

The use of new technologies in the presentation and analysis of ceramics of the Aegean Collection in the National Archaeological Museum of Florence

Giulia DIONISIO | Anna Margherita JASINK
University of Florence

Abstract: The Aegean Collection of Florence is only partially exhibited to the public, being mostly kept in the storerooms of the Archaeological Museum. Such a rich and impressive collection, however, can still be shown to those not within the Museum and made equally available to researchers and the general public through different scientific, technological and data processing methodologies. Our focus is not only on simple interactive and virtual applications, but also on diagnostic analyses and traditional restoration. The combination of these approaches leads to new perspectives in archaeology and allows for a deeper knowledge of the ancient Aegean objects and the context of their production.

In this paper we deal with some specific analyses for obtaining new data about ceramic samples: traditional and virtual restoration, diagnostic analyses, three-dimensional digitalization, and virtual application within an interactive museum (MUSINT). Diagnostic analyses allow us to report useful data about the ancient pigments used on the ceramic surface to obtain specific chromatic effects. Virtual technologies and, in particular, digital restoration, are useful methodologies that allow manipulation and study of the ancient ceramics without direct contact with them. Moreover, virtual restoration allows for the visualization and interpretation of the original shape and full decorative pattern of an ancient object, providing detailed interpretive information about its original condition.

Keywords: Archaeological Collections, traditional and virtual analyses and technologies

The Aegean Collection in the National Archaeological Museum of Florence

The research and educational activities of the @*aegeanlab* (aegean.sns.it) at the University of Florence involve close collaboration with the National Archaeological Museum of our city. The purpose was to give new visibility to the Aegean Collection which – since the great Arno river floods of 1966 and the new arrangement of the Museum sections – has been almost completely restricted to the storerooms (Fig. 1). Nonetheless, in 2006 and 2007, two temporary exhibitions brought many of the objects into public visibility: the first, *Egeo, Cipro. Siria. Mesopotamia. Dal Collezionismo allo Scavo Archeologico*, in the Museum (GUIDOTTI ET AL 2007) and the second, *Il vasellame da Simposio e il servito da vino nelle Collezioni Egeo-Cipriote del Museo Archeologico Nazionale di Firenze* in the prestigious Palazzo Antinori (organized by A.M. Jasink, L. Bombardieri and G.C. Cianferoni). A complete catalogue of the Aegean Collection was published in 2009 (JASINK, BOMBARDIERI 2009), and a related database (JASINK et al. 2009) made the whole collection accessible on-line. Finally, a room in the “Greek section” of the Museum is now dedicated to the collection, in which a selection of objects may now be viewed by visitors (Fig. 2). Still, the greater part of the

Collection is still in the storerooms and, now, a series of research programs have been developed in order to fully describe all the objects by provenance, historical and archaeological context, with the support of data achievable by new diagnostic analyses and data processing technologies.

(A.M.J.)



Fig. 1 – The storerooms of the National Archaeological Museum (Copyright: archeotoscana.wordpress.com)



Fig. 2 – The Aegean collection visible for the Museum's visitors

Scientific, technological and data processing methodologies

The collaboration of science and technology for archaeological and artistic research has allowed us, in recent years, to uncover novel aspects and details of archaeological material. As already noted above, many such collections are not fully exhibited in museums because of, for example, lack of exhibition space, poor preservation of objects or their fragile and fragmentary state. One major point is that the fragmentary and fragile state of the items prevents a traditional restoration required for their significant exhibition. The combined use of art and science methodology can lead to important and unexpected information on artefacts concerning their particular decorative motifs and production technology. Consequently, application of new diagnostic tools to collections not otherwise accessible and the ability to compare such results with a series of other studies will increasingly be of great help in better understanding production processes in ancient civilizations.

The Aegean Collection in the National Archaeological Museum of Florence in recent years has become an important case study in the convergence of science, archaeology and technology. Both traditional and virtual restoration methods, diagnostic analyses and the exhibition of the objects in an interactive museum (MUSINT), allowed a great part of the collection to be seen by a heterogeneous public (children, adults and experts) and to be studied extensively.

(A.M.J.)

Virtual and traditional restoration

Many of the Aegean ceramic artefacts in the storerooms of the Archaeological Museum of Florence have need of substantial restoration. Most of those were restored in the past using unsuitable materials and their conservation has been compromised over the time. Others are too fragmentary or fragile to be subjected to integration operations because the integration of the missing parts would prevail over the original, leading to possible arbitrary and unreliable reconstructions, besides exposing the artefacts to risks of breakage.

Therefore, recourse to traditional restoration for damaged and abraded surfaces or to the integration of chromatic decorations lost over the time is unsuitable. In these circumstances, our program is based on virtual restoration -- a new technology widely applied in recent years for cultural heritage preservation. Virtual restoration is a non-invasive technique operating on digital bi- or tri-dimensional reproductions of the objects and carrying out the restoration without a physical contact with the artefacts and without moving them out of the shelves. This makes it possible to attempt structural reconstructions with alternative methods.

An example is a stirrup jar from Rhodes (inv. 198761) on which both a traditional and a virtual restoration was carried out for educational purposes (Fig. 3).

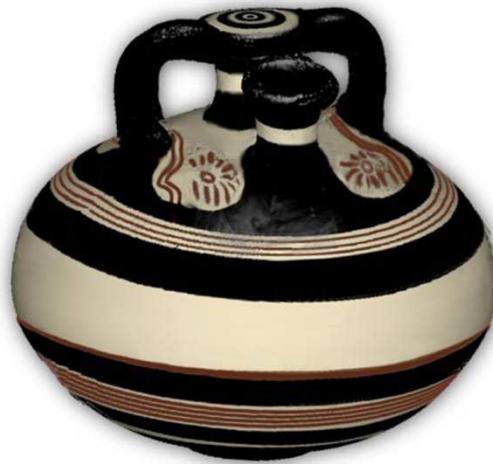


Fig. 3 – The Stirrup Jar invt. 198761: traditional and virtual restoration

The traditional restoration

Traditional restoration made apparent the function of the object. Highly fragmented, with the base totally missing (Fig. 4), a previous restoration made in the early 1900s reassembled and partially reconstructed the preserved parts using unsuitable materials (adhesives and fillers) which impaired the original colours of the surface.

After removal of the old restoration, powders covering the surface of the fragments were removed by cleaning with demineralized water and traces of adhesives eliminated with cotton swabs soaked in acetone. The fragments were then glued with a warm resin (Polyvinyl Acetate). The fragmentary object has been only partially integrated with a wax-based product (named I76) to avoid the dominance of the reconstruction over the original.



Fig. 4 – The Stirrup Jar invt. 198761 before the traditional restoration

The virtual restoration

The virtual restoration was carried out in collaboration with the DREAMSLab (Distributed Research Environment Advanced Modeling and Simulation Laboratory) at the Scuola Normale Superiore of Pisa. The missing parts and the lost decorative motifs were reconstructed restoring the object to its presumed original state. The first step for the virtual reconstruction of the jar was the three-dimensional acquisition through the combined use of NextEngine 3D laser scanner and photogrammetry techniques. The 3D model was imported in Blender, an open source 3D graphics and animation software, to model the missing parts. The shape was reconstructed from the geometric analysis of the fragments and morphological characteristics on one side and by comparisons with similar artefacts on the other. The colours were generated relying on decorations in the best preserved parts of the fragments.

(G.D.)

Diagnostic analyses

A large set of Minoan Kamares pottery is conserved in the National Archaeological Museum of Florence. This ceramic class, developed in Crete during the Protopalatial period, is characterized by the variety of forms and by the peculiarity and beauty of decorative motifs, realized with three main colours, white, red and orange applied on a black surface.

This collection has recently been the object of diagnostic tests for the characterization of the pigments (FRATINI 2012).

Raman spectroscopy was used to obtain information on the chemical composition of selected samples. This is a non-invasive and non-destructive technique particularly suited for in-situ analysis of colour layers. A monochromatic (laser) radiation hits the surface of an object and a small fraction of the radiation is scattered by the molecules at different energies than the incident radiation. The different scattered energies (Raman effect), collected, revealed by a detector and displayed as a spectrum, are determined by the chemical structure of the scattering molecules.

The same Kamares samples were also analysed at the Scanning Electron Microscope (SEM/EDS – Scanning Electron Microscope/Energy Dispersive System) for a complete pigments characterization. This technique effectively investigates in depth and at high magnification both the morphology and the chemical composition of the substances.

The SEM/EDS data have confirmed most of the Raman findings on pigments composition.

As an example, Raman data on the chemical composition of the orange pigment on two Kamares samples (Inv. n. 84055 and 223435) on two areas of uniform colour have shown the presence of an iron oxide, hematite (Fe_2O_3), along with the forsterite (Mg_2SiO_4), a silicate mineral of the olivine group.

For the conical cup n. 84055, the presence of goethite ($\text{FeO}(\text{OH})$), an iron hydroxide of the jasper group, was also detected (FRATINI 2012: 54-56, catalogue n. 5 and 15).

These results were of considerable interest since they may be compared with the Raman analysis of the orange pigment on two Kamares Ware in the Pigorini Museum of Rome (DIONISIO 2015). That analysis revealed a similar chemical composition of the pigment, with presence of hematite and forsterite and traces of magnetite (Fe_3O_4).

Given the few available archaeometric studies of the pigments of this ceramic class, analysis of the Florentine Kamares Ware collection also yielded important information on the chemical structure of the less studied red and orange pigments and their application method to the ceramic body.

(G.D.)

Virtual application: the MUSINT project

Last year, we reported on our MUSINT project (<http://musint.dreams.sns.it/>) in a dedicated Round Table Discussion at this Conference, MUSINT - Interactive Museum – (JASINK ET AL 2011) deals first of all with the objects kept in the archaeological museums of Tuscany. MUSINT is organized in five main geographical areas represented in the objects preserved in the museums: Greece Mainland, Crete, Cyclades, Rhodes, and Cyprus. The user can view the history and the artistic production of each area. The project site contains images, drawings, photographs and explanatory texts and, of great importance, faithful digital 3-dimensional reproductions of several archaeological artefacts. This latter feature allows for a direct interaction between users and archaeological objects and is a useful tool for both scientific research and teaching purposes. An educational project was designed for primary school children to introduce pupils to the history, mythical stories and the artistic production of the Aegean world through such legendary characters as Minotaurus for Crete and Agamemnon for the Mycenaean world (Fig. 5) (DIONISIO 2011).

During the year, the MUSINT project has been greatly implemented in different directions, all intended to offer greater knowledge of the archaeological collections and their environment to a large audience. Since 2013, the MUSINT project and its didactic section have been presented with success in a primary school of a town nearby Florence (Montelupo Fiorentino). In the next years the collaboration with the Montelupo school will be further pursued, proposing new models and new myths and characters.

This is a good demonstration of the opportunities for the Museum to encounter the city and interact with a larger audience, which can both be realized and made easier by technological devices.

(A.M.J.)



Fig. 5 – The educational Project of MUSINT: Agamemnon and the Minotaurus

References

- DIONISIO, G. (2011) 'L'archeologia nei progetti didattici multimediali in Toscana: il percorso didattico del progetto MUSINT' in A.M. Jasink, G. Tucci, L. Bombardieri (eds.), *MUSINT. Le collezioni archeologiche egee e cipriote in Toscana. Ricerche ed esperienze di museologia interattiva*, Firenze University Press: 43-52.
- DIONISIO, G. (2015) 'Indagini Archeometriche sulla Ceramica Kamares' in A.M. Jasink, L. Bombardieri (eds.), *AKROTHINIA. Contributi di giovani ricercatori italiani agli studi egei e ciprioti*, Firenze University Press: 79-87.
- FRATINI, T. (2012) *Le Ceramiche Kamares del Museo di Firenze. Archeometria dei pigmenti e inquadramento storico-archeologico dei dati*. PhD thesis in Storia e Civiltà del Mondo Antico. Firenze: Università di Firenze.
- GUIDOTTI, M.C., LO SCHIAVO, F., PIEROBON BENOIT, R. (2007) *Egeo, Cipro, Siria, Mesopotamia. Dal Collezionismo allo Scavo Archeologico. In onore di Paolo Emilio Pecorella*, Casa Editrice Sillabe.
- JASINK, A.M., BOMBARDIERI, L. (2009) *Le Collezioni Egee del Museo Archeologico Nazionale di Firenze*, Firenze University Press.
- JASINK, A.M., BOMBARDIERI, L., DIONISIO, G., FARALLI, C. (2009) *Le Collezioni Egee del Museo Archeologico Nazionale di Firenze. Il catalogo digitale*, Firenze University Press.
- JASINK, A.M., TUCCI, G., BOMBARDIERI, L. (2011) *MUSINT. Le Collezioni Archeologiche Egee e Cipriote in Toscana. Ricerche ed Esperienze di Museologia Interattiva*, Firenze University Press.

Imprint:

Proceedings of the 19th International Conference on Cultural Heritage and New Technologies 2014 (CHNT 19, 2014)

Vienna 2015

<http://www.chnt.at/proceedings-chnt-19/>

ISBN 978-3-200-04167-7

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie

Editorial Team: Wolfgang Börner, Susanne Uhlirz

The editor's office is not responsible for the linguistic correctness of the manuscripts.

Authors are responsible for the contents and copyrights of the illustrations/photographs.