

A Guide for Native American Objects with Glass Deterioration

by Robin O'Hern and Kelly McHugh

Introduction

Virtually every culture group in North America used or is using glass beads to create designs for adornment, to communicate identity, or for protection and spirituality. The beads themselves and the designs they create are essential parts of the objects that contain them. Glass beads affected by glass disease can have an altered visual appearance or structural damage that causes partial or complete loss (fig. 1).

The preservation of the object and its beaded designs is an integral part of maintaining and communicating the cultural knowledge associated with that object. Unlike other items of cultural patrimony where degradation is inherent or accepted, retention of the beaded designs and coloration is a cultural necessity. Whether it is a beaded dress, baby carrier, gun case, or bag, without the beads, the object has lost its ability to communicate or protect.

Given the cultural importance of glass beads, how can conservators preserve them and address glass deterioration? This article presents a brief overview of research conducted at the National Museum of the American Indian (NMAI) on deteriorating glass beads and their treatment (O'Hern and McHugh 2014). It will address some of the most frequently occurring questions about glass disease, such as how common it is, what the most susceptible colors are, and what can be done to treat deteriorating beads. Our hope is to improve the preservation of collections with Native American beadwork by raising awareness of the pervasive issue of glass deterioration.

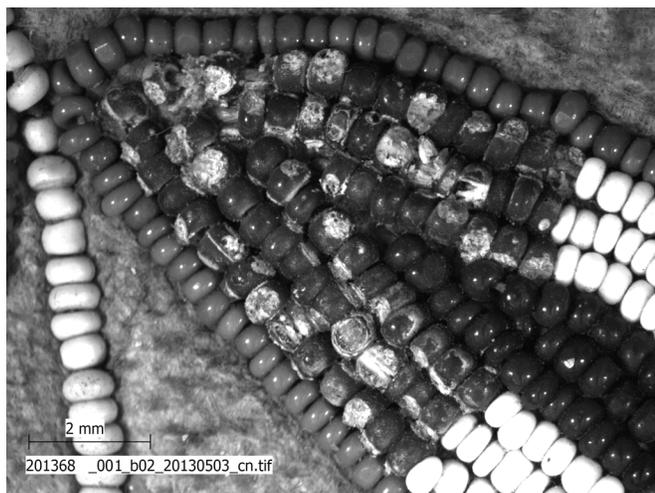


Fig. 1. Image of white heart beads with unstable glass on a glove. National Museum of the American Indian, Smithsonian Institution

Glass Trade Beads in North America

Beads made from locally sourced or traded natural materials, such as bone, shell or teeth have been used by people of North America for thousands of years. Glass beads imported to North America came from Venice, Bohemia (now the Czech Republic), Holland, England, France, China, and other countries. Glass beads are made

using several different techniques, including but not limited to drawn, wound, mold-pressed, and hollow blown (Sprague 1985; Dubin 2009; Karklins 2012).

The introduction of glass beads exponentially increased the opportunity for broader and more sophisticated visual articulation. In the Plains, glass beads quickly replaced traditional forms of adornment like quillwork, which were laborious and time consuming (Dubin 2009).

The preservation of glass beads is inextricably linked to the preservation of Native American cultural material, and therefore the mechanisms of deterioration and treatment must be examined and well understood.

What is Glass Deterioration

Scholars and researchers use many different terms to describe unstable glass, including glass disease, glass illness, glass deterioration, sick glass, weeping glass, sweating glass, and crizzling glass.

Glass deterioration begins when hygroscopic components from within the glass migrate to the surface and form salts, leaving behind voids in the glass, which can cause structural damage. Visually, unstable glass will develop a fine network of cracks (crizzling), a white crystalline growth on the surface, aqueous or oily surface droplets (weeping), pitting, or fracturing.

The deterioration of glass beads occurs as a result of the chemical composition of the glass, the use-history of the object on which they are attached, the environmental history of the object, or the substrate (e.g. hide) (Fenn, 1987; McHugh and Carroll 2001; Kunicki-Goldfinger 2008). (fig. 2).

Unfortunately, the process cannot be stopped once it begins, only slowed down by maintaining stable and low relative humidity conditions and removal of the surface salts (Koob 2006; Kunicki-Goldfinger 2008).

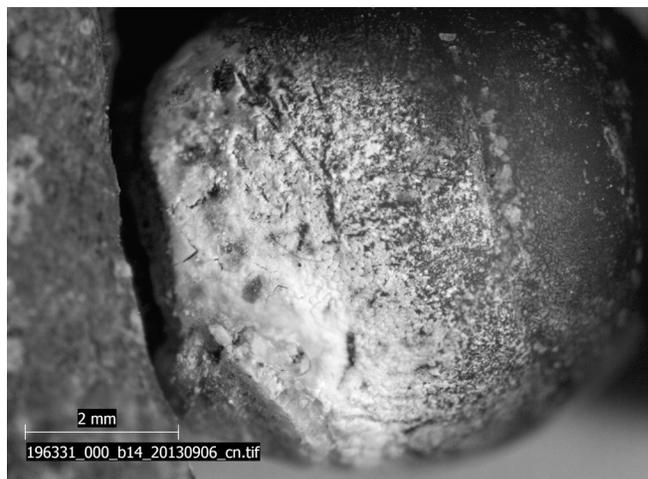


Fig. 2. Detail image of beads developing glass disease where they are in contact with leather on a Plains Breastplate. National Museum of the American Indian, Smithsonian Institution

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How Common is Glass Deterioration?

On average, what percentage of a collection with glass beadwork will have deteriorating glass beads? The published literature was searched for other surveys of deteriorating glass beads and glass collections that assessed percentages of unstable glass. Three published examples of collection-wide glass surveys (Oakley 1990; Cobo del Arco 1999; Fusco and Speakman 2010), and our own survey of records at the NMAI revealed a range between 13.5 – 25% of the collections that are exhibiting signs of deterioration. Our work at the National Museum of the American Indian indicates that 25% of objects at this institution with glass beads and conservation records have a history of unstable glass.

What Color of Beads are Most Likely to Deteriorate?

We analyzed the data in the conservation records for objects that included the words “glass disease” or “bead disease.” The beads on these objects were summed by color and then the percentage of each color identified as having unstable glass was calculated (graph 1).

The blue beads are much more likely to have a record of glass disease (68%), followed by the red beads (48%) and then black (30%). The information in this graph does depend on the conservators accurately reporting which beads have glass deterioration as well as on their naming each of the colors of beads on the object in their treatment report. Lovell (2006, 37) also found that “certain colors of beads – namely blues, reds, and black – tend to be more susceptible to glass disease.” The composition of these bead colors make them susceptible to deterioration, as all tend to have lower amounts of calcium oxide in their composition, for reasons that depend on the color.

Copper oxide creates different colors in glass, ranging from blue to green. The composition that results in a blue color requires reducing the calcium oxide, therefore rendering the glass susceptible to deterioration (Weyl 1959, 164; in Hancock, Chafe, and Kenyon 1994).

The red beads surveyed tend to be translucent rather than opaque. Their susceptibility to deterioration can be explained by the reduction in calcium oxide that allows the glass to be translucent or transparent.

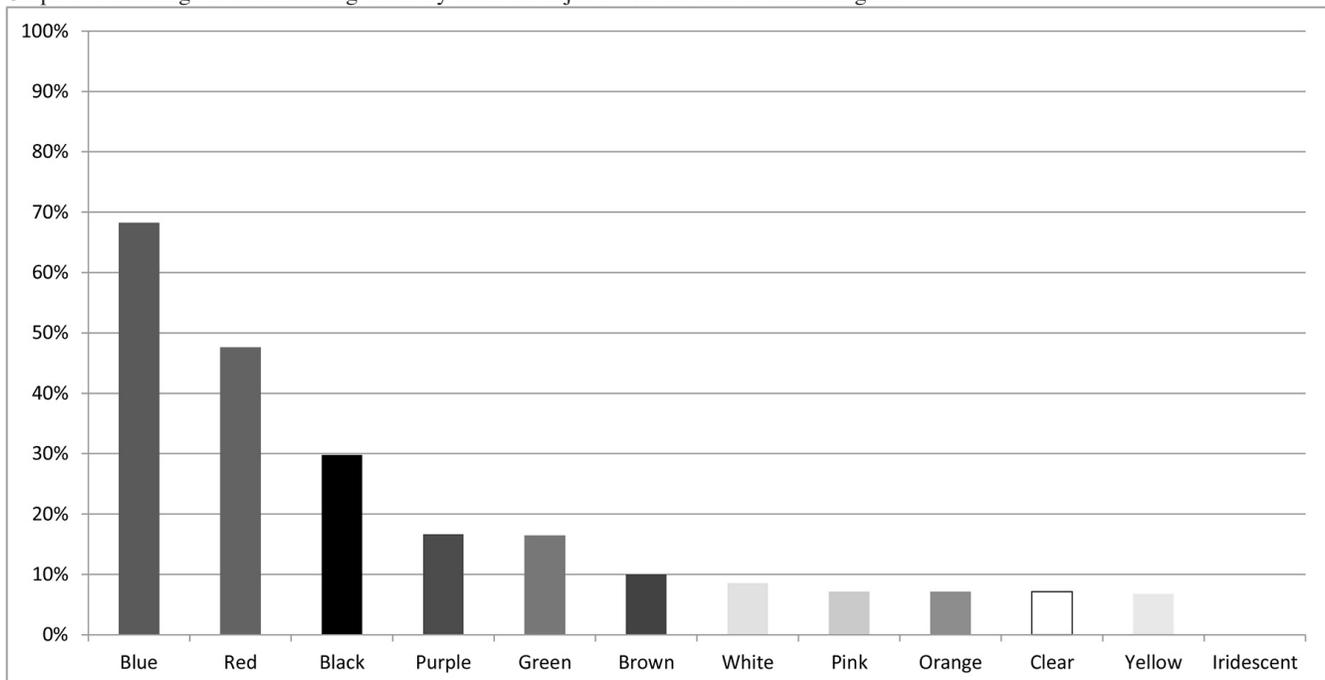
An explanation for the high deterioration rates for black beads is harder to establish but is likely also related to reduced calcium content (Karklins et al. 2002). Further analysis of the unstable and stable glass beads is recommended to improve understanding of the factors leading to their deterioration. (see O’Hern and McHugh 2014 for more information).

How Do I Determine if Glass Disease is Present?

Visual examination is commonly the first method of recording condition. One looks carefully at the beads, often with magnification, to identify the signs of glass deterioration described above. Unfortunately with visual examination there is the potential to misidentify glass deterioration due to a dusty surface, culturally applied kaolin, or other factors.

We found measurement of the pH on the glass bead surface essential for determining whether the bead has alkaline surface salts present, or culturally applied kaolin, or just a matte surface (Lougheed 1988; Sirois 1999; Lord 2001, 129; Smith 2006; Lovell 2006, 37).

Graph 1: Percentage of deteriorating beads by color on objects with records of unstable glass



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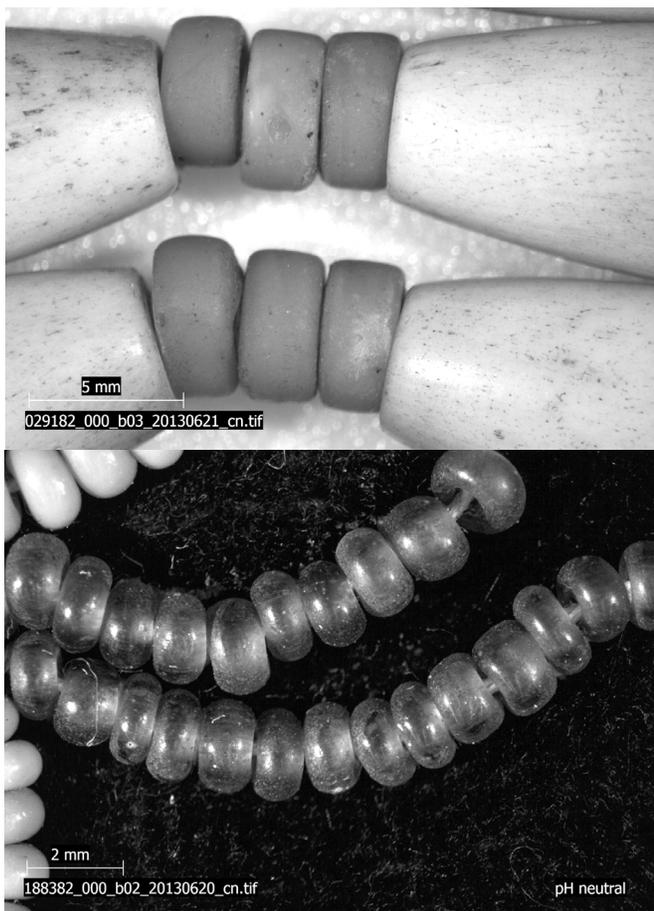


Fig. 3. Top, a Northern Athapaskan Necklace with unstable glass beads that initially appear stable. Bottom a detail from an Anishinaabe (Chippewa/Ojibwa) Man's leggings that appear to be deteriorating but are actually stable.

Matte surfaces with neutral pH may be from manufacture, a sign of previous glass disease damage that disrupted the surface but has not reoccurred, or a result of wear (fig. 3). Alternatively, it can be difficult to see the glass disease present on some beads, in which case an alkaline pH can alert the researcher to its occurrence. Therefore, measuring the pH of all the bead colors on an object is an essential practice.

We used the following technique for measuring pH:

- Cut tiny rectangle of ColorpHast paper (pH 6.5 – 10.0)
- Moisten paper with deionized water
- Tap on towel to draw off excess moisture
- Place and hold on bead for 3 sec
- Evaluate color change of pH paper

The color change – or lack thereof – of the pH paper indicates a surface pH close to neutral and stable glass. A pH of 8 usually corresponds with barely visible surface salts, and a pH of 9 or greater usually occurs when the salts are clearly visible on the bead surface.

How Do I Clean Unstable Glass?

Clearing surface salts from the glass bead can help to prevent additional deterioration by reducing the pH and removing hygroscopic components. When cleaning Native American beadwork, it is important to consider whether the surface grime is soiling or if it is a traditionally applied material like red ochre or kaolin (a type of white clay), which would not be removed from the object at the NMAI.

Conservators begin the cleaning process with mechanical techniques like vacuuming while brushing or using cosmetic sponges (non-latex polyurethane foam), which are least likely to cause damage (Doyal 2001; Frisina 2004). The next step is the use of water or solvents, which should only be undertaken after testing the surrounding materials for adverse effects. Deionized or distilled water and ethanol have distinct advantages and disadvantages depending on the bead, substrate, and other factors (Table 1). While the glass bead literature strongly recommends using ethanol over water, a 2006 survey of conservators found that most choose water as their cleaning method (Lovell 2006, 62).

We conducted a survey of a group of objects at the NMAI that had been cleaned with water, ethanol, or 1:1 water: ethanol to learn how beads treated with the different techniques re-develop glass disease differently (O'Hern and McHugh 2014).

Twenty-one objects with red beads and 38 objects with blue beads were surveyed to assess their current condition. Each of these objects had a history of glass disease on blue and red beads and a documented conservation treatment that involved cleaning with either water, ethanol, or 1:1 water:ethanol. All of the treatments occurred between 1994 to 2011 in preparation for exhibitions and loans by the NMAI.

The use of water, 1:1 water: ethanol, and ethanol were examined and it was found that while there was no clear frontrunner, beads cleaned with ethanol had the lowest rate of return: 50% of objects with beads cleaned with water had glass deterioration return, 52% of objects with beads cleaned with 1:1 water: ethanol had glass deterioration return, and 47% of objects with beads cleaned with ethanol had glass deterioration return.

When the objects cleaned with ethanol are compared over the same time with the objects cleaned with 1:1 water:ethanol, then the rate of return of glass deterioration for beads cleaned with ethanol decreases slightly to 42%. It should be noted, however, that the rate of return could be influenced by more than just solvent choice alone and likely depends on how clean the beads became, the substrate or sewing material (Carroll and McHugh, 2001), method of manufacture (Sirois 1999, 85), or other factors (O'Hern and McHugh 2014).

Our research does seem to indicate that beads cleaned with ethanol are slightly less likely to re-develop glass deterioration.

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Table 1. Advantages and Disadvantages of Each Treatment Material

Material	Advantages	Disadvantages
Deionized or Distilled Water	Preferred for cleaning vessel glass Effectively removes surface salts (Newton and Davison 1989; Ryan et al. 1996 Oakley 2001; Koob 2006; Smith 2006)	Can cause staining or tide lines on the substrate material Can corrode nearby metal beads May create a micro-environment around the thread facilitating glass deterioration Can break weakened beads through the expansion of the moistened thread (Louheed 1982; Loughheed 1988; Stone 2010)
Ethanol	Does not cause corrosion of metal beads Does not create a microenvironment around the threading material Does not play a role in facilitating bead deterioration May help to solubilize fatty components of surface accretions (Loughheed 1988; Doyal 2001; Lord 2001)	Can displace the moisture in the glass Can reveal the full extent of crack development May solubilize components of the backing material or substrate (Ryan et al. 1996; Koob 2006; Smith 2006)
1:1 Deionized or Distilled Water : Ethanol	Effectively removes surface salts Dries more quickly than water alone May help to solubilize fatty components of surface accretion (Stone 2010; Grabow 2011)	May cause staining May corrode nearby metal beads Can still create a humid microenvironment (Stone 2010)

How Do I Monitor Change Over Time?

With any condition issue, it is important to monitor the status of the object over time. The evaluation of change in the quantity of white deposits on a bead's surface is subjective in the case of glass disease due to environmental, viewer, and documentation factors.

The appearance of glass deterioration products depends on the relative humidity at the time of surveying. If the relative humidity fluctuates around the deliquescence point of the salts, then the salts can appear as crystals one day and droplets the next. As part of our research project described above, we assessed change by comparing an image or description of the beads' previous condition with a visual examination and pH measurement of their current condition. In most cases, the prior documentation images were not sufficiently detailed to determine whether more beads had white salts on them or whether the deteriorating beads had more salts present.

Our experience surveying previously treated objects helped to identify some best practices to facilitate evaluation of change over time:

- A dated detail photo with the location marked on an overall image.
- A record of pH measurements that includes the color of the bead tested, date of test, and testing locations marked on a photo.
- The development and use of a visual glossary for glass deterioration products as they appear on objects in the collection. This will help any written documentation to remain consistent across viewers (for an example, see O'Hern and McHugh 2014).

- When taking photos or recording pH, include the relative humidity in the documentation. This is especially true if the relative humidity fluctuates in the collection area.

What Are the Best Storage Practices for Unstable Glass?

Maintaining specific stable environmental parameters is the best method for the long-term preservation of unstable glass. The recommended parameters vary slightly amongst the scholars who have published recommendations but in general range from 35 – 40% relative humidity (Oakley 1999; Oakley 2001, Koob 2006, Sirois 1999, Loughheed 1988). However these relative humidity parameters may be too dry for the safe storage of adjacent leather or threading materials. Encouraging air circulation around an object may also help to thwart the redevelopment of deterioration products by preventing the formation of microclimates.

Conclusions

Glass beads are integral components of Native American objects and have a cultural importance larger than their role as decoration. Preserving glass beads from glass deterioration is significant for the long-term maintenance of cultural knowledge communicated by the beaded design.

The wide range of factors that can influence the development of glass deterioration can make the preservation of beaded objects difficult. However, the general trends highlighted by this article may help to guide future preservation efforts and museums with Native American collections. It is the hope of these authors that the development of standardized protocols for assessing the presence of glass deterioration and monitoring condition change over time will substantially improve the preservation of beaded objects.

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