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RESTAURACIJA NOVOVJEKOVNE STAKLENE ZDJELICE IZ PULE

THE RESTORATION OF A MODERN AGE GLASS BOWL FROM PULA

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UDK 7.025.4:<904:642.727.2-033.5>(497.5 Pula)“654”
Stručni članak
Primljeno: 16.7.2013.
Odobreno: 18.9.2013.

UDC 7.025.4:<904:642.727.2-033.5>(497.5 Pula)“654”
Professional paper
Received: July 16, 2013
Approved: September 18, 2013

U ovom članku opisuju se postupci restauratorskog zahvata na novovjekovnoj zdjelici, pronađenoj prilikom zaštitnog arheološkog istraživanja nalazišta u Usponu sv. Franje Asiškog, tzv. Bloka 11/22 -23, u Puli. Naglasak je stavljen prvenstveno na metode restauracije stakla, postupku lijepljenja nadogradnje te retušu.

KLJUČNE RIJEČI: novovjekovna zdjelica, restauracija stakla, reverzibilnost, rekonstrukcija (nadogradnja), degradacija stakla, retuš, Pula

This paper describes the restoration interventions on a Modern Age bowl that was unearthed during the rescue archaeological excavations on the site at Uspou Sv. Franje Asiškog, so-called Block 11/22-23, in Pula. The accent was placed primarily on the methods of glass restoration, the bonding procedure for the newly reconstructed parts, and the retouching of same.

KEYWORDS: Modern Age bowl, glass restoration, reversibility, reconstruction (gap-filling), degradation of glass, retouching, Pula

UVOD

Tijekom 1994./95. godine obavljano je zaštitno arheološko istraživanje između jugoistočnog ugla Foruma i crkve sv. Franje, na parceli Uspona B. Lupetine u Puli, tzv. Blok 11/22-23, unutar starogradske jezgre. Blok 11/22-23 po katastru grada Pule današnji je Uspon sv. Franje Asiškog.

Na tom je višeslojnom nalazištu bila planirana izgradnja nove građevine, stambeno-poslovnog objekta Istragradnje (Ujčić 1995, 11).

Tijekom istraživanja pronađeni su ostaci građevina koje pokrivaju dugi period urbanog razvoja Pule. Otkriven je veliki broj zanimljivih arhitektonskih i arheoloških predmeta, keramičkih, metalnih, kamenih i staklenih. S obzirom na količinu pronađenih ulomaka, dio predmeta još čeka na potpunu restauratorsku obradu. Stoga su mnogobrojni stakleni ulomci preuzeti u Restauratorsko-konzervatorski odjel Arheološkog muzeja Istre znatno kasnije u odnosu na vrijeme iskopavanja.

OPIS PREDMETA

Zdjelica, tema ovog članka, izrađena je od bezbojnog stakla, zaobljenog je ruba, poluloptastog tijela koje je ukrašeno okomitim staklenim nitima mlječno bijele boje. Visine je 4,6 cm, promjera 11,6 cm, debljine stijenke 0,3 cm.

Tehnika dekoracije staklenim nitima koristila se za ukrašavanje staklenih perli i raznih staklenih recipijenata (zdjela, boca). Postupak dekoracije staklenim nitima predviđa da se na obrađeni predmet apliciraju užarene staklene niti koje se izvlače iz lončića uz pomoć kratke i tanke alatke zvane "pontil" (*pontello*). One se potom oblikuju spiralno, postavljaju okomito ili u obliku raznih ukrasnih motiva. Staklene niti mogu biti reljefno izrađene ili izjednačene s vanjskom površinom stijenke predmeta. Upravo ove nove tehnike dekoracije (aplikacija staklenih niti - *fili applicati*, aplikacija staklenih kapi - *gocce applicate*, mrežasti filigran - *filigrana a reticello*, tordirani filigran - *filigrana a retortoli*) koje su se pojavile početkom 16. stoljeća omogućile su pretpostavku datacije rebraste zdjelice u 16. st. (Barovier Mentasti 2004).

RESTAURACIJA PREDMETA - METODOLOGIJA RADA

Općenito je rad na staklenim predmetima vrlo zahtjevan, bilo da se radi o čišćenju, spajanju ulomaka ili o rekonstrukciji. Stakleni predmeti koji potječu iz arheološkog konteksta većinom karakteriziraju tanke stijenke te su zbog toga lako lomljivi. Ne bi li restauracija bila uspješna, između ostalog potrebna je i spretnost samog restauratora (Prpa - Stojanac 2012).

INTRODUCTION

During 1994/95, a rescue archaeological excavation was performed between the southeastern corner of the Forum and the church of St. Francis, on a plot of land at Uspona B. Lupetine in Pula, so-called Block 11/22-23, in the old section of the town of Pula. In accordance with the cadastral register of Pula, Block 11/22-23 corresponds to present-day Uspon Sv. Franje Asiškog.

A new edifice was supposed to be built on this multi-layered site, a residential-commercial structure belonging to Istragradnja (Ujčić 1995, 11).

The remnants of structures that cover a long period in the history of the urban development at Pula, were discovered in the course of the ensuing exploration activities. A large number of interesting architectonic and archaeological objects were unearthed, which were made of pottery, metal, stone and glass. Some of these objects still await a thorough restoration, due to the sheer quantity of unearthed fragments. Many glass fragments were therefore brought to the Restoration-Conservation Department of the Archaeological Museum of Istria at a much later date with respect to the time of their excavation.

OBJECT DESCRIPTION

The small bowl that is the subject of this paper was made of colorless glass, it has a rounded edge, and a hemispherical body decorated with vertical glass threads that are milky white in color. It is 4.6 cm high, with a diameter measuring 11.6 cm, and it has a wall thickness of 0.3 cm.

The glass thread decoration technique was used to decorate glass beads and various glass receptacles (bowls, bottles). The glass thread decoration procedure requires the application of red hot glass threads onto the desired object. These threads are drawn out from a pot with the help of a slender tool called "pontil" (*pontello*). They can then be spirally formed, placed vertically, or in the shape of various decorative motifs. These threads can be placed in relief onto the surface of the wall of an object, but they can also be leveled with its outer wall surface. It was these new decorative techniques (application of glass threads - *fili applicati*, application of glass drops - *gocce applicate*, reticular filigree - *filigrana a reticello*, twisted filigree - *filigrana a retortoli*) that appeared at the beginning of the 16th century, which facilitated the dating of the small, ribbed bowl into the 16th century (Barovier Mentasti 2004).

Već pri samom utvrđivanju predmeta, odnosno češće ulomaka, temeljem makroskopskog promatranja donose se prvi zaključci. U konkretnom slučaju ustanovljeno je da staklo nije krhko te da stijenke nisu pretjerano tanke. Također, nije bilo vidljivih znakova degradacijskih procesa oslobađanja alkala (sode ili potaše), koji se inače nalaze u vezama trodimenzionalne mreže amorfne kristalne rešetke stakla.

Inače, oslobađanje alkala pokazatelj je neprikladnih i promjenjivih vrijednosti uvjeta u kojima se staklo nalazilo, u ovom slučaju tla u kojem je predmet stoljećima ležao. Dobro stanje konzerviranosti zanimljivo je s obzirom na inače relativno vlažno tlo, k tomu u blizini mora, što je vjerojatno pokazatelj kvalitetno obrađene osnovne strukture staklene mase korištene pri izradi zdjelice (Vilucchi 2000, 25 - 27). Zaključeno je da su stakleni ulomci koji su predmetom ovog rada stabilni te ih nije bilo potrebno podvrgnuti nikakvim konzervatorskim procesima.

Nakon faze utvrđivanja stanja predmeta slijedi faza čišćenja. Mogući su različiti mehanički tretmani. U ovom slučaju ulomci su oprani u demineraliziranoj vodi.

U trećoj fazi, pri rekonpoziciji sačuvanih ulomaka, iznimno je bitan izbor vezivnog sredstva jer treba zadovoljiti uvjete reverzibilnosti postupaka i upotrijebljenog materijala. Osim toga, valja voditi računa o neutralnosti u odnosu na izvornu površinu, konstantnosti fizičkih i vizualnih karakteristika tijekom vremena i izlaganja različitim zračenjima te o niskoj viskoznosti ljepljiva, potrebnoj za kapilarno prodiranje u spojeve (Perović 2008, 16 - 17). Uspjeh faze lijepjenja, tj. integriranja svih sačuvanih ulomaka ovisit će o preciznosti i strpljenju restauratora.

Sljedeća faza je faza nadogradnje. Što je predmet bolje zalijepljen (integriran), to će nadogradnja biti vjernija sačuvanom originalu. Prilikom nadogradnje treba obratiti pozornost na vizualnu uočljivost razlikovanja izvornog od rekonstruiranog (nadograđenog) dijela, što se postiže različitim nijansiranjem ili drugačijom prozirnošću nadogradnje. U ovom slučaju problematika koja se javila u fazi nadogradnje nije uzrokovana lošom integracijom predmeta, već je preciznost u sljubljivanju nadograđenog dijela sa samim originalom ovisila o slobodnoj izvedbi tehnike dekoracije zdjelice - staklenih niti, koje variraju u debljini od 0,3 cm do 0,5 cm, te u razmaku između samih staklenih niti, od 2,2 cm do 2,6 cm. Rješenje problema je jednostavno; umjesto dvije veće nadogradnje učinjeno je pet manjih, koje su omogućile veću preciznost u uzimanju otiska putem silikonskog kalupa.

RESTORATION OF THE OBJECT - WORK METHODOLOGY

Work on glass objects is, in general, very demanding, starting with cleansing, the bonding of fragments, or the actual reconstruction itself. Glass objects that stem from an archaeological context are in the majority of cases characterized by thin walls that make them easily breakable. Great skillfulness on the part of the restorer is needed, among other things, in order to perform a successful restoration (Prpa - Stojanac 2012).

Right from the start, when an appraisal is made of the object, or more frequently, of the fragments, the first conclusions are already drawn on the basis of macroscopic observations. In our case, we determined that the glass was not brittle, and that the walls were not too thin. Likewise, there were no visible signs of degradation processes in the form of the release of alkalis (soda or potash).

The release of alkalis is otherwise an indicator of unsuitable and changing values regarding the conditions in which the glass was situated, in our case the ground where the object was lying for centuries. The good state of conservation is interesting if we take into consideration the otherwise relatively humid ground, and in addition, the vicinity of the sea, which probably indicates a qualitatively satisfactory processing of the basic structure of the glass mass used for the manufacture of this small bowl (Vilucchi 2000, 25 - 27). It was therefore concluded that the here discussed glass fragments are stable, which means that it was not necessary to expose them to any conservation processes.

After this appraisal phase to determine the condition of the object, we proceeded with the cleansing phase. Different mechanical treatments were possible. In this case we washed the fragments in de-mineralized water.

In the third phase that deals with the re-composition of the preserved fragments, it is of utmost importance to select the proper adhesive that must satisfy the conditions of reversibility of both the procedures and the materials chosen. Besides, particular care should be taken as regards neutrality with respect to the original surface, the constancy of physical and visual characteristics in the passage time, the exposure to different radiations, and the low viscosity of the adhesive, which is necessary for capillary action in the joints (Perović 2008, 16 - 17). The success of the bonding phase, i.e. the integration of all the preserved fragments, will be directly dependent on the precision and patience shown by the restorer.

Posljednja faza je retuš. Postoje dvije moguće izvedbe retuša. Kompleksnija izvedba je tzv. unutarnji retuš; nadograđena rebra bi se nijansirala pigmentom direktno u smjesu tekućeg epoksidnog ljepila. Takva bi se rebra morala aplicirati na glatku stijenkku rekonstrukcije, odnosno bilo bi potrebno najprije rekonstruirati cijelu zdjelicu, a zatim aplicirati obojena rebra. Poteškoće leže u činjenici da je otežano dobiti pravi oblik rebara s obzirom da njihove dimenzije variraju od rebra do rebra. Jednostavnija varijanta jest tzv. vanjski retuš – nadograđena rebra jednostavno obojiti.

RESTAURATORSKI ZAHVATI NA ZDJELICI

Od cjelovitog, izvornog stanja zdjelice bilo je sačuvano pet ulomaka koji su se međusobno spajali. Bilo je moguće ustanoviti da u odnosu na cjeloviti predmet nedostaje oko 30 % tijela. Stakleni su ulomci oprani mekanim kistom u destiliranoj vodi (sl. 1).



Sl. 1 Sačuvani ulomci staklene zdjelice.

Fig. 1 The preserved fragments of the small glass bowl.

Usljedilo je privremeno fiksiranje ulomaka tankom ljepljivom krep-trakom. Cijanoakrilnim ljepilom (*Super Attak*) pričvršćene su s vanjske strane ulomaka dodatne pomoćne klamfe od mesingane žice. Nakon što su ulomci spojeni ovim postupkom, uklonjena je ljepljiva krep-traka. Privremenim su učvršćivanjem zdjelici vraćeni kompaktnost i oblik. Uz pomoć klamfi svi su sačuvani ulomci učvršćeni te je na spojeve loma naneseo dvokomponentno epoksidno ljepilo (*Araldite 2020*) (sl. 2). Nakon 24 sata sušenja zdjelica je uz pomoć skalpela očišćena od viška ljepila, zatim su polako mehanički i uz pomoć obloga etanola odstranjene metalne klamfice te je laganim tapkanjem vatom natopljenom alkoholom staklena površina do kraja očišćena.

The next phase is the gap-filling phase. The better the object was bonded (integrated) the more will the reconstructed sections be in line with the preserved original. During the gap-filling process, particular attention should be paid in order to attain a visual differentiation between the original and reconstructed sections, which can be achieved by a different nuance or transparency of the reconstructed part. The problems that arose during the gap-filling phase were in our case not the result of poor integration of the object. The precision, with which the reconstructed parts merged with the original, was dependent on the unhindered execution of the technique used to decorate the small bowl – the glass threads that vary both in thickness, from 0.3 to 0.5 cm, and spacing between one another, from 2.2 to 2.6 cm. The solution to the problem was simple enough; instead of two larger gap-fillings, we made five smaller ones, which enabled us to be much more precise when taking an impression with the help of a silicone mold.

The last phase consists of retouching. Retouching can be done in two ways. The more complex of these is the so-called interior retouch; the reconstructed ribs would be nuanced with the help of a pigment introduced directly into the mix of the liquid epoxy glue. Such ribs would have to be applied directly to the smooth wall of the reconstruction, i.e. prior to that it would be necessary to reconstruct the entire bowl, and then apply the colored ribs. The problems associated with this are in the fact that it is rather difficult to obtain the right shape of the ribs because their dimensions vary from rib to rib. A simpler variant is the so-called exterior retouch – the reconstructed ribs simply have to be painted.

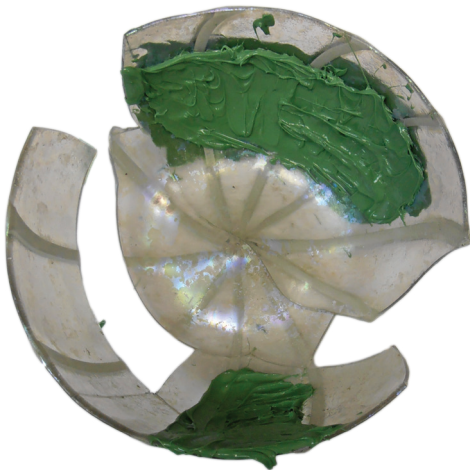
RESTORATION INTERVENTIONS ON THE BOWL

There were only five mutually connecting fragments that were preserved from the entire bowl. It was likewise possible to establish that approximately 30% of the body of the bowl is missing. The glass fragments were washed in distilled water with the help of a soft brush (Fig. 1).

The fragments were then temporarily attached together using thin, self-adhesive masking tape. In addition, auxiliary brass wire clamps were fastened on the outer surface of the fragments with the help of cyanoacryl glue (*Super Attak*). After the fragments were connected together with this procedure, the self-adhesive masking tape was removed. With this temporary measure, the vessel obtained its compactness and form. The clamps

Prije izrade nadogradnje napravljena je proba; izrađen je silikonski otisak/kalup s ugla dijela predmeta (kalup je izrađen u jednom komadu, zbog lakšeg rukovanja). Proba je poslužila kao pokazatelj kakva će biti nadogradnja (proba se radi u slučaju nijansiranog stakla ili onog s gravurom, dekoracijom i sl.). Naime, iako je riječ o načelno bezbojnom staklu, moguće je da potpuno bezbojna nadogradnja djeluje previše istaknuto u odnosu na originalno staklo. No, utvrđeno je da je ton nadogradnje tek malo svjetliji od originala te da prozirnost nije potpuna, već se postiže određena zamućenost površine.

Slijedila je izrada nadogradnje nedostajućih dijelova. Izrađeni su precizni vanjski i unutarnji otisci s originala, dvokomponentnim vinil-polisiloksanskim silikonom (*3M ESPE express*) (sl. 3). Kalup je zatim pažljivo smješten na odgovarajuću poziciju tik uz originalno staklo i zalijepljen cijanoakrilnim ljepljivom trakom (*Super Attakom*) na nedostajući dio predmeta. Na odgovarajućim mjestima vanjskog kalupa napravljene su perforacije za lijevanje dvokomponentnog epoksidnog ljepljiva (*Araldite 2020*) te odušak za zrak (po potrebi jedan ili više njih). Zatim su na otvore postavljene PVC slamke (sl. 4). Predmet je stabiliziran u odgovarajuću poziciju u posudu s pijeskom, a zatim je u najnižu slamku lijevano dvokomponentno epoksidno ljepljivo. Nakon 24 sata sušenja nadogradnje silikonski kalup je uklonjen, a višak je odstranjen vatiranim štapićima u etanolu te mehanički uz pomoć skalpela.

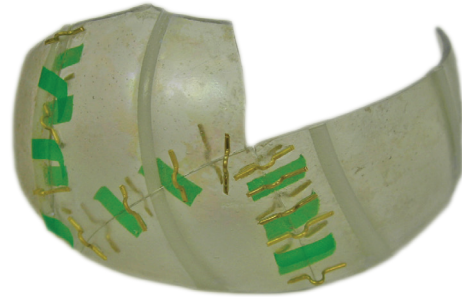


Sl. 3 Izrađeni vanjski i unutarnji otisak dvokomponentnim vinil-polisiloksanskim silikonom.

Fig. 3 The outer and inner impressions made with bi-component vinyl-polysiloxane silicone.

Učinjena je test-proba najprikladnije vrste boje (tempera, akril i uljana). Najbolje je rezultate davala uljana boja, zbog najbližnjeg vizualnog efekta, viskoznosti i trajnosti. Nadograđena rebra staklene zdjelice retuširana su bijelom uljanom bojom (sl. 5, sl. 6).

were used to affix the preserved fragments, and a bi-component epoxy glue was put onto the breakage joints (*Araldite 2020*) (Fig. 2).



Sl. 2 Zdjelica učvršćena ljepljivom trakom te s vanjske strane dodanim pomoćnim klamficama od mesinga.

Fig. 2 The bowl that has been strengthened with self-adhesive tape and on the outer side with auxiliary brass clamps.

The surplus glue was removed from the bowl with a scalpel, after a drying period that lasted 24 hours. The metal clamps were then slowly mechanically removed, with the help of ethanol pads. What then followed was a thorough cleansing by tapping alcohol-soaked cotton wool on the glass surface.

A trial was made before we proceeded with the reconstruction; we made a silicone impression/mold (the mold was made in one piece in order to facilitate handling). This trial served as an indicator of what the reconstruction will look like (a trial is always made when dealing with nuanced, engraved or decorated glass, and the like). Even though we were dealing with what is in principle colorless glass, it could nevertheless be possible that a completely colorless reconstruction would stand out conspicuously in relation to the original glass. However, we did find out that the tone of the reconstruction is only slightly lighter with respect to the original, and that its transparency is not total, the surface being translucent instead.

What followed was the actual reconstruction of the missing parts. A precise outer and inner impression was made from the original, using a bi-component vinyl-polysiloxane silicone (*3M ESPE express*) (Fig. 3). The mold was then carefully placed on the required position next to the original glass, and glued with cyanoacryl glue (*Super Attak*) onto the original part of the object. Perforations were subsequently made on the appropriate spots of the outer mold, in order to pour the bi-component epoxy glue (*Araldite 2020*), as well as air escape vents (one or more of them, according to need). PVC straws were then placed into these openings (Fig. 4). The object was



Sl. 4 Kalup smješten na odgovarajuću poziciju uz original.

Fig. 4 The mold that has been placed in an appropriate position next to the original.



Sl. 5 Zaštita krep ljepljivom trakom prije bojanja nadograđenih rebara zdjelice.

Fig. 5 A protection consisting of crepe self-adhesive tape, before painting the reconstructed ribs of the bowl.

ZAKLJUČAK

Svako arheološko istraživanje na svjetlo dana donosi mnogobrojne ulomke povijesti, pa tako i staklene. Nalazište Blok 11/22 - 23 nije u tome iznimka. Arheološki stakleni predmeti predstavljaju izazov pri restauratorskoj obradi zbog svoje krhkosti, često degradacija i potrebne velike preciznosti pri radu s njima. Staklena struktura novovjekovne zdjelice bila je, srećom, u dobrom stanju, a stijenske joj nisu bile pretanke. Ove su činjenice olakšale rad s njome. Izazov zahvata ležao je u rekonstrukciji rebara i njihovom toniranju (retušu) te usklađivanju estetskih potreba s potrebama vidljivosti zahvata. Restauracija je dala potpuno zadovoljavajuće rezultate, zdjelici je vraćena čvrstoća i originalni oblik, a pažljivom oku odmah su vidljivi zahvati.

stabilized in the required position in a vessel containing sand. The bi-component epoxy glue was then poured through the lowest straw. After the reconstruction was left to dry for a 24-hour period, the silicone mold was removed, the excess material was eliminated either with cotton swabs soaked in ethanol, or mechanically, using a scalpel.

A test-trial was made in order to determine the most appropriate kind of paint (tempera, acryl or oil paint). The best results were obtained with oil paint because the visual effect was most similar to the original, but also due to its viscosity and durability. The reconstructed ribs of this small glass bowl were then retouched with white oil paint (Fig. 5, Fig. 6).



Sl. 6 Novovjekovna staklena zdjelica nakon restauratorskih zahvata.

Fig. 6 The Modern Age glass bowl after restoration.

CONCLUSION

Every archaeological excavation brings scores of fragments of history to the light of day, and amongst these are also those made of glass. The site Block 11/22 - 23 is not an exception in this regard. Archaeological glass objects are otherwise regarded as a restoration challenge due to their fragility, frequent degradations, and the great degree of precision required when working with them. The glass structure of the small, Modern Age bowl was, fortunately, in a good condition and the walls were not too thin. These facts certainly made the restoration easier. The actual challenge was the reconstruction of the ribs and their retouching, coupled with coordinating esthetical needs with the need to protect the visibility of the intervention. On the whole the restoration gave satisfactory results, the small bowl was again provided with its original hardness and form, and the careful observer will at once spot the interventions that were made.

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