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# PHILLYSEAL R- TO GOOD TO BE TRUE? A LESSON FOR THE FUTURE

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**Abstract**

Phillyseal® R, a two part epoxy putty developed by ITW Polymer Technology as a sea faring putty has been utilized in the practice of mount making and heritage conservation.

Experience in its use for structural fixings, mounts, and supports in the conservation and restoration of monumental, fragile and diverse stone sculptures from the collection of Glasgow Museums, Scotland provided informative data of a material study and furthered practical skills in the mount making and structural stabilization of varying large stone artifacts.

Phillyseal® R's ease of handling in addition to its working, and finishing qualities led to the resin's employment as a casting material for the replication of a Viking grave stone for outdoor display of the newly opened Museum of Transport, Glasgow, in June 2011.

In the first part of this paper three conservation programs involving the utilization of Phillyseal® R for structural repair and support of stone sculpture are presented.
The second part will focus on aspects of sustainability and permanence in the availability of materials and how these differ for their assessment of natural materials in comparison to modern manufactured materials such as Phillyseal® R.

**Keywords:** epoxy resin, conservation, stone, sustainability, availability, permanence



## 1. Introduction

Phillyseal® R, the two part Epoxy resin supplied by Philadelphia Resin, as a sea faring putty is also known in the trade as 'rat seal'.

As a proven high performance gap filler employed on marine vessels in marine environments it applied itself to be used and explored practically by mount makers and conservators for creating high spec structural supports to facilitate safe handling, installation and display of fragile structures and large scale objects (1, 2).

**Figure 1.** Phillyseal® R Epoxy resin

The white resin and the black hardener, supplied in 2.5 l tubs are mixed by hand in a 1:1 ratio, similar to mixing two colors of plasticine.

The grey pale blue homogenous coloration of mixed resin serves as a visual reference, when sufficient mixing for optimum resin performance is achieved. The material retains its malleability for approximately 1 hour, gradually becoming more and more ridged. During the various stages of setting different methods and tools can be employed to achieve high precision surface decoration through detailed modeling, carving and sanding of the Epoxy putty.

The overall consistency of the mixed resin is similar to plasticine and does not sag or run off vertical surfaces, another desirable quality for many applications in mount making, molding and casting.

Phillyseal® R was also found to have excellent adhesive properties; a fresh batch of the resin can be added to a cured part of the material and will form a solid bond. This allows a level of care and precision in its application over a long period of time for particularly large areas to be built up or filled when creating precision and integral supports for a stone object.

The Epoxy's compatibility to almost all materials, such as metal, stone, and wood is specifically useful in its application for structural fixing mechanisms facilitating an external handling and display system that often included other materials such as wood and metal screws.



## 2. Case studies

### 2.1 Battle of Langside Memorial stone, Kelvingrove Art Gallery, 2006

The monumental memorial sandstone was originally erected on the Court Knowe, south of Cathcart Castle commemorating the spot where Mary Queen of Scots viewed the downfall of her hopes at the Battle of Langside, May 1568 (3).

For its proposed open display in the newly refurbished Kelvingrove Art Gallery in 2006, a mount and support base had to be prepared to allow a stable upright positioning of the stone on its uneven bottom surface.


**Figure 2.** Uneven bottom surface of memorial stone

Phillyseal® R with its ease of preparation, modeling qualities and chemical and physical long term strength was selected to build up a profile base as part of the overall mounting system with metal brackets secured to the wall to provide additional safe and secure mounting on open display.

The profile of the bottom part of the stone was initially recorded with permanent marker pen on Melinex, as a template for building up the resin base inside a plastic crate.

Prior to lifting the stone onto the uncured resin, cling film was placed between resin and stone surface as a physical barrier.

After 48 hours of resin curing time the stone was lifted off and revealed a precise mold of the bottom face. The resin base was forwarded to the external mount maker to measure and adjust the metal bracket components and returned to the conservation studio for coloring the pale blue resin surface.

Acrylic paints were particularly good for achieving a color match resembling the surface coloration of the stone which rendered the resin base almost invisible.



**Figure 3.** Memorial stone on display

**2.2 Roman Distance Slab; St Mungo's Museum of Religious Life and Art, Glasgow, 2010.**

For the temporary exhibition 'Digging up the Past' in the St Mungo's Museum of Religious Life and Art, a Roman distance slab stone had to be structurally stabilized and restored.

The local buff sandstone originates from the Antonine Wall, and displays incised Latin inscription testifying the completion of 3666 and a half paces of the Antonine wall, between Summerston and Castlehill, by a detachment of the Sixth Legion (4).

**Figure 5.** Roman distance slab in old mount

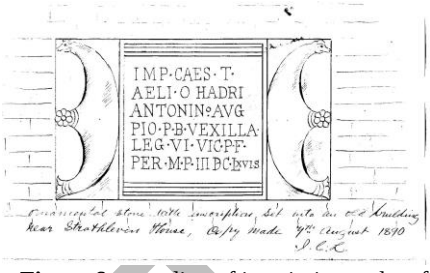


**Figure 6.** recording of inscription and surface

Initial conservation condition assessment of the stone object resulted in proposing the removal of the old wooden frame crate and cement adhering the fragile and porous sandstone to the wooden backing and to replace the old mount with a system that would also facilitate safe and secure handling installation and storage of the heavy yet fragile stone.

15 % Paraloid B72 in Acetone was selected as a consolidant for the porous stone to strengthen the individual stone fragments prior to employing Phillyseal® R as a structural filler and adhesive to join the two halves and secure the distance slab onto its purpose made wooden plinth.

To meet the criteria for Phillyseal® R's reversibility contact surfaces of the stone were consolidated with two further applications of Paraloid B 72 in Acetone at increasing concentration. In some cases the prepared surface was further covered with cling film, particularly where the set resin had to be removed for working the resin component itself.

If the resin repair is to be removed soaking cotton wool in Acetone and placing it over the area of stone-adhesive-resin and covering it with cling film softens the Paraloid B72. With the aid of mechanical tools such as scalpel blades and wooden tooth picks and localized brushing of acetone the resin component can be safely removed from the stone surface.

Tests were carried out on samples of Phillyseal® R in achieving surface finishes and color matching to blend the repair in with the original stone surface in regards to texture and coloration.

Good results in surface fastening of added materials such as sand, dust and pigments to the resin and the ease of modeling and carving of the Epoxy during its curing process allowed for detailed texturing and coloring of the surface.

Stainless steel metal bolts were set into the resin gap fill and fixed the overall restored stone against a wooden backing board. The stone rests on a wooden plinth on top of a Phillyseal® R resin mount fixed with screws to a plinth and backing board, providing an overall integral physical support mechanism.

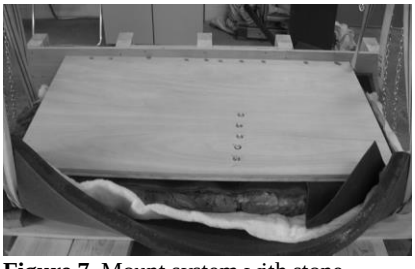

**Figure 7.** Mount system with stone

**Figure 8.** Treated stone on display



### 2.3 Viking hog backed replica: Riverside Museum, 2011

As part of the permanent outdoor display for the opening of the Riverside Museum in 2011 a cast of one of the so-called Govan gravestones was to be created.

The 9th Century 'hogbacked' gravestone is one of a number of gravestones and Viking king's sacophogae found in the graveyard of Govan Old Parish Church.

A replica of this stone was to be permanently displayed outside the new Museum of Transport to provide a reference to Govan across the river Clyde, a center for shipbuilding and for the industrial success of Glasgow in the late 19th and early 20th Century.

Prior to molding and casting various plasters and cements were considered and tested to assess the proposed material's performance in regards to durability of shape, decoration and structure in an uncontrollable wet, cold and physically demanding outdoor environment as found at the West Coast of Scotland.

Through consultation with one of the Riverside Museum project conservators the remaining amount of Phillyseal® R ordered in bulk for its use in mount making for specific exhibits meant the usually high cost of the resin did not apply and led to considering the resin as a potential casting material.

The epoxy resin displayed the most desirable performance during preliminary comparable material testing of various traditional and modern casting materials in regards to permanence of homogenous and saturated surface coloration and retained good overall cohesion even after long periods of being submerged in water.

For the actual cast about 3% of black pigment paste was added to the two components prior to mixing. The decision to color the resin itself instead of painting the surface afterwards was based on achieving a more permanent stability of the surface color in an exposed and severe outdoor environment. Additionally potential damage through human activity such as using the replica as a skate boarding ramp are realistic considerations.

With the installation of the completed replica outside the Riverside Museum- this resin sculpture also serves as a study of the long term performance of this material.

**Figure 9.** South face of resin cast in situ

**Figure 10.** North face of resin cast in situ

Shortly after the installation of the replica outside the Riverside Museum a substantial crack appeared along the horizontal surface of the width of the cast.

The mounting and installation of the replica was carried out employing self-expanding foam to fill the large volume inside the cast prior to adding cement for allowing strong hold to stainless steel bars set into the concrete plinth.

The installation had to be rushed to fullfill managerial demands on having the replica on site for the opening and meant some of the internal materials had not fully set before being permanently mounted and sealed.

The crack in the outer resin layer was assumed to be a result of physical expansion of the internal self-expanding foam pushing the two resin halves apart along the seam lines and filled employing more Phillyseal® R and pigment.

After an unusual spell of sunny and warm weather 11 month later, further cracks appeared on the south face of the replica. With the cracking occurring along the seam lines of individually prepared batches the cause for this is thought to be a combination of thermal expansion of the black resin and a potential decrease of adhesive qualities of the resin through addition of the pigment paste. The mixing by hand of the two part epoxy by only 1 member of staff slowed down the application of batches into the rubber mold achieving only a small number of batches in one working day.



**Figure 11.** Crack along joining seems of separately cast halves

Excessive heat was the least anticipated scenario for the outside display environment in Glasgow and tests in assessing the performance of the colored resin in sustained periods of heat were not considered.

## 3. Epoxy resins as modern materials and challenges relating to their future preservation

Revisiting the ITW Polymer Technology/ Philadelphia Resins web page to order further quantities of the material for repair work on the replica- it was discovered that the manufacturer stopped its production of Phillyseal® R in 2004.

After further enquiries via Email an advisor for the company recommended two other products with similar performance properties to Phillyseal® R and indicated the reason for its discontinuation in following reply…'The unfortunate nature of Phillyseal "R" is the fact that a little went a long way. Nobody ever needed 20 gallon kits. We discontinued it about 7 years ago. Unfortunately, there is just not enough market demand for this product…' (5).

The large quantities of Phillyseal® R purchased from a Scottish supplier in 2006 were the remaining stock that lasted for a further two years after discontinuation of the product and supported the statement that 'its demise is the fact that a little went a long way. Nobody ever needed 20 gallon kits' (5).

The increase in the resin shell cracking and splitting at the same time of this Email correspondence appeared to somewhat emphasize the end of Phillyseal® R.

With the Epoxy ceasing to exist and therefore no longer an available material to the conservator the wealth of information gathered from practical study and use of the Epoxy to support its use as a conservation material for stone became somewhat obsolete. Additionally the task was now to find a gap filling material for the repair of the cracks that would be compatible with the resin in regards to surface coloration and adhesion.

Introducing further materials to the damaged resin shell is also thought to impact on the overall long term stability and surface appearance of the replica and the investment of time, cost and equipment into what is likely to become an ongoing maintenance and care program is not in proportion to its long term benefits.

This has led to a complete re-think. The reviewed conservation recommendation of preparing a new replica from the existing mold is informed by investigation into varying traditional and modern casting materials and identification and assessment of aspects for sustainability and permanence to assure the materials availability rather than aspects such as reversibility.

There has been much debate on the suitability of Epoxy Resins in the various disciplines of conservation in general and in stone conservation specifically (6).

Particularly the conservation concept of 'reversibility' of materials and treatments employed in conservation practice meant the utilization of an 'irreversible' Epoxy is likely dismissed without a critical comparison of its properties with 'reversible' materials such as acrylics, thermoplastic resins, and plasters.

In some ways the ethic of reversibility and the general use of the term 'irreversible' for characterizing Epoxies can be misleading if the term 'irreversible' is equated to the concept of 'permanence'.

Stone as a material in sculpture intrinsically implies permanence due to its age of when formed as igneous, sedimentary or metamorphic rock and its utilization through human history as a structural and building material.

Particularly in 19th and early 20th century sculpting practices stone would be selected by the sculptor as the final medium of the artistic expression for its associated character of permanence.

While conservation assessment of aspects for sustainability and permanence in regards to availability of natural resources in creating or manufacture of cultural heritage is a mechanism for interpretation of material culture and their technologies of the past, assessment of sustainability and permanence of availability of manufactured modern materials may be a mechanism to identify suitable and potentially sought after materials in and for the future.

Anticipating the shortage of materials that are currently readily available may aid preparation to assure the future preservation of not only such materials, but also the required knowledge and skills for their maintenance and conservation care.

The detrimental effect the loss of natural resources and associated knowledge and working skills pose to the future preservation of cultural heritage can be seen in the example of Glasgow's stone heritage.

The wealth created by the ship building and associated industries at the river Clyde in the late 19th and early 20th Century was expressed in Glasgow's architecture, sculpture and monuments of the readily available resource stone and related expertise in required working skills.

Tenement blocks for example, build during this time, obtained the building stone from approximately 400 active stone quarries all within the area of Glasgow. The diversity of the many available stone quarries led to rows of stone houses with distinct coloration for individual streets.

Today there are only 3 active quarries within Scotland left and a history of industrial pollution and stone cleaning of resulting pollution crust's, has left much of the build stone heritage in poor condition (7).

The lack of availability of specific stones for potential replacement or restoration is only one part of the problem to carry out adequate maintenance and restoration care. Additionally, today after the decline of the many industries and workshops there is a shortage of relevantly skilled and experienced practitioners in the field of stone heritage and building conservation.

This leaves the wealth of Glasgow's19th and 20th Century cultural stone heritage such as architecture, sculpture and monuments threatened to become permanently lost. A scenario that would have not been considered by the sponsors and makers involved in the creation of this heritage in times of plenty.

**Figure 12. '**Sculpture', outdoor sculpture, Kelvingrove Art Gallery

## 4. Conclusions

Epoxy resins are important materials with a wide range of use in the field of stone conservation. The possibility of designing and manufacturing a polymer with very targeted and specific functions to some extent assures availability of specialist products for the conservation practitioner.

Their chemical and physical strength make them popular materials in the creation of structural supports for heavy yet fragile stone monuments or structures and allow to create decorative and permanent mounting systems for stone structures and sculptures.

The focus of conservation ethics on 'reversibility' resulted in often critical views of the 'irreversible' Epoxy resin, with the justification of their employment based on a somewhat misleading understanding of the definition of their chemical 'irreversibility' with 'permanence'.

The overall experience led to viewing modern manufactured materials such as Phillyseal R as temporary materials, their existence being determined by economic and technological circumstances. It highlighted a need to consider preservation of physical and intellectual access to the creative process, working skills and required resources of modern manufactured materials since a substantial amount of this temporary media makes up our present day environment and culture.

For the future care of our contemporary cultural heritage preservation of the technical knowledge and skills of the manufacturing process of temporary materials will determine the level of its conservation care and survival in the long run.

## References

BJ Farrar; J. Maish; M. Shiro: *A preliminary Review of some alternatives to Phillyseal R Epoxy for Conservation and Mountmaking*. cool.conservation-us.org/waac/wn/wn31/wn31-1/wn31-103.pdf

http://cool.conservation-us.org/waac/historical/pastmeetings/2008-losangeles/images, 19/06/2012, BJ. Farrar; J. Maish: *Phillyseal R- is there an alternative?*

Source: Multi Mimsy Museum database. Entry record 1927.78, 15/06/2012

Source: Multi Mimsy Museum database. Entry record A.1942.18, 15/06/2012

Personal Email correspondence with ITW Polymer Technology, 02/06/2012

G. G. Amoroso 1983. 'Stone decay and conservation', *Materials Science Monographs*, **11**, Elsevier: Amsterdam.

Personal notes from 1 day symposium 'Stone cleaning in Kelvingrove Art Gallery', Kelvingrove Art Gallery, 6th October, 2006.