# The Composition of Byzantine Glass Mosaic Tesserae

**Leverhulme International Network**

**Workshop report**
**Venice and Ravenna 8-13 June 2008**

Present

| Venice | Ravenna |
|---|---|
| Bente Bjornholt (Network Facilitator, University of Sussex) | |
| Chris Entwistle (British Museum, London) | |
| Cesare Fiori (Università di Bologna - sede di Ravenna) | |
| Ian Freestone (University of Cardiff) | |
| Julian Henderson (University of Nottingham) | |
| Liz James (Network Director, University of Sussex) | |
| Polytimi Loukopoulou (School of Chemical Engineering of the National Technical University of Athens) | |
| Marie-Dominique Nenna (Lyon) | |
| Stefan Roehrs (British Museum, London) | |
| Nadine Schibille (Paris) | |
| Mariangela Vandini (Università di Bologna - sede di Ravenna) | |
| Maria Vassilaki (Athens, Thessaly) | |
| Marco Verità (Stazione Sperimentale del Vetro, Venice) | |
| Luca Chiesura (Orsoni, Venice) | Francesca dell'Aqua Boyvadaoglu (Università degli Studi di Salerno) |
| Ettore Vio (Procuratorio of San Marco, Venice) | Rossella Arletti (Università degli Studi di Modena e Reggio Emilia) |
| Sandro Zecchin (CNR-IENI (Padua)-The Institute for Energetics and Interfases) | Eve Borsook (I Tatti, Firenze) |
| | Cetty Muscolino (Director of Museo Nazionale di Ravenna) |
| | Silvia Pasi (Università di Bologna - sede di Ravenna) |
| | Claudia Tedeschi (Scuola per il Restauro del Mosaico -Ravenna) |

**Papers:**
Marco Verità: *Analysis of glass tesserae of the fourteenth- century mosaics of the baptistery, St Mark cathedral, Venice*
Ian Freestone: *Why are red glass tesserae different?*
Polytimi Loukopoulou: *Looking into Byzantine metal-leaf glass tesserae: technology and decay*
Julian Henderson: *The mosaics in Torcello Cathedral*

Marie-Dominique Nenna: *Latest results from the excavations at Wadi Natrun*
Nadine Schibille: T*he sixth century mosaics of Hagia Sophia in Constantinople*
Cetty Muscolino: *San Apollinare Nuovo: restoration of the mosaics*
Eve Borsook: *An overview of the terminology used in mosaic materials analyses and conclusions drawn from them in recent literature*
Rosella Arletti: *Eleventh-century Byzantine mosaic tesserae from the Greek Monasteries of Daphni and Hosios Loukas*
Claudia Tedeschi: *The degradation of the glass mosaic dome of the Neonian Baptistery in Ravenna. A unicum in research, operations and ethics*

**Visits:**
Venice:
Orsoni mosaic factory. Special visit guided by Luca Chiesura.
San Marco. Special visit guided by Ettore Vio, chief restorer of the church.
Santa Maria Assunta, Torcello.
Ravenna:
San Apollinare Nuovo. Special visit guided by Cetty Muscolino.
Neonian Baptistery. Special visit guided by Claudia Tedeschi.

## Committee Business

Outputs, update from Bente Bjornholt:

- The database/bibliography of research and analysis of Byzantine glass mosaic tesserae. This now contains about 100 publications; it is not online yet, updating is ongoing.
- A database of sites where glass mosaics are known. It is on the Sussex University website as a trial and is being constantly edited and improved as well as populated.
- A database of primary literature sources about glass mosaics (Byzantine writings in the first instance). It is on the Sussex University website as a trial and is being constantly edited and improved as well as populated.
  There was some delay in the creation of the databases because of the Sussex Web team being overworked, but they should shortly be sufficiently complete for Network members to contribute directly.
- A glossary of key terms used by scientists, archaeologists and art historians. This is in its final stages of editing and should be online before the end of 2008.

**Future schedule of meetings**
**Spring 2009:** Study day on Byzantine mosaics, London.
**June 2009:** Athens, Network Workshop.
**September 2009:** Thessaloniki. Representation of the Network at 18th Congress of the AIHV, Association Internationale pour l'Histoire du Verre, where there is special focus on Greek glass from prehistory through to the Byzantine period.
**Late spring 2010:** Finale at British Museum to coincide with BM conference on Byzantine glass, London

**Aims and outcomes:**
Participants in the workshop came up with various proposals for future work. These concentrate on:

- Sampling and analysis
- Meetings, conference representations
- Building on existing research, for example, collaborative publications

Concrete suggestions:

- Eve Borsook suggested that we persuade the Leverhulme to use the rest of the funds for the Network to start non-destructive sampling of one or more monuments. She suggested Daphni, but has also provided details of Italian officials to contact for permissions. She suggested collaboration between a Network scientist and local experts.

- Ian suggested that Liz could gather together a small group of mosaic-minded art historians who could write an open letter to some important journal pointing out that scientific studies of tesserae are yielding/have the potential to yield a lot of useful information and that conservators should ensure that adequate samples from the mosaics they worked on are taken and stored for future analysis, as each time a mosaic is conserved, it is effectively made inaccessible for decades or centuries. Then we could use that letter to encourage conservators and to help raise funds.

- Ian, Stefan, Liz: proposal for pilot project to test different types of handheld XRF on tt and mosaics in UK collections leading to bigger application to work on monuments in Med. We would negotiate with institutions that own XRFs to borrow/lease them to us. An XRF costs in the region £20-40.000 depending on manufacturer and range.

We are looking for funding for all possible routes forward. The AHRC Science and Heritage strand is a possibility and the Getty has a new funding strand on mosaics in the Med. which is yet to be officially publicised. They told Bente that it will be about 'training and mosaics'. Bente and Liz are looking into the funding for future programmes of work, but please keep an eye out.

**Abstracts of papers:**

Marco Verità, *Analysis of glass tesserae in the fourteenth-century mosaics of the baptistery, St Mark Cathedral, Venice*

Fourteenth-century glass tesserae from the mosaics of the baptistery of the St Mark cathedral in Venice were sampled to be analysed. Both metal leaf tesserae and coloured glass pastes (consisting of crystalline component dispersed in a glassy phase in 4 to 6 hues) were sampled and investigated by optical and scanning electron microscopy and x-ray chemical micro-analysis.
The results of the scientific analyses of the components of the tesserae (glassy phase, opacifiers, pigments, metal leaves etc) were linked to historical sources in order to identify the origins of the tesserae; documents of the Archivio di Sato in Venice testify for the production in Murano since 1308 of glass slabs for mosaics for St

Marks. The analyses were also compared to the available compositional data of Venetian and Levantine glass of this period.
It appears that only soda-lime-silica glass was used in the manufacture of the tesserae. The analyses identified the use of a natron type glass in a few samples (two gold foil and an opaque yellow tesserae, a rare colour in these mosaics). The results suggest that the natron type tesserae were probably old re-used tesserae (recovered, for example, from ancient mosaics). The glass of the majority of the tesserae was of the soda plant ash type. Quartz grains were used as an opacifier for the blue, green and purple-brown glass pastes and colouring minerals were also identified.
The comparison of these results with the analyses of Byzantine mosaics of the 10th-13th centuries (Hosios Loukas, Torcello, Monreale) shows clear similarities in the glass-making technology. Regarding the question of origin we cannot exclude the possibility that the 14$^{th}$-century glass tesserae from the baptistery of St Mark were made in Murano. It is well known that the Venetian glassmaking technology of this period is strictly related to the Byzantine and Islamic traditions and such production therefore falls well within the local activities. Further analyses will be necessary to verify similarities and differences between the glass tesserae of St Mark and of the other Byzantine mosaics of this period.

Polytimi Loukopoulou *Looking into Byzantine metal-leaf glass tesserae: technology and decay*

Metal leaf glass tesserae and particularly gold glass tesserae are found in abundance on Byzantine mosaics as they were extensively used for the gold background. It is a special type of tessera due to its manufacture technique -a metal leaf is enclosed between two layers of glass. However, only limited study of its nature and decay has been carried out.
The PhD research is focused on the study of the condition and alteration of metal-leaf glass tesserae in Greek Byzantine monuments. A short review of current knowledge and research was presented at the workshop (concerning technique, composition and alteration of metal-leaf glass tesserae) along with preliminary results of macroscopic examination. In addition, future work was introduced and some research issues were addressed.

Claudia Tedeschi, *The degradation of the glass mosaic dome of the Neonian Baptistery in Ravenna. A unicum in research, operations and ethics*

The mosaics in the baptistery have undergone restoration several times and were in acute need of more intervention. The recent work had to deal with a series of problems concerning the conservation of materials and the products to be used, study of the construction techniques and iconographical analysis of the decorations.

An example of the latter is the top section of the dome that shows Christ being baptized by immersion in water (*abluzione*), while at the same time John the Baptist is baptizing him by the method of *aspersione*. This double baptism is due to an old restoration of damage to the mosaics carried out in the second half of the nineteenth century by an artist from the Vatican State. The restorer mistakenly changed the original scene to show *aspersione* as well as *abluzione*.

In the circle of the twelve apostles around the baptism scene, part of Simon's garment was originally represented as transparent testifying to the excellent skill of the ancient artist since such representation is extremely difficult to achieve in mosaics. Over the years the garment had lost this effect, which the restoration campaign managed to restore to its original state.

Among the traditional mosaic glasses we found a transparent glass which testifies to the use ancient mosaic artists made of raw materials. Similar material was found in the cargo of a Roman boat which sunk off the northern Adriatic coast. Since glass furnaces have never been found in Italy, we presume that the production of mosaic glass was temporarily carried out near the buildings which were to be decorated with mosaics.

The surface displayed a number of areas where in the past gypsum was used to fill in gaps left by missing pieces of mosaics. This created quite a few conservation problems. The solution was to remove all the pieces of gypsum which revealed that roots of the original tesserae still remained attached to the mortar. We then decided to replace the missing parts by applying a new layer of mortar, which would later be modelled as an imitation of the original mosaic and then painted in fresco to match the surrounding area.

As a test we also carried out another aesthetic restoration on gold metallic tesserae. The degradation of this type of the glass involves the loss of cartellina and the gold leaf which had caused the loss of important details, for example the inscription of the apostles' names. To resolve this problem we used an experimental reversible process in a very small area of the mosaic. The top of the gold tesserae were covered with a mixture of soluble fish glue and golden powder. Subsequently the new golden layer on the top of the tesserae was covered with an acrylic resin. The result was very positive.

Unfortunately as demonstrated by the analysis carried our by Dr Marco Verità, and previously by prof. Cesare Fiori, most of the tesserae of the baptistery are made of easily degradable materials (glass silicico-sodico-calcico). This situation generated quite a few ethical problems among our staff who had to decide whether to use specific chemicals which would definitely save the mosaics, but which would at the same time be quite invasive.

The funds came to an end before the restoration programme when the team was about to apply products to consolidate the extreme degradation of the glasses.

Nadine Schibille, *Aesthetic Data in the sixth-century mosaics of Hagia Sophia in Constantinople*

In this paper I aimed to reconstruct the aesthetic data that are contained in the original sixth-century mosaic decoration of Hagia Sophia in Constantinople. The evidence points to an entirely non-figurative mosaic decoration for the Justinianic programme, a fact that has provoked numerous speculations as to the underlying reasons. The lack of figurative mosaics has either been explained with the enormous size of the building that was considered not conducive to representational mosaics or, in fact, it was assumed that time was too short to allow for a more elaborate design. However, I believe that the design and colours of the original sixth-century mosaics suggest a deliberate aesthetic choice.

The mosaic decoration of Hagia Sophia evidently followed a consistent programme without drawing the attention to any particular feature. They seem to be almost exclusively made of glass and there does not seem to have been any shortage

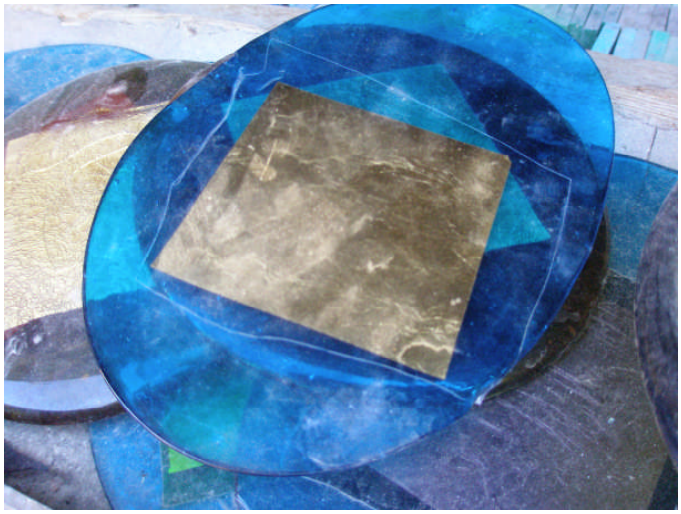
of the material, while the colours used were restricted to gold, silver, red, green and blue/black. This range of colours appears to represent an aesthetic choice that reflects the late antique idea of the nature of colour and seem to have been chosen on grounds of their optical properties. The very nature of the mosaics and the selection of colours testify to an aesthetic of light that was in turn intimately linked with an underlying ideology of light and colours. At the same time, the careful use of colour contrasts shows that physiological aspects of vision have played a central role in the design of the mosaics also.

Pictures:

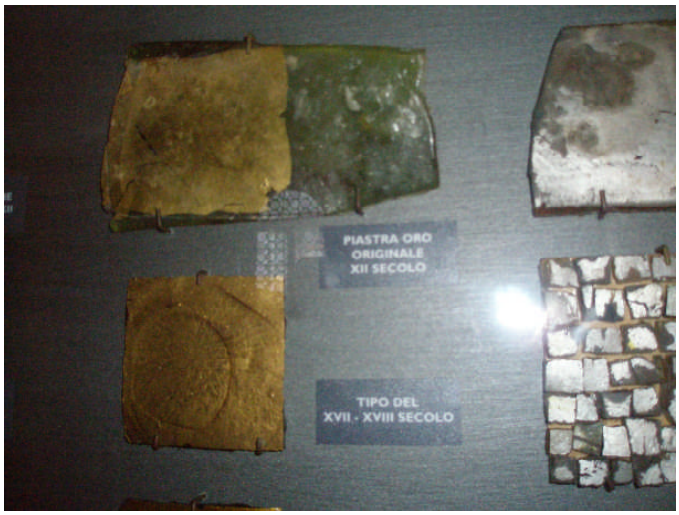
Orsoni, Venice: Oven

Orsoni, Venice: store room of glass slabs

Orsoni, Venice: Luca Chiesura explains



Orsoni, Venice: metal foil glass slab (lingua)




San Marco, Venice: 12C metal foil glass slab (lingua)

San Marco Museum, Venice: mosaic of OT kings.

San Marco Museum, Venice: mosaic of saints head

Ravenna, Battistero Neoniano


Ravenna, Battistero Neoniano


San Marco, Venice

Burano, Venice

Ca de Ven, Ravenna.