Archaeological Evidence of Pottery Repairing

Stanley South

University of South Carolina - Columbia, stansouth@sc.edu

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Since pottery fragments are of primary interest to the archaeologist in establishing temporal relationships, he frequently finds himself involved in statistical treatment of the sherds he recovers. Whenever possible he glues the fragments together to determine the form of the vessels. Through restoring to its original form a clay pot made perhaps by an Indian woman a thousand years ago, he sometimes finds drilled holes on each side of a crack that had apparently occurred before the vessel was completely broken and discarded. These holes have been interpreted as patching holes, through which a thong of sinew was passed, allowing the vessel to continue to be used, perhaps for storage of dry materials. Such holes reveal that the archaeologist was not the first to repair that particular vessel.

Archaeologists have found clay vessels representing numerous components, covering thousands of years in time, that were once repaired by drilling holes on each side of a crack. From this fact the question arises as to how long this practice of repairing pots has been used among North American Indian groups. The answer would be in terms of several thousand years, at least. Evidence for this is seen in steatite vessels from the Archaic Period having drilled repair holes similar to those found on the later clay vessels. One such vessel is on exhibit in the Natural History Museum at the Smithsonian Institution. From this we might say that the Indians have been repairing pots, by drilling holes, perhaps almost as long as they have had pots. Wooden bowls, of course, could easily be repaired in the same...
manner, and a long history of repairing of wooden vessels may have existed among Indian cultures, evidence for which we do not have.

The historic site archaeologist might be brought to an awareness of the mending of vessels by drilling of holes on each side of the break, by finding fragments of mended porcelain, or possibly delft or faience, on the site he is excavating. In the ruin of the eighteenth century Hepburn-Reonalds House ruin in Brunswick Town, North Carolina a fragment of an Oriental porcelain bowl rim was recovered, having a brass plate through which two copper rivets were fastened through holes on each side of a crack. The brass plate measured three-quarters of an inch long and three sixteenths of an inch wide, with the rivets one-half inch apart. On the inside a small cone-shaped copper washer had been fastened over each of the rivets and then the rivet was hammered over the washer to provide a tight fit. If the crack was a long one, a number of such rivets would, no doubt, have been used. While the exterior of the vessel so mended would have a fairly attractive appearance due to the smooth brass backing plate, the interior was somewhat unsightly due to the presence of the two rivet heads with attached cone-washers, plus the fact that when the hole was drilled entirely through the steel-hard porcelain, concoidal fractures occurred around the holes on the inside of the vessel. Nevertheless, the bowl was patched, and further service was obtained from the vessel by the owner due to this repair.

At "Russellborough", the home of the royal governors at Brunswick Town from 1758 to 1770, an overglazed enamelled porcelain handleless teacup was recovered that had been repaired with no less than ten drilled holes. The heat of the fire that destroyed the building in 1776 was such that the rivets had been melted from the holes, and no indication of what they had been was found. The holes were again characterized by the typical concoidal fractures
around the opening, caused by the process of drilling the very hard porcelain.

At the eighteenth century site of the Fortress of Louisbourg, Nova Scotia, archaeologists have recovered a number of examples of mended vessels. John Dunton reports that these were French coarsewares and faience, and all were of the simple wired type, with holes drilled on each side of the break through which iron, brass or lead wires were inserted and then twisted to tighten, a simple method, reminiscent of that used by the American Indians using sinue.

From the archaeological evidence seen here it is clear that patching of broken vessels was practiced on eighteenth century ceramics. From an advertisement in the Pennsylvania Chronicle of April 20, 1767, placed by Daniel King a brass-founder and brand-maker we find that besides his brass wares he advertised that "He also rivets broken China, in the neatest Manner." This indicates that brass-founders were the craftsmen that were, sometimes at least, making these ceramic repairs. Tinsmiths and tinkers also likely turned their talents to this endeavor as the occasion demanded.

Something of the history of china mending is revealed by Parsons and Curl in their book China Mending and Restoration. They say:

1 John Dunton, personal communication.
2 Pennsylvania Chronicle, April 20, 1767.
China in daily use comes in for the severest tests and hard use.

Riveting has long been the traditional method of mending it, which is the science of holding broken pieces together without adhesives. It is an ancient craft; a form of riveting was practiced in China as early as the seventeenth century. It took Europe by storm in the nineteenth century when it became so popular that riveters paraded and embellished rather than disguised their rivets. Later craftsmen learnt to do work that was both efficient and discreet, but it is the samples of clumsy, ill-proportioned riveting that have formed prejudice against the craft, and recent scientific development in adhesives has led many people to believe that riveting is now obsolete.  

The craft of repairing by riveting is not obsolete, as these authors point out. Since period china is irreplaceable, it becomes more and more important that necessary repairs on frequently used pieces be done with the greatest professional care. Riveting is ideally suited for wares that must come into daily contact with steam and detergents, since no adhesive is used. All adhesives have a limited life, whereas the riveted repair will last as long as the vessel. Since riveting was practiced both in the eighteenth century on vessels of the period, and by nineteenth century and twentieth century riveters, it is important that museums that utilize the services of riveters make a record of when the repairs were carried out and by whom, so that there will not be a confusion as to when the repairs were carried out. This writer has found examples of repaired eighteenth century vessels in museums where no record of the repair existed except in the memory of the curator who recalled that some years ago a man was employed to do this type work. No one had thought to record that it was done or by whom, and from the appearance of the riveted repair, it might well have been done in the eighteenth century.

Parsons and Curl reveal all the most minute details of the riveters craft, pointing out that the work of repairing a broken vessel must be done in the lap, and that in this regard females might have more difficulty than males since a bosom is no asset at all, the worker needing "a clear and unobstructed view of what is going on in the lap." Once the worker has an unobstructed view of his lap, he uses a Chinese string drill, operated by the fingers of one hand, to bore holes into the surface of the porcelain, producing a flat bottomed hole with sides at a fifteen degree angle away from the cracked edge. The drill bit is a small chip of diamond fitted into the end of a spindle. With less than one hundred strokes of the Chinese string drill a hole sufficiently deep to accommodate a rivet can be made in porcelain. The rivet looks like a modern staple, though thicker, and with short arms. It is made from half-round brass wire by shaping with pliers. The short arms are cut so as to fit snugly into the holes on opposite sides of the crack in the vessel. The arms of the rivet are bent slightly inward. One arm of the rivet is then placed into one of the drilled holes, and through pressure applied to the back of the rivet the other arm is snapped into the second hole. Thus, under pressure, the rivet always exerts an inward pull on each piece of the vessel, and when a sufficient number of these rivets are in place the vessel is repaired in the strongest manner, and will withstand the usual handling and exposure to steam and detergents without leaking or coming apart.

5 Ibid., pp. 35-44.
The advantage of this method of riveting as opposed to those specimens from Brunswick Town and Fortress of Louisbourg where the hole was drilled entirely through the wall of the vessel, is the fact that here the interior of the vessel is left entirely free of any blemish caused by rivet heads or by twisted wires. An elaboration of this riveting method reported by one who was a resident of China for many years is used by craftsmen there in repairing porcelain vessels, allowing no rivet to be seen on either side of the repaired vessel. This method is the same as described above by Parsons and Curl for drilling the holes and inserting the rivet, but with the added feature of both holes being connected by a slot. The rivet is then inserted into the holes, but instead of lying on the exterior face of the vessel, it is countersunk below the surface in the slot. The porcelain dust is carefully saved during the drilling operation and mixed with an adhesive, and this mixture is used to fill over the rivet, providing not only a very strong repair, but allowing the rivets to become invisible.6 This improvement, practiced in China a few decades ago, and probably still in use there today, would seem to be the ultimate development in the technique of repairing vessels by means of drilling holes on each side of the break, a technique used by man for thousands of years in his efforts to salvage for further use an accidentally broken vessel.

6 Mrs. Frank Albright, Old Salem, North Carolina, personal communication.
Repaired Ceramics from Eighteenth Century Sites

Oriental Porcelain from Brunswick Town, North Carolina

Over-gaze Enamelled Porcelain from Brunswick Town

Faience from Fortress Louisbourg, Nova Scotia

Lead-glazed Earthenware from Fortress Louisbourg

Faience from Fortress Louisbourg


Over-gaze Enamelled Porcelain Bowl at the Smithsonian Institution with Twentieth Century Rivet Repair.
The archaeologist uses glue to restore to its original form the Indian pot whose owner effected his own repairs by means of drilling holes. This use of glue by the archaeologist points out the two basic methods of repairing pottery, riveting and "sticking" or gluing. We have discussed the riveting technique as seen through a few artifacts recovered from archaeological sites, and would now like to mention the second technique, gluing. The archaeologist is familiar with this method, and many have had to re-glue vessels that have originally been repaired with an acetone solvent glue after it fell apart in his hands, having been in storage for some time.

This paper is not designed to enter into all the aspects of pottery gluing, but will simply point out some observations, and two examples of eighteenth century gluing archaeologically recovered.

Acetone solvent glues form a hard film which is effective for gluing together many objects. However, earthenware is highly susceptible to changes in moisture in the air, and when the weather is damp it takes on moisture, when it is dry it gives off moisture. This "breathing" effect, of moisture passing in and out of fired earthenware, affects the glued joints of vessels restored with acetone solvent glues. In dry weather the moisture passes from the earthenware sherd into the air, and where there is a glue joint, it abuts against the hard film of waterproof glue. In so doing the hard film of glue is gradually loosened from its bond with the earthenware, and when such a vessel collapses, the glue joints can be easily pulled away from the sherds as a hard transparent film. This situation is familiar to archaeologists who have had this happen, and is most disconcerting. In air conditioned buildings the problem is not so great, but in areas where the humidity is high, this can become a significant problem.

What is the answer? Suppose that a water-soluble glue was used, then
when moisture was taken into the earthenware or given off, it would similarly affect the glue joints, allowing for expansion and contraction of these at the same rate as that in the earthenware. Therefore, there is no separation between the glue joint and the earthenware sherds due to differential expansion and contraction as well as differential rates of moisture absorption. The result is that such a glue does not release its bond after prolonged storage under high humidity conditions as does glue with an acetone solvent base. Therefore, white glue such as Elmers or Weldwood has proved to be an excellent bonding agent for large earthenware vessels. It becomes tacky very quickly, and therefore will allow almost continuous restoration on large vessels such as amphora or large oil storage jars. It is highly recommended for this type gluing. On stonewares, however, where there is no absorbancy of the sherds of the moisture in the glue, it is not quite so satisfactory. Once set, however, it again is much superior in holding power to those vessels bonded with acetone solvent glues.

At Brunswick Town, in the ruin of the Public House-Tailor Shop, burned in 1776, a fragment of Oriental porcelain had a film of what appeared to be glue along some of the edges, providing evidence that the piece had possibly been repaired by this method.

Another interesting use of the gluing technique in the eighteenth century is to repair broken Oriental porcelain and white salt-glazed stoneware vessels was recovered during excavation of the pottery shop ruin and other ruins at Bethabara, North Carolina, an eighteenth century
Moravian settlement. The potter Gottfried Aust was found to be using a green glaze on broken porcelain and stoneware vessels, which, when fired, would produce a green joint along the original break, but resulted in an effective repair of the vessel.

Parsons and Curl report that:

Recent research in synthetic-resin preparations — adhesives, compositions, glazes — has lifted china mending to new levels of efficiency...7

It is interesting to note that Gottfried Aust had conducted his own research between 1755 and 1771 at Bethabara, and found that he could use glazes to effect successful repairs, and thus raise his own china mending to a new level of efficiency. One wonders if this was an innovation of Aust's, or if this was a common practice of potters of the day. If archaeologists will look for and report on Oriental porcelain and European stonewares with glaze along the edges of fragments found in their excavations, eventually we may be able to learn whether this technique of pottery repairing was an innovation of the master potter Aust, or was rooted in a broader base among eighteenth century potters in America.