piece of glass extensively worked to form a tool of traditional shape made us particularly responsive to an anonymous peer reviewer's reference communicated to the authors via *Historical Archaeology* editor Joe W. Joseph in August 2013 regarding "Shannon Dawdy's glass shards in New Orleans". Failing to locate these items in Dawdy's publications, we contacted her directly. She replied that she had "never

excavated a significant find in that direction” (Personal Communication: Shannon Dawdy October 29, 2013). The reviewer generated an archaeological “urban legend” regarding chipped tools fashioned from glass.

The rarity of chipped glass artifacts modified into local traditional stone tool shapes led us to spend a great deal of time tracing finds of window glass that had been called “tools.” Such “artifacts” are frequently mentioned in cultural resource management (CRM) literature; sometimes in error regarding what the “report” is discussing and what was actually found. The use of incidentally broken but unworked glass was common throughout the Americas, but deliberate working of glass was not (Becker and Mounier 2013). An exhaustive literature review yielded surprisingly few descriptions of traditional chipped stone tool types being replicated in glass, or the production of chipped glass artifacts as specifically recognizable as the example described by Griffin. Of some interest is that the search did not identify any reports of native-made chipped glass tools from Canada, New England, or, specifically, from New York. However, Lavin (2013:13, 22) includes information from the Hoadley Collection in which several sites in eastern New York are represented, each of which yielded several pieces of worked glass (Lavin 2013:Figures 7, 10, 11). Lavin (Personal Communication: November 12, 2015) also reports finding a fragment of chipped bottle glass from the Hopkins Site in Warren, Connecticut. The New York worked glass artifacts appear to have been uniformly used as scrapers, with at least one being a concave, spoke shave form.

Review of the Handbook of North American Indians volumes on the Arctic and Subarctic regions and other classics produced no reference to flaked glass artifacts. The extensive use of bits of bone, antler, or slate by indigenous populations in question may have reduced interest in glass as a substitute. Dr. Lisa Rankin, at Memorial University,

informed Mounier that sites along the Labrador Coast often have “glass used as flakes and some scrapers” but no examples of other tools fashioned by extensive chipping of glass (Lisa Rankin Personal Communication: 2012).

The post-Contact Beothuk of Newfoundland produced arrowheads from chipped or knapped chert, hornstone, and quartz (Howley 1915:324), but there is no mention in published literature of attempts to shape glass by knapping. In his treatise on the Beothuk, Howley (1915:340) reports that sharp glass “fragments” were used as tools, some for engraving their unusual bone ornaments. The inclusion of broken bottle glass as a common component of early Beothuk mortuary furniture (Howley 1915:328) suggests that glass fragments were an important element of the post-Contact native toolkit. No traditional bifacial tool forms were replicated from glass in this region.

Undisputed examples of Native-chipped glass tools are unknown in New York. Possible Late Contact period (post-1650) uses of stone tools in New York are suggested in Button’s (2007) report of three nineteenth-century sites from which he claims knapped-glass was found. Chipped stone tools had been entirely replaced by metals by ca. 1650 suggesting that glass tools are unlikely at these locations at that late date although glass shards may have been used as incidental scrapers, etc. While no specific archaeological finds of glass arrowheads in central New York are known, an element of confusion may derive from a statement made a century ago by the Director of the New York State Museum regarding one of their exhibits.

In order that the objects may be of educational interest to the visitor to the Museum not versed in the more technical side of archeology, the specimens have been arranged in a synoptic exhibit to show

the methods by which implements were made and the purposes for which they were employed... In the exhibit of flint chipping, the method by which flints were worked into shape has been shown. All the various tools that have been discovered on Indian sites are shown, and their purposes explained, and a series of [replica?] glass arrowheads and knives made with these tools, is shown (Clarke 1916:53).

The abundance of suitable lithic material throughout most of the Northeast may be a significant factor that inhibited the use of glass in tool making. The number of reports of glass tool use, not necessarily manufacture, from the Middle Atlantic area are relatively high, although many appear erroneous (see Becker and Mounier 2013). As we had postulated in a 2013 paper, most claims regarding chipped glass artifacts are specious, and the rest rarely conform to known Native tool types. More than a year of searching gray literature generally reveals that the “tool” being cited is a fragment of bottle glass that may have been “reused possibly as a scraper” (Personal Communication: P. M. Tucker, January 15, 2014; see Tucker, Au and Heyman 2013) (Figure 1).

Since the Contact Period continues at the recent end of the Late Woodland period, when true arrows came into use, one of the more common tool types at Contact was the small triangular arrowhead. In most of New York, the use of Onondaga or Hudson Valley cherts for these triangular forms is common. Glacial outwash made these cherts available further south. Kurt Jordan (Personal Communication: July 3, 2014) reports that the continuing excavations at the White Springs Site, a Seneca village dating from 1688-1714, had recovered “no formal tools save gunflints.” Jordan reflects, “This continues the pattern of

expedient tool production from local (glacially-deposited) cherts” of which they had about 10 “retouch flakes from translucent chert, which by eye appears to be derived from honey-colored “French” chalcedony. These likely represent retouching of gunflints.” Perhaps an abundance of glacial cherts rendered moot any interest in bottle glass as a resource. Krohn (2010) reviews various theories concerning the Seneca gradual transition from stone to other materials for bifacial tools as documented at two sites that had been occupied over a period of 66 years and distant from access to their usual lithic sources.



Figure 1: Opportunistic use of glass as a scraping tool from Site 28-Mr-229 (from Tucker, Au, and Heynman 2013). Arrow points to reworked edge.

Quartz or quartzite predominates as material for stone tools on Long Island and in most of Pennsylvania and the Middle Atlantic region. Much of this quartzose material originates as cobbles or pebbles from glacial outwash on Long Island, as well as the coastal plain on New Jersey. The pegmatite quartz of the Piedmont region was commonly exploited. Quartz and quartzite were far more difficult to work than jasper, which was relatively available in the region. The jasper-rich Reading Prong geological feature in eastern Pennsylvania has abundant native-dug jasper quarries, especially around Macungie and Vera Cruz. These jaspers can be found near a buffer zone at the northern limit of Lenape homeland and were accessible to tribes living along the Delaware River, as well as to most of the Haudenosaunee. Despite their availability, these jaspers are relatively infrequent in Contact period tool inventories and appears to correlate with the rarer presence of tools fashioned from imported glass. Nathaniel Knowles (1941:157, Table 4) presents a summary of bifaces by type and material from New Jersey's Depression-era Indian Site Survey excavations. Small triangular bifaces (Knowles Type 1) had the following frequency by materials: flint (n=344; 64.1%), argillite (n=77; 14.3%), quartz (n=42; 7.8%), and quartzite (n=74; 13.8%). The "flint" specimens consist of jaspers, cherts, chalcedonies, and flint, all loosely defined. Knowles tabulated data is not separated by period.

Excavations at an 18th-century site in Lock Haven, Pennsylvania revealed a late habitation site within what had been an extensive former buffer zone of north-central Pennsylvania. After 1710, this vast formerly shared resource zone that once separated the Five Nations Iroquois from the members of the Susquehannock Confederacy (Becker 2020) revealed the presence of numerous small sites. Some of these contained evidence of serial occupation by small families (Custer et al. 1996:49). This occupation pattern would be expected in this shared resource zone that

largely controlled by the Five Nations after 1710, but far from any major Iroquoian villages. A trade ax, possibly dating from 1645 to 1665, may be the earliest item found by archaeologist Jay Custer while most of the dated trade material from this site is much later in time. Trade beads range in date from 1700 to 1750, and finger rings of nearly the same date, 1715 to 1760, suggest activity prior to the French and Indian war. One glass shard, worked along two edges, and a scraper that had been chipped from an "olive bottle" (Custer et al. 1996:7, Figures 5a, 6d) reflect careful use of the limited resources in this area.

Kraft's (1975:152) summary of archaeology in the Tocks Island Area along the upper Delaware River reports the finds of two scrapers fashioned from bottle glass at the Harry's Farm Site. Kraft identified this as a Late Minisink ("Munsee") period site (ca. 1650-1700), located 4.8 kilometers down river from the Miller Field Site. The Miller Field Site, located in Pahaquarra Township, Warren County, New Jersey, lies 13 kilometers upriver from the Delaware Water Gap. Staats (1987:92) reports finding a 17th-century English glass wine bottle at this site and a glass fragment that he believed had been used as a scraping tool. In a nearby plowed field he found an end scraper that he believed was chipped from green bottle glass. Kraft (1976) thought that the use of jasper in the area of the upper Delaware Valley was of minimal, if any, importance during the Late Woodland period, but this appears speculative at best. He claimed that stone and glass were in use at the Pahaquarra Site near Miller Field as late as 1750. Kraft's conclusion is contrary to evidence from other sites throughout this region (Kent 1984).

Three Native activity sites in central Philadelphia provide some indication of the use of bottle glass as a resource in the post-Contact phase of the Late Woodland period, 1600 to 1650 CE. This half century date range marked a slow transition in the kinds of

material goods used by Native Lenape (Becker 2005b). In 1957 B. Bruce Powell, excavating in the State House Yard (Independence Square, Philadelphia) recovered a pile of wine bottle fragments from one of a series of trenches (Grass Plot 17, Test Trench 17). These artifacts were afforded complete catalogue review in 2007 (cf. Toogood 2004, 2012). At that time, Juliette Gerhardt identified a fragment of olive-green bottle glass, catalogued as INDE 97837, that she believed to have been intentionally worked along one edge (Personal Communication: Jed Levin, 2012). While this appears to be a Native-made glass scraper, the context suggests that it is an opportunistic artifact, not glass knapped into the bifacial form of a traditional tool (Becker and Mounier 2013).

Near the Independence Square area in Philadelphia are two proximal Native American sites situated on high ground adjacent to a waterside marsh. One is at the location of the Federal Detention Center and the other at the National Constitution Center. Both sites once stood closer to the Delaware River (Becker 2006), but infilling has left these sites several blocks from the river's present edge. The general area once occupied one of the highest elevations in the vicinity, most of which was waterside marsh used by local foragers during the period just before and after European Contact. Each of these sites was located near a small stream feeding the Delaware. The absence of any European materials at one of these sites suggests a relative chronology for these two locations. The worked glass finds at the more recent site were reported orally by several individuals involved with these excavations long before the information appeared in print. This is discussed below.

Excavations between 1995 and 1996 at Philadelphia's Metropolitan (Federal) Detention Center (36Ph91, 7th and Arch Streets) revealed a Late Woodland period site (Becker 2005a). Native tools were present, but there was no trace of European materials. The

National Constitution Center location, between 5th and 6th streets, was excavated between 2000 and 2003 (Personal Communication: Douglas Mooney 2002). This was near Minnow's Run, now entirely channeled underground. In addition to some Archaic period and Late Woodland period stone tools, a number of European trade items were found, including at least 270 glass trade beads possibly dated to ca. 1550 and 1600, cowrie shells, and pierced coins. The early beads confirm that trade along the Delaware River long pre-dated Hudson's voyages or came overland from other areas (Mooney et al. 2002). In 2007, Jed Levin (Personal Communication: 2007) mentioned finding a piece of white, salt-glazed stoneware clearly altered to form a drill or awl (Quinn 2007: B-13), along with glass bottle fragments that may have been worked. A later report describes two clusters of "'knapped' or modified glass and hard-fired European ceramic pieces." The latter are disk-shaped, possibly used as gaming pieces (Philadelphia Archaeological Forum website, 5/16/2009). One piece of a "knapped" European ceramic plate is irregular in form but may have been used as a tool. Michael Gall reports finding a medallion that had been an ornament on a Westerwald vessel that had been knapped to form a gaming piece (Gall 2016:35). This item was found in the excavation of a late 18th-century blacksmith shop in Franklin Township, Somerset County, NJ. The makers are unknown.

Note should be made of the suggestion by George Morris, more than four decades ago, that small triangular ceramic artifacts in New Jersey had been fashioned for use as arrow points (Morris 1977). Mounier (1980) had replied to this interesting speculation by pointing out that while the Riggins Fabric Impressed pottery was quite hard, it is nowhere near as hard as stone and incapable of maintaining a cutting edge. Forty years later, without reference to Mounier's earlier discussion, Bebbler and colleagues (2020) published a review of the same subject,

explaining why traditional ceramics were simply unsuited for use as arrow points or cutting tools. At a third site, excavated and recorded by Thomas Crist, at 6th and Race Street in Philadelphia, recovered Indian artifacts include “quartz arrowheads, gun flints, ball clay pipes, a piece of stone armor and tools fashioned from European bottles” (Jaffee 2001:A4).

Sites in North America

Chipped glass artifacts were never numerous in North America, but a few examples have been reported from sites across the continent. The following pages provide a canvass of a number of sites and related finds of imported glass that have been chipped, accurately or not, and appeared in the literature. These “areas,” states, or regions have been demarcated based on a variety of publications that provide relevant evidence. Some evidence in locales is incidental, while coverage of evidence in other places is significant. The relative paucity of evidence in some regions is in many situations as informative as reports of

some extent. By clustering the evidence, readers are provided with a basic guide to have little is known about this subject, and suggests how much misinformation exists and why inventories and definitions are fundamental to archaeological inquiry.

The Middle Atlantic Region

Daniel Griffith (Personal Communication: 2009, 2012) reports the discovery of two triangular points chipped from bottle glass at the Avery’s Rest site (7SG57) in southern Delaware near the north side of Delaware Bay (Figure 2). Both resemble terminal Late Woodland period examples of other materials from the same site, being bifacially flaked along all three edges. The glass examples reveal the original surface of the bottles centered on both sides. This important early colonial site is situated in a lithic resource-poor zone that would particularly favor the use of bottle glass during the transitional period as Natives selectively adopted European materials into their material culture repertoire. The Fox Gravel Pit Site in Maryland



Figure 2: Two bottle glass arrow points from the Avery’s Rest Site (7SG57), Sussex County, Delaware, a location occupied from ca. 1675 to ca. 1715. Courtesy of Daniel R. Griffith, Archaeological Society of Delaware, 2012.

(18CE30) yielded mostly “Woodland I” stone artifacts, but also a retouched base from a green wine bottle and an aboriginal gunflint worked from a jasper cobble (Ward 1987:41, 44, Table 12). The specific dates associated with these items are uncertain, but at least some are from the Terminal Woodland or Contact period.

Andrew White’s “Brief Relation,” documenting his 1634 voyage to Maryland, provides important ethnographic data relating to the few Native people who were using European glass to produce tools. His description of “Arrowes, of a yard long, furnishe [sic] with three feathers at the top; and pointed either with the point of a deer’s horn, or a sharpe three-corner’d white flint; the rest is a small cane, or straight stick” (White 1634:6). The “three-corner’d white flint” is a typical Late Woodland quartz or quartzite arrowhead. Clayton Colman Hall’s (1910) flawed transcription of White’s “Relation” includes mention of the Yoacomaco, then living in the area of St. Mary’s City, and their neighbors, the Susquehannock. The group described as “very proper and tall men” (Hall 1910:42) must be the Susquehannock (Becker 1991, 2019a). Hall’s transcription of White’s work distorts the description of the arrows, with Hall calling them an “ell” long (45 inches, or 114 centimeters) and “feathered with turkie feathers, and headed with points of deer’s horns, pieces of glasse, or flints [sic].” Hall’s literary license distorts White’s ethnographic account by suggesting the use of chipped glass, which is not the case.

The very limited archaeological evidence for Native chipped glass from Maryland and Virginia, along with the Delaware finds, lends limited support to my belief regarding stone resource-poor areas being more likely locales for Native use of glass soon after Contact. The evidence offers no strong support for this thesis. Maryland’s Posey Site (18CH281), possibly occupied year-round by a small Native group during the period 1650 to 1680

“affords archaeologists the opportunity to study how interaction with European colonists changed the material culture of Maryland’s Indians in the 17th century” (Rivers-Cofield 2013:33). While many imported goods became part of Native material culture, including many uses for copper, there is no incorporation of glass into this assemblage (see Harmon 1999). This pattern appears parallel to that found at the Sarah Boston Site (no site number) in Grafton, Massachusetts at a later date (Law 2008; Bagley et al. 2014:179), probably revealing the general pattern of minimal incorporation of glass into most Native traditions of material culture.

Ritchie’s (1965:182; Plates 62 and 63) discovery of a copper flaker for working siliceous stone at the Muskalonge Lake Site in New York vindicates the value of that metal as a knapping aid. In the light of Ritchie’s find, the presence of small copper tools at the Posey Site is of interest here. Mounier’s recent development of skills in chipping glass have affirmed that copper tools can be of particular value in this process. Other scholars also recognize this connection with chipped glass, but knappers among today’s experimental archaeologists prefer the use of organic tools to use in making indentations (Personal Communication: Jack Cresson, 2021).

Dennis Curry (2013: fig.) has identified four pieces of worked green bottle glass in Maryland that are excellent candidates for Native chipped scrapers (Figure 3). Although not replicating traditional bifacial tools, these items from Maryland’s Heater’s Island Site (18FR72) are important candidates for Native worked items. Formerly known as Conoy Island, this was the final location of Piscataway in Maryland (1699 to ca. 1712).

Ben McCary (1962) had earlier reported on finds of glass artifacts made by the Indians in Virginia. He dated these few examples from three different sites to the first half of the 17th century. Subsequently, Howard McCord (1969:20) reported finding a triangular



Figure 3: Glass scrapers from Heater's Island, Maryland.
Courtesy of Dennis Curry.

arrowhead chipped from bottle glass at the Camden Site (44CE3) in the tidal area (Figure 4). McCord's inferences regarding other finds may be a bit strained, but the glass artifact is interesting despite not being securely dated. Martha McCartney (2012b) indicates that the lands surrounding the Camden Plantation Site, along with the land directly across the water on the upper side of the Rappahannock River, became a preserve (reserved area) on which the Portobago, Nanzattico, and other Native groups resided after 1650. A silver medal struck for "Ye King of Machotick" and other finds there are dated to circa 1680 (McCord 1969:29-30, 33, 46-55, Figure 18).



Figure 4: Chipped glass from the Camden Site in Virginia.

A number of Indians were still living on this property in 1686 to 1687 (Durand 1932:152-154). McCord's (1969:37, Appendix I) interpretation of the functions of the single cabin identified at the Camden site is suspect. Chipping arrowheads from available glass may have maintained traditional skills without the need to locate or trade for appropriate lithic materials. McCord (1973) published an intact example of a glass arrow point from a site in Essex County, Virginia. This is one of the few documented finds of a glass artifact chipped in a traditional form.

The Essex County site is associated with Colonoware pottery, a ceramic type associated with a transitional population. Durand (1932) also noted that in 1686 to 1687, the Native women resident in the area of the Camden Site made "pots, earthen vases and smoking pipes" that were traded to the colonists, further revealing that trade with European colonizers was robust (see McCartney 2012b).

Virginia archaeological records commonly interpret the discoveries of early materials through comparisons with John Smith's ethnographic observations made early in the seventeenth-century. In Smith's description, after stating that these natives use bows and arrows, he offered information on different types of arrows, as well as the many types of points affixed to them.

Their arrowes are made some of straight young sprigs, which they head with bone, some 2 or 3 ynches long. These they vse to shoot at Squirrels on trees. Another sort of arrowes they vse made of Reeds. These are peeced with wood, headed with splinters of christall [quartzite], or some sharp stone, the spurres of a Turkey, or the

bill of some bird. ... His arrow head he quickly maketh with a little bone, which he ever weareth at his bracer, of any splint of a stone, or glasse in the form of a heart, and these they glew to the end of their arrows (Smith 1632:31).

John Smith's use of the term "glasse" appears to refer to the European product as distinct from quartz or quartzite, that he identified as "christall." A bracer, spelled "bracer" by Smith, is a wrist guard used in archery, as well as in fencing (Becker 2012). Smith also describes how to make the glue used to affix arrow heads to the shaft (see also Becker 1981). The text of the 1632 edition is identical to that of the three earlier publication editions, the first of which dates from 1624. The events and encounters described extend back to as early as 1606, when bottle glass would have been an extremely rare material in the Virginias.

Considerable tension remained between the Virginia colonists and many regional tribes for years after the first Powhatan uprising in 1622 (McCartney 2004). Hostilities may have disrupted traditional trade routes and limited Native access to flint or other resources. The minutes of the Proceedings of the General Court of Virginia for February 8, 1627/28 record that: "It was ordered that a warrant be sent to Accawmacke that the Comaunder make enquiry of *Robert Browne & Samuell Woolues* or any others, what Pson or Psons they be, that haue sold any glass bottles to Indians" (McIlwaine 1924:165). Rountree and Davidson (1997:285 note 21), who cite the wrong page in McIlwaine, interpret this as an edict forbidding the use of glass bottles in trade with Virginian Indians in order to keep this raw material out of Native hands. Many records clearly indicate that other materials could be used to tip arrows, and that glass would not have been an essential commodity. The availability of other materials from which to fashion arrowheads, including brass kettles, argues against the Rountree and Davidson

interpretation of the glass bottle "enquiry." More probably, these records reflect efforts to restrict the trade in alcohol rather than any effort to deprive the Natives with access to glass for tools. Quite simply, selling "glass bottles to Indians" refers to bottles of alcohol and not empty glass bottles (cf. McCartney 2012a).

On May 4, 1652, Michael Upchurch, a Virginia colonist of some prominence (McCartney 2012a), wrote to Nicholas Ferrer in England concerning a number of matters. In his letter Upchurch made reference to Indian baskets and pipes being sent home to England along with tobacco and other commercial items. Upchurch provides the following information at the end of his letter:

... and as concerning the Indians makeing of bowes and arrowes they make there bowes of Locust and there arrowes of reeds and their arrow heads bee of glasse or else from turkicock Spurs or tipps of deer's hornes and they doe gett glasse from the English and make Tryangle Just <l as this marke is, they had not cut it with diamonds[,] ore with an oulde [conce] knife or pippel stone[,] and as concerning mettles I am ignora[n]t there is diverse sorts of mettle stones but I cannot gett any because the Indians are at war one with that other but I shall promise some against the next year (Upchurch 1652, as cited by McCartney 2012a).

This letter is among the many items in the digitized Ferrar Papers at Magdalene College, Cambridge University. The transcription that appears here has been adapted by Becker from the version recorded by Martha McCartney (Colonial Williamsburg Microfilm no. 589 included in the Survey Report 6695 of the Virginia Colonial Records Project), and a transcription of the original letter made by Pat Kramer.

Although the charter for the Virginia Company of London had been revoked in 1624, much of its archival material was retained by the Ferrar family, who also collected other documents (Ransome 1992). Upchurch, who was ignorant of flintknapping techniques, specifically noted that the Indians did not score the glass in the way that glass cutters had learned to do before breaking it. Kramer interprets the adjective with “knife” as “conce” [conch?] and the term “pipple” is either a variant spelling or a transcription error for “ripple”, meaning a slight cut or scratch. Diamond was used to score (i.e., cut or scratch) glass for breaking, but many hard stones or metals can achieve the same end. Native use of pressure flaking to work glass seems to have entranced Upchurch, who was ignorant of the art of gunflint knapping and who never had seen glass shaped, other than flat glass that was scored or scratched before breaking.

Upchurch’s observations, which seem to echo those of John Smith (1632:31) printed above, reflect the last vestiges of the use of chipped stone and glass tools among the Natives of the Middle Atlantic region. By 1660, or very soon after, chipped stone disappears from the material culture inventories of all the coastal tribes. The historical documents, as well as archaeological finds, demonstrate that glass arrow points were fashioned by Natives in the Virginias during the first half of the 17th century. Rountree and Davidson (1997:285, note 21) specifically mention Natives’ use of green glass to make arrowheads, but the two references they cite (Hening 1809, I:167; Nugent 1934:23, 35) are not relevant to this subject.

Theodore Reinhart (1993) describes a single scraping tool fashioned from “the thick glass of a green bottle kick” found in undisturbed fill dating to ca. 1725 to 1750 at a downscale rural site (44JC160) in James City County, Virginia. Reinhart does not ascribe any specific ethnic identity to the probable makers. As previously noted, broken glass is

commonly used as opportunistic scraping tools by a wide range of peoples. A more recent find of worked quartz crystals and what appears to be the worked base of a glass stemware are reported from an area above Fones Cliffs on the North bank of the Rappahannock in an area that may have been inhabited between 1700 and 1730 by an individual known as Indian Peter. Julia King (Electronic Communication: 2021) offers a photograph of a worked clear glass stem (not a base: Figure 5) found in association with two quartz crystals (cf. Becker 2019b). Post-Contact clear glass may have served purposes similar to those of quartz crystals in pre-Contact society. This piece of clear glass appears to me to resemble a Native tool (see in Brown 2021: 39) found at a site tested further up the river (Personal Communication: Julia King, January 13 2021). The popular report on these finds is less than clear but does include an excellent illustration of the flaked wine bottle base fragment found above Fones Cliffs (Figure 6). Finds from these distant locations suggest that green glass bottle kicks may have been used to fashion items distinct from objects fashioned from clear glass wine glasses.

Early in the 18th century, decades after Upchurch and Durand had seen and described Indians in Virginia, John Lawson saw glass being chipped by Natives during his travels through the interior parts of the Carolinas. Lawson (1737:57-58) reported traversing an area of mixed pine and hardwood forests to yet another Native hamlet in the interior. At this single isolated location, he saw bottle glass being used to fashion arrow points. That this use of glass was noteworthy to Lawson suggests that Natives in the Carolinas did not commonly use this material at that time. The use of bottle glass by only one of the many groups he encountered may reflect scarce stone resources in the interior, or that these people had a specific means of and desire for maintaining older cultural practices. Lawson (1709:57-58) states, “I saw, among these Men, very long Arrows, headed with Pieces of

Glass, which they had broken from Bottles. They had shap'd them neatly, like the Head of a Dart, but which way they did it, I can't tell."

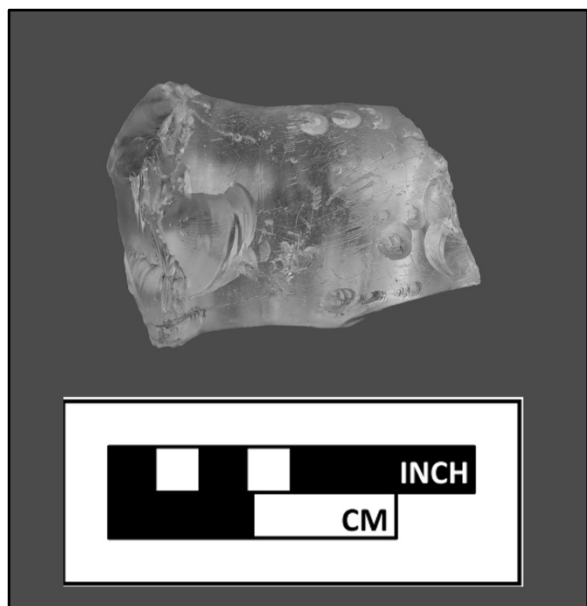


Figure 5: Native-worked item chipped from a clear wine glass found with two quartz crystals. Courtesy of Julia King.

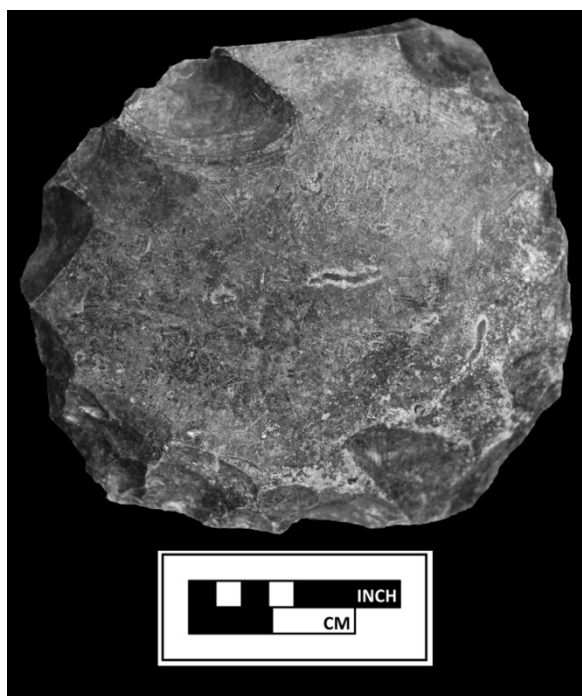


Figure 6: Worked bottle base found near Fones Cliffs. Courtesy of Julia King.

Lawson, as Upchurch before him, appeared unaware of the techniques used to produce these arrowheads. These were the same techniques used to produce the flints used in flintlock arms that had, by 1700, become ubiquitous! Squier and Davis (1848:213, note) thought that the arrows which Lawson had seen "were pointed with obsidian or quartz" and mistaken for glass. But Lawson clearly states that this was but one group of people who used bottle glass, and he probably identified it by its olive-green color. Some modern authors, such as James Merrell (1984:549), have suggested that the makers of these glass tools were Catawba and have otherwise distorted Lawson's singular comment.

Louisiana

Further south, in Louisiana, glass "sherds," (N=35) said to be tools, or to have served as tools, are reported from a plantation in contexts dated from the 1840s into the 1920s (Wilkie 1996:47). Wilkie carefully presents her evidence and refrains from making claims regarding possible fabricators, who may have been enslaved Africans or even enslaved Native Americans. Whether these flaked "sherds" reflect a possible misinterpretation of function, which Griffin (1949) suggests is a common error or represent an unusually good collection of examples will require further study. The desire to ascribe a "tool tradition" to a collection of glass shards seems to be a means by which random glass debris can be given "meaning" in a context from which there is no longer evidence for a recognized Native population. Ascribing retouch efforts to simple damage along glass shard fractures seems all too common. Wilkie (1996: 48) also provides a series of additional references that she claims relate to glass "tools" excavated from this region. I believe that during the early 19th century, the Native peoples of the Louisiana territory and farther west were more likely to have been incorporating metal tools than extending stone working techniques to include glass.

Upper Midwest

The region near the headwaters of the Mississippi River was proximate to the center of trade in a number of commodities for more than 1,000 years. Copper from the upper Midwest and marine shells from both coasts passed through this area. By the middle 1600s, every possible type of European trade good was available across the continent. Not surprisingly, extensive excavations at Fort Michilimackinac (Mackinaw City, Michigan), revealed a location that had been at the center of exchange networks for millennia. Excavations at a location dated to the period 1715 to 1760 found “30 projectile points cut from sheet brass and iron barrel hoops” (Maxwell 1964:23). Hoffman (1896:256, note 1), writing about the Apache in 1871, provides the only other reference thus far seen to the fabrication of arrowheads from barrel hoops.

Also found at Fort Michilimackinac were 22 chert projectile points, of which 21 are small triangles. In addition to these are two points made from green bottle glass (Maxwell 1964:25, Pl. II, group F, marked with a smaller “G”; Quimby 1966:136). Assuming that there was not an earlier occupation at this location, the dates for stone arrowhead use in this area suggest the survival of this technology into the 18th century. These findings indicate a cultural conservatism among native peoples in this region (Jones 2007).

Walter Hoffman (1896:256), in his study of the Menomini [Mamaceqtaw] of Wisconsin, reported that “the making of stone weapons was discontinued by them four generations ago”, or by about 1800. Hoffman goes on to report that by 1900, having no memory of aboriginal knapping techniques, some Indians in northern Wisconsin thought that arrowheads “had been made by a ‘little bug’ that stirred little whirlwinds of dust in dusty places.” This is akin to the old Scotch-Irish notion that chipped flint implements were Elfshot, the tips of darts used by elves or

fairies to cause mischief (Personal Communication: Tim Rast, 2004). In the 1970s, Becker heard these small arrow points termed “fairy darts.” Many Italian examples had been mounted in the 19th century in silver frames to be worn as charms. The apparently late survival of stone and glass arrowhead manufacture at Michilimackinac might be linked with an account of the Wisconsin naturalist and knapper, Halvor Skavlem. In the early 20th century, Skavlem fashioned stone tools of all kinds from local lithic materials, as well as the “bottoms of beer bottles, brown and green” (Stewart 1923:804; Mossman 1990:330). Skavlem’s considerable production leads one to question the sources of other glass artifacts reported from that region and perhaps from others.

The Plains and Southwest

Tales of natives using telegraph insulators to fashion tools abound on the North American Plains (Personal Communication: Bernard Powell, 2006), but actual published evidence is difficult to locate. Paul Picha reports that evidence for Native recycling of glass objects on the Northern Plains has been recovered from villages and trading posts in North Dakota dating from the early to middle 19th century. Like-A-Fishhook and Fort Berthold II (Smith 1954, 1972:174, Figure 79e-g) are two examples where chipped glass artifacts have been documented.

Hoffman (1896:256, note 1) reported that in 1871, when he was in Nevada and Arizona, he saw many kinds of stone tools still in use. In this note, Hoffman says that the “arrowpoints used by the Apaches at that time were made by themselves, and a number of specimens then obtained consisted of chert, obsidian, and bottle-glass, and a single specimen was of gold quartz”. The latter item appears to be the quartz from a vein in which gold also was found. These arrowheads were all small (Hoffman 1896:284). Later Hoffman (1896:275, 279) states that two distinct groups of Apache were still making arrowheads from

“jasper, obsidian, and bottle-glass”, and that he collected examples from the Coyotero Apache. Although he does not state that he visited any “ancient pueblos,” Hoffman (1896:282) claimed that some arrow points found there were made of bottle glass.

Western North America

The western side of the Rocky Mountains, and the entire southwest, had been part of the Spanish trade system since before the Virginias became of interest to the English. The many nations competing for peltry all along those shores have left a complex set of histories. The story of the area now identified as the Pacific Northwest may be anthropologically better known due to the complex fishing societies that had developed in that region. Recent archaeology has revealed some very interesting examples of tools chipped from glass that had been imported into that region. Martindale and Jurakic (2006) set the path for the identification of expedient glass tools recovered from among Tsimshian sites on the Northwest Coast. Their study demonstrates that this adaptation of glass in place of stone resources may be expected on sites widely dispersed across the continent. In the Northwest, a site known as the Middle Village also represents a summer village of the Chinook that had been used from ca. 1790 to 1820 (Wilson et al. 2017:118). Despite having “abundant cherts”, the excavators found that the occupants practiced highly expedient “reuse of both gunflints and glass bottles as tools” (Wilson et al. 2017:121; Wilson et al. 2009). Simmons (2014) offers illustrations of some replicative examples of tools chipped from clear glass and proposes a method by which these bits of glass tools may be studied to distinguish if they are replicative of traditional tools or opportunistic forms. The Middle Village site is just one of five sites from which bottle glass items have been recovered (Wilson et al. 2017:124-125). All of these publications relating to the archaeology of the Northwest include bibliographies with a

worldwide coverage that reveals the paucity of published materials from this region.

The early immigrant Spanish population along the lower Pacific coast had a very different impact on the Native peoples there than the English colonists had in New England and the Middle Atlantic regions. During the Honorable Caleb Lyon’s tour in California, just before the 1849 gold rush, Lyon met a party of Shasta Indians who were still using stone weapons. Later in Lyon’s brief report it becomes evident that glass was not one of the materials used for chipping. According to a pair of identical published accounts, Mr. Lyon communicated his findings to the American Ethnological Society through a Dr. E. H. Davis. Mr. Lyon’s (1859a, 1859b) brief observations describe the technique of working bottle glass into arrowheads by one of the Natives among those he met. “I then requested him to carve me one from the remains of a broken porter bottle which (after two failures) he succeeded in doing. He gave as a reason for his ill success that he did not understand the grain of the glass.” Clearly, this Native individual was employing glass for the first time and was unfamiliar with this material for tool making. He also appears to have learned quite rapidly.

Bancroft (1886, I: 342-343), in a discussion of the Californian Indians, recounts Mr. Lyon’s narration, citing Lyon’s letter to the American Ethnological Society. Obviously, Bancroft had never seen stone flaking done, nor was he intuitive about what he read regarding stone chipping since he believed that the process of fashioning a tool involved an “Indian, spending days, perhaps weeks, on one piece.” Mason (1894:669-670) appears to have taken his somewhat distorted ideas on the subject from Bancroft.

Perhaps the best-known Native American stone knapper was Ishi, a surviving California Indian of the Yahi tribe in northern California. A. L. Kroeber studied and worked with Ishi for some time. Ishi’s arrowheads typically had

symmetrical, slender isosceles triangular blades, with deep, well-formed corner notches. In a somewhat romantic version of this tribe's material culture, Kroeber's widow and a colleague put together the following:

By a strange irony, however, most of the arrows with which Ishi killed deer, bear, and wildcats during his life, were tipped with points made by him out of an undisputed product of civilization—*glass* from windows or bottles... [In fear of] supposedly murderous Americans, trade with the obsidian-gathering tribes to the north and south was cut off... In his timid nightly prowlings Ishi therefore carefully picked up and hoarded the discarded beer bottles and similar refuse of glass that the dusty teamster or cattleman had thrown away (Heizer and T. Kroeber 1979:115, 158).

In the late 1870s, glass arrowheads were made and used by the Wintun (Wintoon) Indians of California. The glass used apparently had less value than obsidian, suggesting that the natural product was less accessible, either directly or through trade. Relative value via symbolic significance may be considered. Prior to the close of the Modoc War, the Wintoons or Cloud River Indians in the Mount Shasta region were without firearms, partly because of prohibitions. As there were no areas then used for agriculture, and no mines near the Cloud River, the Wintoons remained in almost undisputed possession of prolific hunting grounds, which included enormous salmon runs and trout. Redding (1879:668-669) suggested that the Wintoons had little contact with Euro-Americans until Mr. Livingston Stone established a station on the river for acquiring salmon eggs for distribution by the U.S. Government. Guns were still so rare among these people that the bow was still in use (Redding 1879:675). Redding sought out a Native knapper as noted in his narrative:

While visiting the United States Fishery a few days since I expressed a wish to Deputy U.S. Fish Commissioner Livingston Stone, who has acquired a knowledge of the Wintoon language that one of the best arrowhead makers of the tribe should make, in my presence, a stone arrowhead using only such tools and implements for the purpose as were in use by the Indians before their contact with white men (Redding 1879:669)

Redding goes on to say:

When I came to the purchase of the arrowhead and flake, I found they would cost seventy-five cents, payable in shells, *Dentalium entalis*, which he esteemed more highly than their value in money. The worth of the flake and arrowhead was not based upon the time or labor employed, but upon the value of the obsidian, as he offered for a dollar's worth of shells to give me ten arrowheads of the same shape and size made from the bottoms of glass ale bottles (Redding 1879:675).

From about the same period, but farther north along the Pacific Coast, in the Aleutians, comes a report from John Muir, the well-known naturalist. Muir had signed on to an 1881 expedition in search of the remains of Commander George W. De Long and his ill-fated vessel, *Jeanette*, that failed to return from an Arctic voyage in 1879. Muir recorded an account of this trip, including observations of aboriginal lifeways in the Aleutian Islands. Muir (1917:14) stated, "In one of these huts I saw for the first time arrowheads manufactured out of bottle glass. The edges are chipped by hard pressure with a bit of deer horn." Almost certainly these arrowheads had been made by these Natives for their own use and not for sale.

California's Ishi and Stone Tools

The story of Ishi (d. March 25, 1916), supposedly the last surviving member of the Yahi or Southern Yana tribe in California (or possibly the Wintun), is available in a biography by Theodora Kroeber. This was published in 1961, more than 40 years after Ishi's death. Mrs. Kroeber (1961:136), the widow of the famous anthropologist Alfred A. Kroeber [Figure 4], makes only a brief mention of Ishi's stone working skills. Ishi's "flint working" skills are described at some length in an eyewitness account by Nels Nelson (1916). Nelson notes that Ishi preferred to use iron tools for his knapping and "heavy plate-glass" as his material of choice. A long lance-like blade is illustrated by Nelson, with Solutrean-like, long flakes taken from the surface. Mounier believes that tiny obsidian and gemstone points are well known from northern California, but these are often of smaller size than the documented examples of tool forms that Ishi made. The famous blue-green insulator glass associated with "Ishi points" appears to be a late addition to his available raw material. These blue-green artifacts, as well as many other typical Ishi points, were created in response to market demands. Mounier believes that Ishi had learned a wide variety of traditional knapping skills as a child and used those skills to create tools from glass.

An excellent review of Ishi's life and culture, and their stone tool production, has been summarized in an important historical article (Shackley 2000). Michael Steven Shackley became the central figure at the center of the historical reconstruction of the culture into which Ishi had been born. Like the Australian aboriginals who developed a market in attractively shaped and colored glass 'artifacts', Ishi became a feature in anthropological theatre as represented by chipping glass tools.

Becker notes that the Spanish and possibly Russians had been trading in his region for

400 years, but the influence of their material culture on Native traditions has not been explored. The survival by direct transmission of traditional knapping skills may be questioned. The Ishi tale may relate to what is known about Australian Kimberley points, described below.

The untoward tendency for glass to fracture on impact becomes less of a concern if the object of manufacture is essentially aesthetic or if items are made primarily for sale to tourists. For example, some of the glass specimens that Ishi made to demonstrate knapping technique were considered to be "too long and fragile for use" (Heizer and Kroeber 1979:184, note 14). The same may be said of particularly long examples of glass Kimberley points. Both groups of chipped glass appear to have been produced for sale rather than to replicate traditional and functional Native tools.

Silliman (2000a:339-340, 2000b) examined worked glass at a California site but found no sign of formal tool manufacture, although some of these pieces do have bifacial flaking that has produced a sharp edge. These appear to represent expedient and random possible plate glass and retouched bottle bases, or opportunistic rather than replicative. Formal glass tools are known from Spanish missions in California where Silliman has found three examples crafted from bottle and window glass (Allen 1998 for Mission Santa Cruz; Hoover and Costello 1985 for Mission San Antonio; Silliman 1997 for Fort Ross). More significant is Silliman's (2003:148) review of 2,896 glass "artifacts" in which he finds that only 4.9% revealed unequivocal evidence of intentional flaking.

Glass Tools from Other Parts of the World

Considering the limited distribution of Native chipped glass artifacts in North America, it is not surprising that finds of glass incorporated into traditional stone working repertoires are unknown, even where populations of knappers have access to a ready supply of glass.

Where Native peoples had ancient iron working traditions, as in many parts of Africa, or copper industries such as in Peru, replicating tools from imported glass was simply unneeded. This also applies to large parts of the world where metallurgy was more sophisticated

Mesoamerica

The presence of vast obsidian workshops at many Classic Period and earlier Maya sites (Haviland et al.1985) and the wide trade in this material throughout Central America, would make the post-1500 CE use of imported glass for tools unlikely. Yet Hayden and Nelson (1981:893-896; Deal and Hayden 1987:248) report on glass shards being used in modern highland villages. Most of this material is simply broken glass, such as those bits inserted into wax or other materials for use as instruments of self-flagellation. This use of broken glass slivers is a specific application of this material to one artifact category, and not to a great range of Native tools that previously had been fashioned using obsidian. The possible cognitive relationship between self-flagellation using industrial glass and the makers (Spanish) may not be coincidental. We suggest that in this context, that imported glass served as a symbol of the Spanish Conquest.

The modern Lacandón Indians of Yucatan and northern Guatemala once made small arrowheads of glass to tip the arrows that they sold to tourists along with simple bows. Anita Haviland (Personal Communication: 2012) reported seeing several Lacandon “arrowheads” purchased by William R. Coe and said to be made from green glass telephone insulators. More likely that these items were fashioned from green tinted obsidian that is abundant in central Mexico. Fragments of green tinged obsidian are now abundant on the surface of most ancient Maya and other sites, as pointed out by Nations (1989: 452-454). Since these Lacandon have had firearms since the colonial period, these

tourist items must have evolved with the tourist trade. The demise of these items may relate to the evolution of forest tourism as well as limitations regarding what can be taken on airplanes.

The amazing sharpness of obsidian flake-blades has been noted quite often by archaeologists working in regions where native peoples commonly had access to volcanic glass. In the early 1980s, Prof. Payson Sheets developed the idea of making surgical scalpels of a standard size from glass polyhedral cores, based on Mesoamerican obsidian prismatic blade technology. These are sharper than steel (Maurer 1982:35) and gained him a government patent, #4,647,300 (Personal Communication: Payson Sheets, 2012). Prof. William Fowler (Personal Communication: 2012) reports that he underwent “surgery with a freshly struck obsidian prismatic blade made in an experimental workshop by Gene Titmus in 1989.” Laser surgery was concurrently being developed, which soon superseded obsidian surgical technology.

Fuegeans and the Straits of Magellan

Shortly before Mackenzie presented his discussion, a note relating to Mr. F. H. Cushing appeared in *Nature* (1879) that may be the first to indicate chipping technology among the Fuegians. “At a recent meeting of the United States Anthropological Society, Mr. F. H. Cushing, who has made an original and experimental study of aboriginal processes” in the United States and Europe, had determined that chipping was done not with “a rude stone hammer” but with far more delicate processes. Cushing reported that flint could be worked without the use of metal tools. Soon after this publication appeared, R. W. Coppinger read it and wrote to report that “as I have had many opportunities of observing the method by which the Fuegeans of Magellan’s Straits fashion their glass arrow-heads,” he wished to add to the discussion (Coppinger 1880:97). Coppinger

stated that “empty bottles are now to be found” throughout the region. Thus, the natives had shifted to the use of bottle glass “to the exclusion of obsidian, quartz, or flint.” Coppinger provides an excellent description of pressure flaking, while noting that in half an hour a piece “is fashioned entirely by pressure”. Coppinger’s communication was sent from “H. M. Surveying Ship *Alert*, Swallow Bay, Straits of Magellan, March 21.” His March missive appeared in *Nature* on June 3rd (Coppinger 1880:97) and was reprinted in full in *The New York Times* on June 27, 1880. Neither of these reports mention the use of teeth in the chipping process.

An early account from the Straits of Magellan, referencing an as yet unspecified date early in the 19th century, was later published in London in 1882. F.R. Mackenzie, responding to D. Howard’s presentation (see 1882:221-231) read a paper titled, “What Are Scientific Facts?” This response was made at a meeting of the Philosophical Society of Great Britain on February 21, 1881. Mackenzie stated the following about aboriginal use of bottle glass in the aforementioned region:

A good many years ago I happened to be in the Straits of Magellan for a period of seven or eight months and during that time I saw a good deal of the Fuegian savages, a race of beings whom I should be inclined to put very low in the scale of humanity from what I observed amongst them. I was very much struck with one of the weapons which I saw in the possession of a native; these people use bows and arrows and the arrow heads are shaped something like the one just produced except that they have a longer stem for fitting into the shaft. The stem of the arrow head produced had been broken. This drawing [of] a small arrow head about the size of the section of a walnut shell is the exact shape of the arrow heads I saw and these heads are

inserted into a reed or stick and then bound with a piece of sinew to complete the arrow. I never saw one so large as the specimen on the table. I was on one occasion very much astonished at finding in a man's sheath — in which he was carrying half a dozen arrows — one of the arrow heads made of glass. I consequently got a broken bottle and took it to him. It was of the same sort of glass as that of which the arrow head was made, not the dark description but the light green of which so many bottles are manufactured. I made the man understand by signs that I wanted to have some of the arrow heads made. To my astonishment after breaking the bottle into a number of pieces he took a piece of glass that was nearest to the size he wanted and having chipped it a little nearer to the right size with a stone, he began to bite it with his teeth in order to form it into shape after which he handed it to one of the women who were on board with the party to be finished. He did the best part of the work himself but it was finished off by a woman and the entire arrow head was thus bitten into shape while I was looking on. That savage had only one arrowhead of glass; the others were of flint and there is no doubt in my mind that they were made in the same manner (*Journal of the Transactions of the Victorian Institute or Philosophical Society of Great Britain* 1882:233-234).

What specifically did the Straits women do to finish the piece? Did the women also employ their teeth in the flint tool making? Mackenzie’s narration is suspect; indeed, purported dental knapping may be nothing more than an illusion performed by Natives to impress gullible prospective buyers of these curiosities. The scheme seems akin to the magician’s trick of placing a packet of needles and a piece of thread in the mouth, “chewing”

them for a few seconds, then extracting the needles all neatly threaded. The late Bernard Powell and I discussed this report and suggest that were this a true tale, “skeletal dentition might even yet harbor traces of ‘work’ induced retouch and perhaps scratches, stress cracks, etc.” Mackenzie obviously made purchases of examples of these “tools” because he reports having given specimens of these chipped tools to a Mr. Saul, a wine merchant who had had a museum. By 1882, Mr. Saul had been dead for many years, and the disposition of his collection is unknown, making direct observation of the artifacts virtually impossible.

John Murdoch (1890:64) repeated Mackenzie’s story of Natives in the Straits of Magellan using bottle glass “roughly shaped by biting” to fashion tools, including the detail of wrapping the glass in hide before placing it in the mouth. However, Murdoch cites “Stolpe 1888” as his source. As a young man, Hjalmar Stolpe (b.1841 - d.1905) was a member of the world circum-navigating expedition of HMS *Vanadis* between 1883 and 1885. On the voyage, he was assigned to purchase ethnographic and archaeological materials. He collected some 6,300 items, of which around 100 came from Tierra del Fuego (Stolpe 1889:5). These are not listed or described in his publication. Stolpe’s list of scientific publications (YMER 1906) includes nothing that would provide information on chipping, but Murdoch may have cited a lecture by Stolpe delivered to the *Svenska Sällskapet för Antropologi och Geografi* (Swedish Society for Anthropology and Geography, SSAG) or an extract of it in YMER (1908, Vol. 18, pages I, II). In 1900, Stolpe became the first director of the ethnographical section of the Museum of Natural History in Stockholm, but nowhere in his publications does there appear a recounting of the use of teeth in stone or glass chipping.

Michael Gall pointed out (in editing this article) that Mackenzie uses nineteenth-century language to dehumanize the Native

makers of these tools and included the story of use of teeth in the process to popularize and sensationalize this narrative to portray these people as “other” and “savage.” A review of Mackenzie’s tale of “dental-chipping” and its subsequent retelling leads to the conclusion that this sleight-of-”hand” was part of a show performed to boost sales of glass arrowheads and other trinkets to passing seamen and tourists. Bolstering this thesis are accounts from tourists and travelers through the Straits of Magellan, as well as elsewhere, where the production and sale of “native goods” created a new economy. In the Straits of Magellan alone, in addition to rugs woven from animal fur, travelers could buy baskets, canoe models plus miniature paddlers, and archery equipment. Similar suites of “native goods” could be bought around the world, wherever Native populations remained in residence. Spears (1895:296-297) explicates this aspect of the tourist trade at the Straits of Magellan:

The arrow heads made by the Ona Indians of Tierra del Fuego from pieces of glass bottles that have been cast over from Cape Horn ships are equally interesting. The bows and arrows are not of a form to attract special attention, except that the arrows are very light. One wonders how such a weapon could pierce a guanaco or a lone prospector, as they are said to do. That the arrow points are usually a genuine Indian product I presume there is no doubt, though not necessarily Ona made, for the Tehuelches of Patagonia can make a glass arrow head. But one finds so many new bows on sale at Punta Arenas, bows that show the mark of a jack knife, too, that a doubt is thrown over the whole collection...

The Onas too are continually at war with the whites. The two races go hunting each other with considerable success on both sides. The whites, of course, capture some bows and

arrows, but they do not usually bring them in as trophies. The whites of Tierra del Fuego are sheep herders or gold diggers, who do not want to be bothered with such stuff. Besides, bows from the battlefields are never new and clean, nor do they show marks of a jack knife. Like the Eskimos of the west coast of Greenland the Yahgans of the Cape Horn region have learned that the whites will buy curios, and they supply the market by making models of their canoes and weapons (Spears 1895:296-297).

This adaptation in the farthest southern reaches of the Americas indicates that populations everywhere will turn exotic materials to their own uses, creating marketable commodities. One example is the production of miniature canoes with two to four or more paddlers. Paddles, containers, fishing equipment, and an array of miniaturized items appear in museum and personal collections around the world.

Western Asia

Continuing the survey of glass chipping to include Japan and points west led to a note dealing with Siberia in which the observer says that "It was very seldom that I met with arrow-heads made of other brittle mineral bodies than rock crystal, flint, jasper, obsidian, or glass" (Fischer 1885:188, note 2). Fischer also mentions what appear to be chipped stone artifacts from Japan, perhaps among the Ainu, comparing them to pieces known from Finland. "Among these objects [in Japan, arrow and lance-heads] are a great number which are of delicate workmanship which elsewhere, as in Finland, was bestowed exclusively on silex, obsidian and glass" (Fischer 1885:197). Fischer does not specify glass as the material from which the Japanese artifacts were made, but seems to imply it. Apparently, he believed that the Finns (Saami?) flaked glass as well, but his sentence

is a bit ambiguous and no cultural-temporal framework appears in the text. Were it not that glass and obsidian are mentioned together, one might suppose that the author confused one with the other. There appears to be no mention of the origin of the glass used in Japan, whether from bottles, panes, mirrors, or some other product. As to technique, the author only indicates "chipping."

Australia

The Kimberly District of Northwestern Australia is best known for diamond mines. The possible relationship between these riches and the glass-working efforts of Aborigines in that area may not be coincidental. The aesthetics of the skillfully flaked Kimberley points made of glass by Australian Aborigines have long made these chipped-glass products a commodity in the collector trade (Harrison 2006). There are abundant claims that Aborigines commonly used bottles and glass insulators from telegraph lines to fashion tools for their own traditional uses. These claims appear in the popular literature and often in conversations at North American professional meetings. At least three glass "spearheads" collected in Western Australia before 1931 are part of the collections of the University Museum in Philadelphia, identified as item numbers 31-33-101 (olive green), 31-33-104 (white), and 31-33-113 (olive green). Aside from the general location of their origins, nothing else is known about these items. Their form seems to have been sufficient reason to associate them with a generic Australian Aboriginal "tradition."

As with claims of broken glass having been used by Native Americans in the Northeast region of North America, direct evidence is lacking. Australian Native peoples certainly learned to employ various flaking techniques in the working of glass. Questions regarding when and for what purposes glass was worked remain common among archaeologists in Australia and are of great interest to all anthropologists interested in the processes of

culture contact and the adoption of material culture.

The incorporation of glass into the Native technology in Australia is well documented as early as 1843, when James Backhouse (1843:103) described a Native “doctor ... smeared and streaked with red ochre and grease. The Doctor had his instruments lying by him, consisting of pieces of broken glass, picked up on the shore; with these he cuts deep gashes in any part affected with pain”. This does not refer to chipping of glass to create a tool, but indicates a random or opportunistic use for found glass shards, a use that would not be evident in the archaeological record. Backhouse makes two other references to glass being incorporated into Native technology, neither of which would require modification that could be detected archaeologically, unless the preservation of context was optimal, and the recovery and interpretation were most cogent. The first reads: “Their spears are generally simple rods, but to some, they attach on one side a sort of barbed ridge, of pieces of glass, by means of Grass-tree gum” (Backhouse 1843:517, 433, Figure 4). The same figure also depicts a drawing of the other type of spear that he describes. “Most of their spears are barbed with wood, and some have a ridge of sharp splinters of quartz-crystal or of glass; these they call death spears” (Backhouse 1843:546, 433, Figure 4).

The next earliest known written account of glass being incorporated in any way as part of any Australian Native tool inventory dates from 51 years following the Backhouse narrative. By the 1890s, a significant shift may have taken place in the goals of those Aboriginals who were applying stone chipping technology to imported glass and porcelain materials to produce “native” items. In 1894, a brief note in *Railway World*, published in Philadelphia when it was a major center for the production of railroad engines, speaks to “Civilization” in Australia being “tripped up by curious obstacles”. In addition to cutting

telegraph wire from the Overland Telegraph line to fashion ornamental copper rings, “the natives have exhibited great taste in fashioning the porcelain insulators into arrow-heads” (*Railway World* 1894). This “observation” was echoed a decade later when Windle (1904:33) indicated that:

The natives of Australia make admirable arrow-heads out of glass bottles, and also out of the insulators of telegraph wires. Indeed, *it is said* that they are so fond of the latter, and have caused so much inconvenience by annexing them, that it has been found wise to leave a number of fragments of broken bottles at the bottom of the telegraph poles, in order to provide the material which would otherwise be sought at its summit [emphasis added].

Note that Windle is not reporting on anything that he had seen, but only what he had heard. Were the Windle account found to be accurate, the process of leaving discarded bottles and other glass items at the bases of telegraph poles would be an excellent early example of applied anthropology. Variations of this story are so often repeated, and in such questionable contexts, that it has assumed the characteristics of a legend as defined by Forbes (1921:80) and Spencer (1928). The “legend” regarding Native use of bottle glass within the culture, now called the Kimberley tradition, soon had become accepted into the anthropological literature as fact. This “fact” was verified when the authoritative Kenneth Oakley identified a “spearhead of bottle-glass,” approximately nine centimeters long, as belonging to this Kimberley tradition, he provided no reference at all (Oakley 1950:20, 31, Figure 12h, 1966: 32, 49, Figure 12h). Archaeologists now have a different view.

During the summer of 2017, excavations at an Aboriginal prison location on Rottnest Island (Perth, Southwest Australia) revealed activities from 1838 to 1931. Tools of various

sorts were commonly fashioned from green glass during this period, but none of them have the elaborate serration that are identified as the Kimberly tradition in tool production. The impressive studies of Rodney Harrison (2000) have examined every facet of glass chipping among Australian Aboriginal peoples, including regional variation in their techniques. Harrison (2004a) recognizes that pressure flaked biface points are common at prehistoric archaeological sites. However, in Australia these bifaces tend to be produced in greater numbers, grow in size after Contact, and become more finely worked in response to the development of a colonial market in the trade for these items. These changes also relate to the reorganization of Kimberley societies that followed European contact (Harrison 2002a). The progressive development of glass artifacts throughout Australia leads to those Kimberley points that are the most easily recognized items developed for trade to collectors. In particular, Harrison (2002a) describes a more complicated scenario related to the reorganization of life among Aboriginal peoples, within which glass point production is only one element.

Throughout Australia, as in the American Northeast, glass was often used opportunistically to fashion simple scraping and cutting tools. Harrison (2004b:176-177) provides an account from an Aboriginal woman from Dennewan narrating her use of broken glass as late as the middle and later part of the 20th century. Harrison (2003) further recognizes that Aboriginal people sometimes produced ‘copies’ of stone tools in glass that were not meant to be used or traded. He suggests that this has something to do with the way in which Australian Aboriginal people perceive and experience colonialism. Harrison’s insight regarding knapped glass and tourism, linking that development with Aboriginal adoption of a wide range of post-contact materials and technologies, especially raw materials, such as particular metals (Harrison 2002b, 2005; Gibbs and Harrison

2008). The use of glass to make goods suitable only for sale to tourists may be of particular relevance to the brief interval in the American Northeast when imported glass was chipped by Natives for use as tools.

Despite Harrison’s efforts, popular belief in the antiquity of a specific Kimberley point production remains strong. J. Allen (1973), in his dissertation, reviews tools knapped from glass bottles by Australian aborigines at Port Essington, Northern Territory at a late date: post-1850. More recently Allen (2008) published his information in greater detail, but any evidence for examples resembling Kimberly tradition artifacts dating from before the late 19th century remains lacking. Lynette Russell’s (2005) observations on glass scrapers appearing among stone tools fashioned by Aboriginal women in the 19th century appears to be reliable indicator for their production and use, but these are quite distinct from the elaborate chipped items identified as Kimberly points. Alice Gorman’s (1998) listing of dozens of publications that mention Native use of glass to fashion flaked tools has its focus on Australian Aboriginals and the popular literature (Powell 2008). The origins of a glass artifact from Australia (Cat. No. 31-33-114) at the University Museum in Philadelphia (Moore 2021) and elsewhere might reveal what the collectors thought about these artifacts.

We conclude that the well-known Kimberley points of Australia (Figure 7) primarily are a category of tourist goods that had developed using traditional Aboriginal stone tool technologies, late in the 19th century. The specific details of this enterprise remain unknown, but the general outlines now seem clear. Any bottles, whether or not deliberately left for the Natives, would have provided a colorful array of glass from which they could produce tools, probably as much for sale to tourists as for possible traditional uses, such as cutting tools or lance points.



Figure 7: Kimberley Point (modern Australian). Example from Australian Museum.

Tasmania

Further support regarding flaked glass tools being made for the tourist trade also can be found in the travel writings of Mark Twain (Samuel L. Clemens). At the end of the 19th century, Twain discusses the glass arrowheads that he observed in Tasmania. Twain does not mention bargaining for or purchasing any examples and the specific context is a bit nebulous. His account reveals that the tourists on these routes encountered Native makers of chipped glass pieces in Tasmania. Twain (1897:283-284) writes:

And there was another curiosity—quite a stunning one, I thought: Arrow-heads and knives just like those which Primeval Man made out of flint, and thought he had done such a wonderful thing—yes, and has been humored and coddled in that superstition by this age of admiring scientists until there is probably no living with him in the other world by now. Yet here is his finest and nicest work exactly duplicated in our day; and by people who have never heard of him or his works: by aborigines who lived in the islands of these seas within our time. And they not only duplicated those works of art but did it in the brittlest and most treacherous of substances—*glass*: made them out of

old brandy bottles flung out of the British camps; millions of tons of them. It is time for Primeval Man to make a little less noise, now. He has had his day. He is not what he used to be.

South Africa

Four early accounts record the use of glass in fashioning tools among the “Bushmen” (now identified as the San) of southern Africa. Three are from the 1880s, beginning with Gooch’s (1882:138, note 2) observation that “...two glass ones [arrowheads] are remarkable from the use of a resinous substance to attach the shreds or splinters of glass bottle of which they are made to the point of the arrow.” Soon after, Feilden (1884:171-172) published the following:

... arrow-heads are to be found in abundance, though often, from their extreme rudeness, they are liable to be overlooked. I have also brought drawings of ... one glass arrow tip flaked by the Bushman of Basutoland, from the base of a glass bottle. Colonel Bowker informed me that, on revisiting spots where he and his escort had encamped in Basutoland, he found evidence of the Bushman having been employed in fashioning arrowheads from discarded soda water bottles.

A comparison between the arrow heads used by the modern Bushman and the prehistoric stone arrow-heads leaves little doubt of the close relationship between the older and more modern forms.

Feilden’s account can be used as evidence for the use of modern glass as an alternate source of raw materials from which a traditional tool form was produced. This is not the case with Bertin’s (1886:56) account: “As often happens among savages on the border of civilized

lands, an old piece of glass or iron, or a nail, is utilized as [the] point of [the] arrow.” This suggests that a bit of glass of almost any shape would have been employed for the purpose, although Bertin might not have been able to discriminate between a broken bit of glass and a finely chipped point of the same material. Stow’s account clearly suggests that fine chipping was involved, stating:

Mr. W. Coates Palgrave informed the writer that at the time of his first visit among the Bushmen of the lower portion of the 'Gariep or Great river, they used invariably small chips of chalcedony, etc., probably obtained from some of the agate gravels of the river, for making the sharp points of their poisoned arrows; but that after travellers [sic] had passed through their country and scattered a number of old bottles about in various directions, he found when he again visited them that they were using chipped pieces of glass in preference [to stone], having found that they could give a sharper edge to the new material than to that which they had before employed” (Stow 1905:69-70).

Questionable Chipped Glass Finds in Published Reports in the United States of America

Having examined global accounts of Native glass uses to fashion artifacts of both traditional form for traditional uses and other forms for the tourist market, we return to reports from North America that are more questionable in their accuracy. We have surveyed in this paper the relatively few well-documented examples of traditional tool forms fashioned from chipped bottle glass. Verified examples in the literature usually appear as single finds among a large number of lithic materials. Long ago John Griffin (1949) suggested that misidentifications of worked objects were fairly common, as not all chipped glass originated with intentional cultural

practices. The same conclusion was also reached by Quinn (2007, Unit 4:37), who stated, “edge chips are very common as *secondary fractures* on broken ceramic or glass fragments. They easily occur as fragments that bump into each other or impact other objects during breakage or subsequent handling [emphasis in original]”.

The problem of distinguishing between deliberate glass flaking to produce a tool and accidental or incidental chipping is evident in the evaluation of both glass and ceramic pieces from archaeological sites (Becker and Mounier 2013). Incidental “chipping” was demonstrated in experiments by Keith Doms (Personal Communication: October 15, 2013). Doms found that stepping on bottle glass fragments which have their edges in contact with very hard surfaces, such as paving stones or cement, produces scraper-like flaking. These fragments are difficult to hold, but the chipped edges on these glass pieces could be confused with deliberately worked edges. Similarly, Mounier was able to produce well-formed glass flakes and shards with deceptively realistic unifacial edge flaking simply by tumbling glass bottles in a cement mixer (Figure 8; Becker and Mounier 2013).



Figure 8: Detail of R. Alan Mounier’s experiment with “accidental” production of a glass “tool”.

Some types of ceramics, including porcelain table wares and telegraph insulators, have similar chipping qualities (Quinn 2007:B-10); they all fall among the lower grades of materials (Khreisheh et al. 2013:39, from Whittaker 1994). Many published reports refer to ceramic and glass pieces that are said to have been deliberately flaked; moreover, the mere presence of flaking (or incidental chipping) is often assumed to denote cultural ingenuity. The concentration of these dubious finds within the United States may in itself be revealing. The questionable interpretations of chipping include those from excavation at the *United States Industrial Indian School at Phoenix*. A number of so-called glass “tools” are listed along with a single “crude stone projectile point, a tool fashioned by a student...” (Lindauer 1996:215-219, Figures 11.12 and 11.13). None of these items appears to be a deliberately chipped artifact, especially the three large pieces of ceramic plates. This small “assemblage” might better have been included in a listing of shards rather than identified as artifacts. Reports from a number of Native Americans sites from across the country of knapping ceramics may be similarly problematic. One exception appears to be a late 19th-century site in Old Town (San Diego, California), which yielded a fish-tail “[p]rojectile point made by flaking transfer-print[ed] porcelain” (Jordan 2006:41). Symmetry achieved by flaking can be an indication of human efforts, particularly when the result is both patterned and bifacial.

A possible example of a chipped glass tool was reported from a site identified as Playwicki in southeastern Pennsylvania that consists of two non-contemporary small structures. Becker believes that these shelters were Irish laborers’ hovels (Hildeburn 1878:317) and suggests a revised contextualization of the suspected chipped glass artifact, while Picadio (1999) and Moore (1999) place the associated material culture into a “Native” tradition.

Testing at the Early Contact period Parkway Gravel Site (7NC-G-100) in Delaware “turned up three pieces of blown bottle glass with evidence of flaking” (Kellogg et al. 1994:29). This site, at the southern fringe of Lenape territory, may date from the early 1600s. Only one of these finds yields what may be convincing evidence of being a deliberately flaked glass object. The cautious statements of Kellogg and colleagues’ (1994:30-33, Figure 12, Plates 6 and 7) are followed by a careful discussion and excellent illustrations. The presence of gunflints and native chipped stone items indicates that the occupants at the site were capable of working with stone. Therefore, we would suggest that the “possible flaking” (Kellogg et al. 1994:31) of the dark green bottle glass as suggested by the survey report authors could be deliberately flaked glass. Although they suggest that the glass “may have been collected or traded at another location and carried to the site to be recycled as lithic raw material” (Kellogg et al. 1994:33), none of the limited evidence supports their thesis of any glass bearing signs of retouching.

The idea that broken glass with chipped edges demonstrates the existence of otherwise undocumented Native people is made manifest in problematic “finds” of supposedly chipped bottle glass “artifacts” at another site in Delaware. The Hurd Site (Bloomsbury) in the territory of the Sekonese [Siconicin] in central Kent County, Delaware (Becker 2004; Blume 1997; Sandy et al. 1998, Heite and Blume 2008, also Blume 2008) produced over 200 fragments of olive green colored bottle glass, said to have been “used and/or flaked to produce tools.” The context is a jumble of broken glass, rather than an activity area (see Heite 1997a, 1997b, 1997c). The location suggests randomly broken bits of glass from among which some candidates for “worked” or opportunistically used glass seem to have been selected. The Blume report (1997) has been reviewed elsewhere (Schoepfle 2002). Becker and Mounier (2013) reach somewhat different conclusions. What may be called

pseudo-artifacts have been discussed by several authors Miller 1982, Mallouf 1982, Mounier 2003, 2012a, 2012b).

Gunflint Manufacture: A Category Related to Glass Chipping Technology?

Closely related to the chipping of glass for tools is the often-mentioned pieces of broken glass and nodules of European flinty materials that arrived in North America as ballast utilized by Natives as raw material in the production of traditional tools. The reuse of European gunflints to create artifacts of use to Indigenous populations and also the conjectural use of European flint nodules that supposedly arrived as ships' ballast in the Americas. This ballast flint served as a source of a raw material coming from colonizing countries and was obtained parallel to trade among Native tribes which continued into the Contact period. However, the rare finds of such tools suggest that traditional sources of lithic raw materials were more regularly employed until Native uses for stone had been replaced by metal tools. Natives, as well as colonists, may have made opportunistic use of broken bits of glass to serve as tools, but these ephemeral artifacts appear to have played little role in Native communities' past tool inventories.

Shoreline sites in the Northeast region of North America often include flinty materials from glacial outwash deposits, but colonists, as well as Natives, also may have been using ballast flint to fashion gunflints in the early 17th century, especially after 1635, when true flintlocks became common in armories (Luedtke 1999:29, from Lewis 1956:5). Such incidentally imported flint remains a possible, but inadequately documented, source of raw materials. Artifacts fashioned from ballast flint are almost as rare as artifacts fashioned by Natives from glass.

Loewen (2010) reports on a site in Montreal, Quebec in which a well-defined layer, among "15 clearly defined levels," is dated to after

1683. The six Native-made projectile points recovered include three of local chert, two of sheet copper, and one of "European flint". Flinty materials, supposedly derived from ships' ballast, are often mentioned as the source of post-Contact Native tools. Tools supposedly fashioned from European ballast flint are reported from the Bark Wigwams Site in Massachusetts (ca. 1620-1640) and at a few other sites, such as those noted in Maryland by Curry (Johnson and Bradley 1987:15-16; also Curry 2013). In addition to the four worked glass items reported by Curry (2013) at Maryland's Heater's Island Site (18FR72: ca. 1690-1720), and mentioned above, he found about 40 gunflints fashioned from both English gray and French honey colored flint and many important retouch flakes. Disruptions in traditional trade routes appear to have isolated the Piscataway from flint sources in Ohio and other lithic resource areas. The lack of resource availability/access appears to have led to a presumably Native-made spall type "gunflint" fashioned from local white quartz.

Scientific verification for European ballast as a source for lithics used for Native tools remains elusive. Verification of sources would require chemical characterization of the material, or at least identifying the probable port where it was loaded. The port of origin would need to have these materials readily available, and to be connected by documentary evidence with ports in the Americas. Jack Cresson's experimentation with nodules of what he interprets to be English ballast "flint" recovered from streams in Camden County, New Jersey reveals the material to be generally of poor quality for making gunflints as well as making traditional Native tool types (Personal Communication: Jack Cresson, 1984).

Discussion

This worldwide survey, which began with a focus on the few known finds of Native tools fashioned from glass in Northeastern North

America, reveals that even minimalist and opportunistic use of glass by Natives in this region was extraordinarily limited. The pyro-technology that brought European trade metals to the Northeast region made the use of concurrently available glass as a raw material substitute for bifacially chipped stone tools largely useless. When we expanded our research area from the Northeast, in no part of the world have we been able to find evidence for local Aboriginal population's desire for glass as a raw material to substitute for stone. The desire for, and use of metal for tools, so far as practical applications are concerned exceeded any desire for glass for knives or projectile points

Inquiry into the use of ballast flint calls up a related issue; how was glass chipping or knapping accomplished, and did it vary from traditional methods of flaking stone? Except for replication experiments in Northeast North America, as elsewhere, there is very little archaeological evidence for how knapping was conducted (Cobb and Pope 1998). Many, if not most, archaeological studies gloss over the matter of interpreting flaking debris, while focusing attention on the description of completed artifacts (Crabtree 1972:3; Flenniken and Raymond 1986:604; Frison 1968; Ritchie and Gould 1986:35). The many obsidian knapping and stone working workshops known archaeologically from Central America (e.g., Chiarulli 2012; King 2012) have yielded very little information regarding the techniques used to produce the everyday tools that were part of a culture's inventory.

Within any culture, the use of introduced "industrial" glass as a raw material substitute for modification into tool forms might be expected to be a rapid process, with the chipped glass tools falling into the normal tool-making patterns parallel to those using natural lithic materials (Ahler 1979). In fact, in Eastern North America we find that glass, a human-made material similar to obsidian, had a limited use for tools within any of the

Aboriginal societies. One reason may arise from the relative fragility of glass. Functional glass artifacts, especially knapped bifacial tools subject to rough service, could be expected to break more often than their counterparts in less friable stone. More likely, the metal objects that were concurrently introduced with glass by colonizing groups were found to produce better tips for arrows and more durable edges for other cutting tools. Native maintenance of pre-Contact exchange patterns does not appear relevant as lithic resources used in traditional knapped stone technologies were phased out in most areas of Northeast North America by the 1650s. As metals became available, both glass and stone were more likely to be used opportunistically than as formal material sources for cutting tools. By 1650, gunflints remained the only stone tools with a specific function that could not be replaced by glass copies or by metal replicas.

The relatively low costs of metals in the early 17th-century Eastern United States and the relatively limited range of stone artifacts used by the indigenous population at that time, produced an impressively rapid shift in sought after materials for tool use, archaeologically speaking. This might be compared with the apparently slower decline in stone use in the Levant region of the Middle East, where stone inserts on threshing sleds persisted for thousands of years after bronze tools became common (Greenfield 2013). The role of glass in this Middle Eastern context has not been reviewed.

By and soon after the 1650s, Native use of lithic materials, and presumably any imported glass, for tools in the Eastern United States was generally limited and began to decline. There does seem to be at least one document suggesting Native use of stone (but not glass) tools from southern Delaware in the early Federal period. At the end of the 18th century, an interesting anonymous account appeared in *American Universal Magazine* (Smith and Smith 1797). The observer described the

cypress swamps of the Delaware and Maryland borderlands and remarked that he had spoken with “an old Indian, after I came down here,” at a date that I would place probably between 1765 and 1778 (Becker 2004). The Indian, named Will Andrew (ca 1699- after 1778), implied that the Native use of stone for tools continued until 1750 or later, presumably during Andrew’s lifetime. Andrew also implied that the types of stone being used came in trade from other Indians, suggesting a wider, non-local usage. While the cultural affiliation of Will Andrew is not cited, his use of the term “Wynota” for God, and “kymps” for the devil may provide linguistic clues to the tribal (or possibly Dutch?) origins of this person. The tribal area was Nanticoke, or possibly Sekonese.

Jack Cresson (Personal Communication: 2010) indicates that a great deal is known “about the retooling behaviors of most of the dominant lithic technology phases” from the Paleoindian through the Late Woodland periods in the Northeastern or Middle Atlantic regions. He includes understanding of the technologies involved in generating bifurcates, narrow blade and narrow stem bifaces, and all broad spear types, as they apply to tools made from locally available or commercially traded lithics. One might assume that only Late Woodland technologies would be of interest, but Cresson points out that Native re-use of tools that they found from earlier periods, as well as the later use of broken glass, are part of the skill sets employed by the peoples with whom we are most concerned here; that is, Natives who largely occupied the Northeast and Middle Atlantic regions of North America. The more common functional forms Native inhabitants of these two regions employed using available lithics were knives, perforators, scrapers and projectile points. Our data reveals that archaeologically recovered Native-made glass projectile points are very rare. Glass scraping tools are the more common artifact category when such functional items have been identified as tools. Correct identification of scrapers can be

problematic. A shard of glass may be used as a scraping tool without any preparation, and we consider this expedient usage quite distinct from use of glass to create a traditional bifacial tool form (Becker and Mounier 2013). In Gustave Flaubert’s 1857 classic French novel *Madame Bovary*, Charles Bovary, the physician protagonist, is described as attending to a very prosperous farmer. Flaubert (1857:Part 1, Chapter 2) writes of the scene, “In order to make some splints[,] a bundle of laths was brought up from the carthouse. Charles selected one, cut it into two pieces and planed it with a fragment of windowpane, while the servant tore up sheets to make bandages...”. While fictional, the expedient use of window glass in the French novel is not far removed from parallel chance uses throughout the world. Becker has used shards of window glass to scrape paint from furniture, and quite probably many artisans of the late 1900s resolved basic tool needs with expedient materials.

The paucity of tools chipped from glass at post-1500 CE sites in the New World suggests that there were inter- and intra-cultural values sustained by the use of traditional networks involving procurement and distribution of materials for manufacturing tools. Even in resource-poor regions where glass became abundant after 1600 CE, as in parts of Maryland and coastal Virginia, finds of glass tools are remarkably few. Poplin’s (1986) consideration of “expedient technology” involving glass in European North America takes us back to the great availability of bits of broken glass at all Colonial sites, such as the Printzhof. This Swedish outpost, established in 1643 (Becker 1979, 2011a), generated a large volume of broken glass fragments that were available to Natives as well as colonists. We have noted above that the chipping of glass tools may have been a means by which Native peoples retained a traditional skill even after trade in lithics had ended and good stone types had become difficult to find or unnecessary to acquire. A lack of alternative materials, however, may not be the reason that

broken glass was used as scraping tools in Louisiana, for example, into the twentieth-century (Wilkie 1996, 2000). The availability of an adequate substitute for formal scraping tools provides sufficient motivation for its use in the latter location.

The existence of any aboriginal stone prototypes of Australian Kimberley glass points is a matter of some debate. Harrison (2004a) suggested that while pressure flaked unifaces and bifaces originated in prehistoric times, knapping continued with refinements into the Colonial period, culminating in the renowned glass bifaces that are known as Kimberley points. Yet few, if any, archaeological examples of stone prototypes of Kimberly points are certainly of prehistoric date. Akerman (2008) suggests that the archaeological record is weak because of the reuse and relocation of specimens as hunter-gatherers moved about, or the loss of bifacial prototypes while out hunting. Akerman (2008) also notes that male bower birds (*Chlamodera nuchalis*) snatch colorful stone tools and flakes from campsites to use in their “nests” as attractants to females. Examples of points said to be in the Kimberley tradition, apparently including some made of stone, supposedly have been observed in such secondary contexts. Reports are rudimentary, with few points of the Kimberley style documented from any sites predating 1831. After this date, colonists opened the countryside and incidentally created a market for Native-made trinkets. In his treatise on glass flaking at Australia’s Port Essington, Allen (2008:86) found that the transition from stone to glass artifacts was accomplished with little alteration in either technique or finished product. More likely, trade to collectors provided the impetus for the reproduction of glass “tools”. We suspect that a 6.1-centimeter serrated glass blade (Cat. N. 61.12497) at the Gilcrease Museum in Tulsa, Oklahoma is a North American parallel to Australia’s Kimberley tradition. The catalogue card for the Gilcrease piece speculates that it derives from Cahokia – or the Mississippian culture

(1100-1300 CE) of Illinois. Not only does the general appearance of this “blade” appear unlike any other known tools from the Illinois region, but the lack of similar examples suggests that this is a modern creation.

For archaeologists, the discovery of a single example of Native-chipped glass may be interesting, but it is not particularly revealing in and of itself. In some cases, the find may aid in assigning a date to a site. However, only when seen in a greater context can the use of glass for tools by Natives provide insight into culture and cultural process. This review is intended to reinforce the current understanding of cultural processes such as those that Cobb (2003) collected. The unusually late dates that are associated with some chipped glass finds in the Northeast are no longer surprising, but they remain exceedingly rare. This is despite documentation for the continued occupation of Native peoples in New Jersey, still using their own Native language and foraging lifestyles, into the late 1800s (Becker 2011b, 2011c). With the breakdown of traditional Native exchange systems in Northeastern North America after European Contact, usual sources of lithic materials may have been disrupted and the need for stone tools, such as arrowheads or knives, concurrently waned as imported metals became more available. The continuing, albeit sparse, discovery of Native-made chipped glass implements at sites spread over a wide part of the Northeast reveals that the region’s Native inhabitants continually adapted to whatever situations came to them, and lived to provide records of continuity as well as change.

Conclusions

The use of bottle glass by Native Americans, in addition to or in lieu of traditional stone resources, in Northeast North America must have begun very early in the Contact period but the actual need for such tools was minimal. The few known examples of chipped glass tools appear to have been made during

the period after 1600. Traditional chipped stone technology expanded to include glass as part of the Terminal Late Woodland inventory, ca. 1600-1750. Traditional forms of chipped stone tools and Late Woodland triangular arrow points appear to have been superseded by the 1650s with metal versions. Glass bifacial tools of traditional form never became a regular part of the archaeological record. The general evidence suggests that limited aspects of traditional chipped stone tool manufacture technology may have continued into the 19th century, but chipped glass artifacts at 20th century sites in the Northeast invariably involved the opportunistic use of broken glass as scrapers, made and utilized by Natives and colonists alike (e.g., Maki and Arnott 2019; Flexner and Morgan 2013; see also Morgan 2008).

In several parts of the world, the economic adaptation of industrial materials to the fabrication of traditional tools, and particularly of weapon tips, for the tourist trade reveals the wonderful adaptability and improvisation of humans. In some regions, such as Patagonia and Australia, Native stone knappers applied age-old techniques on industrial glass or ceramics materials to produce items whose utility was limited almost entirely to their sales appeal as curios. Perhaps the same occurred in the Northeast region of the United States. Adapting to changing conditions is one of the marvels of human culture; a trait still in evidence. With increasing interest in flaked stone tools as curios in the modern world, a new industry also has arisen on the Indian subcontinent — the mass production of arrowheads or animal forms fashioned from a wide range of cryptocrystalline materials (<http://www.alibaba.com/showroom/arrowheads-for-sale.html>)!

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