



## ARCHLAB TRANSNATIONAL ACCESS REPORT

**Project Title:**

Metal threads in Hispano-Islamic textiles (11<sup>th</sup>-15<sup>th</sup> centuries): scientific investigation of the manufacturing techniques and comparative studies with metal threads in Sicilian-Islamic textiles and Lucchese medieval textiles.

**Project Acronym:**

METHIT

**Lead Researcher:**

Cristina Scibè

**Home Institution:**

Escuela Internacional de Doctorado. Faculty of Fine Arts, University of Seville. Seville, Spain.

**Institution requested for ARCHLAB Access:**

Opificio delle Pietre Dure (OPD). Florence, Italy.

**Date of Access:**

15<sup>th</sup> February to 18<sup>th</sup> February 2016.

**Introduction:**

The METHIT project focuses on the study of metal threads incorporated (interwoven in fabrics or used for embroidery) into medieval textiles of al-Andalus, Sicily and Lucca from 11<sup>th</sup> to 15<sup>th</sup> century.

The main aim of this research is to gain knowledge about metal threads manufacturing technology (materials and techniques) in order to characterize Arab craftsmen's techniques and understand their different developments in each textile workshop (tiraz) of al-Andalus and other Mediterranean lands, such as Italy.

Moreover, two of the most interesting goals of the research are: clarifying whether or not raw materials are imported or manufactured locally and reconstructing in this way the ancient trade routes; demonstrating that the study of metal threads technology could make possible a chronological and provenance attribution of textiles of uncertain classification.



In order to develop the present research I planned to use an interdisciplinary methodological approach, both historical and scientific, based on the accurate interpretation of written records, the review of the analytical data already achieved in this field, and the investigation of specific case studies.

In this connection, the ARCHLAB Access to the archive of the Scientific Laboratories of the OPD enabled me to know the results of their copious studies on metal threads and the analytical method they followed, and finally to collect scientific data on metal threads useful for my research.

### **Specific aims of the Access:**

I focused my visit on the following specific directions:

- Consulting and studying the available documentation on metal threaded textiles from 11<sup>th</sup> to 15<sup>th</sup> century;
- Comparing, whenever possible, the morphological and technological characteristics of METHIT samples with those of reference materials stored in the archives of the OPD;
- Taking as an example the OPD analytical methodology used for the study of metal threads samples, and discussing with OPD scientists the most appropriate protocol for multi-techniques analysis of these samples, specially membrane threads;
- Studying corrosion phenomena on metal threads, observing corrosion morphologies and products according to the metal layer composition and the type of metal thread (solid metal strip or membrane thread).

### **Description of the work carried out during the Access:**

Over the years, the OPD Scientific Laboratory have studied a significant amount of textiles of different typologies, periods and manufactures.

The Director of the Laboratory of Biology, Isetta Tosini, in her wide career at the OPD laboratories, has conducted several studies on metal threads samples. Indeed, she is the professional who has mostly dedicated to textiles investigations in the OPD.



Moreover, she has undertaken an interesting research on membrane threads. This research, still in progress, collects all case studies of membrane threads that she has investigated, during the years, analysing textiles.

Visiting the OPD Scientific Laboratories, I had the chance to consult all these studies on metal threads and benefit from the knowledge and experience of Isetta Tosini. In detail:

- I reviewed her research on membrane threads, titled “Characterization of Gilded and Silvered Membrane Threads “;
- I reviewed the analysis on metal threads coming from textiles of the 11<sup>th</sup>-15<sup>th</sup> centuries. For each example selected, I reviewed the scientific report on metal threads characterization, comprehensive of the optical microscopy images and SEM-EDS analysis performed by Isetta Tosini, and the XRF analysis performed on some textile fragments by Andrea Cagnini, as well;
- I consulted the research conducted by Isetta Tosini, Federica Favalaro and Gianna Bacci on metal threads in tapestries, titled “The morphological study of metal threads in tapestries and cleaning methodology”. I focused on the analytical method, the morphological characterization of metal threads and the study of their corrosion and alteration products;
- Along with Isetta Tosini, we planned to compare some OPD samples with some METHIT samples, in order to establish analogies and exchange information and points of view;



Photo 1. Isetta Tosini observing cross-sections samples on MO with reflected UV light.



## Case studies of metal threads consulted at OPD:

During my ARCHLAB Access, I had the great opportunity to consult Tosini's research on membrane threads and also other metal threads case studies mainly coming from medieval textiles, listed below:

- **Dalmatic of Benedict XI, 13<sup>th</sup> century, coming from St. Dominic Church in Perugia:**  
*membrane thread, leather with pure gold (with copper impurities);*
- **Banners, 13<sup>th</sup>-14<sup>th</sup> century, coming from St. Fermo Maggiore Church in Verona:**  
*membrane thread, animal gut with silver alloyed with a smaller amount of gold;*
- **Textile fragment, 15<sup>th</sup> century, coming from the Textile Museum in Prato:**  
*membrane thread, animal gut with silver alloyed with gold;*
- **Textile fragment, 14<sup>th</sup> century, coming from the Museum of Bargello in Florence:**  
*membrane thread, leather or parchment? with silver (with copper impurities) alloyed with gold;*
- **Pillow, Islamic manufacture, 9<sup>th</sup>-12<sup>th</sup> century, coming from the Metropolitan Opera Museum of the Cathedral of Siena:** *membrane threads, leather with silver alloyed with a smaller amount of gold, and leather with gold alloyed with a smaller amount of silver and copper;*
- **Fragment of Chasuble, Lucchese silk Diasper, 13<sup>th</sup>-14<sup>th</sup> century, coming from the Metropolitan Opera Museum of the Cathedral of Siena:** *(diasper) membrane thread, animal gut with silver (with copper impurities) alloyed with a smaller amount of gold; (embroidery) metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*
- **Sendal, Islamic manufacture, 12<sup>th</sup> century, coming from the Metropolitan Opera Museum of the Cathedral of Siena:** *metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*
- **Miter, 13<sup>th</sup> -14<sup>th</sup> century, coming from the Cathedral of Trau in Croatia:** *metal strip of gilded silver (with copper and iron impurities), silver coated with gold only on one-side;*
- **Cope (Opus Anglicanum) of Pio II, 14<sup>th</sup> century, coming from the Cathedral of Pienza in Siena:** *metal strip of silver alloyed with a small amount of copper and*



*metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*

- **Miter of St John, South-Italy manufacture, 14<sup>th</sup> century, coming from the Cathedral of Matera:** *metal strip of silver alloyed with copper and metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*
- **Textile fragment, 14<sup>th</sup> century, coming from the Museum of Bargello in Florence:** *metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*
- **Textile fragment of Samite, Sicilian manufacture, 13<sup>th</sup> century, coming from the Diocesan Museum in Vicenza:** *metal strip of gilded silver (with copper impurities), silver coated with gold only on one-side;*

The characterization of metal threads was carried out by stereoscopic microscopy, optical microscopy, micro-chemical or staining tests and SEM-EDS analysis.

### **Comparative analysis between OPD metal threads samples and METHIT samples:**

Due to the interesting analogies between METHIT samples and some samples collected in the OPD archives, along with Isetta Tosini we decided to compare some of them. We observed their morphology and manufacturing technique by optical microscopy and reviewed the results of the SEM-EDS analysis.

We paid a special attention to the following samples:

- **(OPD sample) Dalmatic of Benedict XI, Central Asia manufacture, 13<sup>th</sup> century, with decorative inserts of Italian manufacture (14<sup>th</sup> century), coming from St. Dominic Church in Perugia:** *membrane thread, leather with pure gold (with copper impurities);*
- **(METHIT sample) Textile fragment (CDMT 20589), Lucca? or Iran? or Iraq? manufacture, second half of the 14<sup>th</sup> century, coming from the Centre of Documentation and Textile Museum of Terrassa in Spain:** *membrane thread, leather with pure gold (with copper impurities);*
- **(METHIT sample) Textile fragment (CDMT 6367), Venice? manufacture, 14<sup>th</sup> – 15<sup>th</sup> century, coming from the Centre of Documentation and Textile Museum of**



**Terrassa in Spain:** *membrane thread, leather with pure gold (with copper impurities);*



Photo 2. METHIT CDMT 20589 sample by Stereoscopic Microscopy.

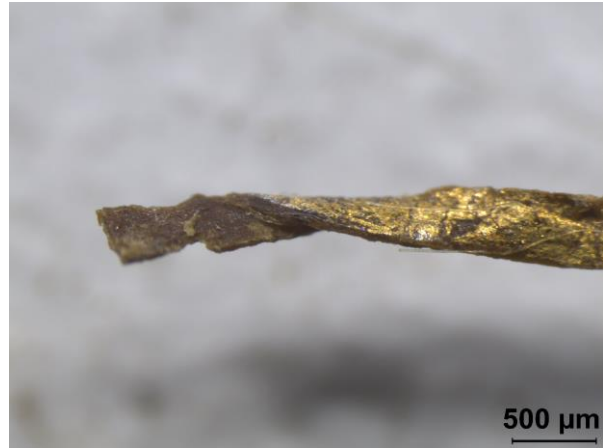


Photo 3. METHIT CDMT 6367 sample by Stereoscopic Microscopy.



Photo 4. OPD sample by Stereoscopic Microscopy.

The samples observed come from different typologies of textiles, different centuries and, apparently, from different textile centers of production, as well.

Nevertheless, the three samples present similar morphology and structure. They are made with leather with a gold layer. We can suppose that some kind of binder was used for joining gold foil to the surface of the support.



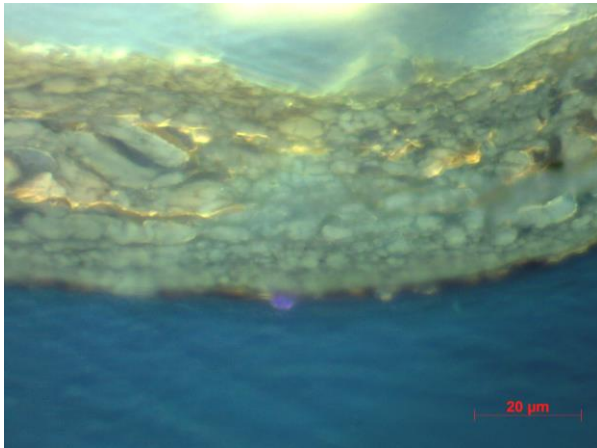


Photo 5. METHIT CDMT 20589 cross-section sample by Optical Microscopy with reflected UV light.

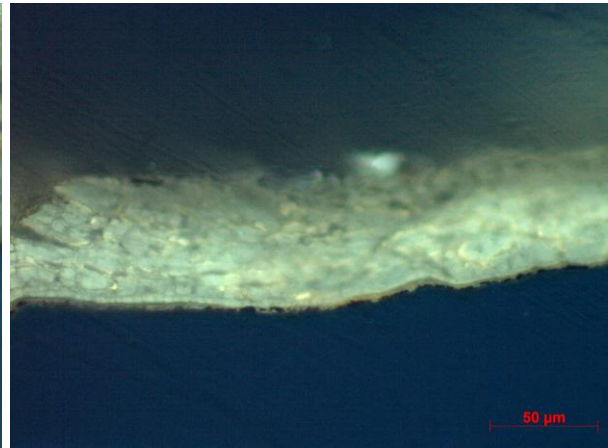


Photo 6. METHIT CDMT 6367 cross-section sample by Optical Microscopy with reflected UV light.

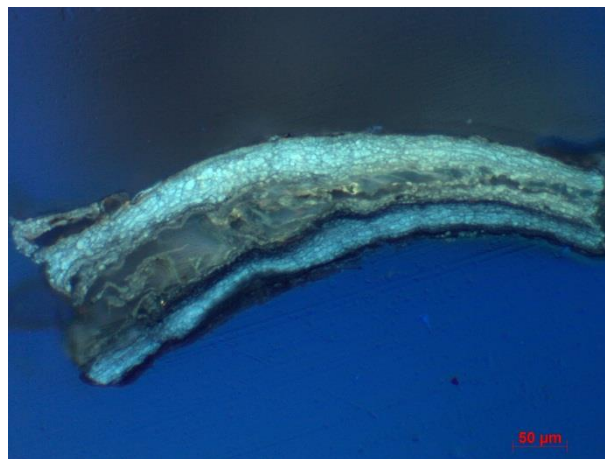


Photo 7. OPD cross-section sample by Optical Microscopy with reflected UV light.

Throughout the observation by Reflected Optical Microscopy with UV light, we established a set of relationships between the cross-sections of the three samples: the organic support is probably treated leather, the adhesive used for joining gold to leather is probably protein-based, according to the UV fluorescence of the materials.

Comparing SEM-EDS images and spectra, we noted that all the samples present a metal coating with pure gold foil. The EDS spectra revealed a recurring presence of calcium, probably related to a treatment of raw leather, and a presence of aluminium, that could be related to alum-tanning methods of leather or pollution presence.

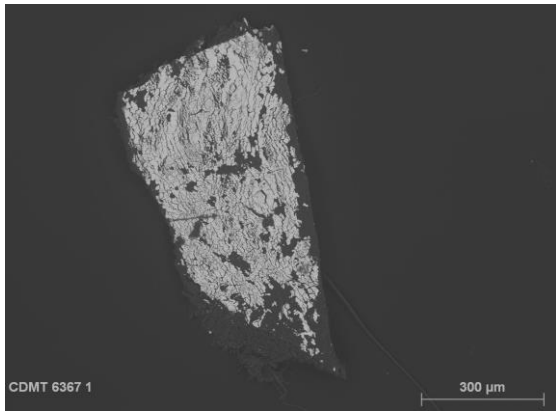


Photo 8. SE image of METHIT CDMT 6367 sample

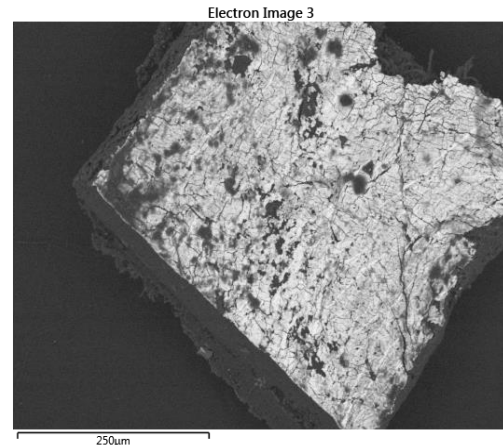


Photo 9. SE image of OPD sample

Arising from this comparative analysis, we discussed the best scientific protocol to investigate the complex structure and various composition of these samples, specially membrane threads.

In this connection, Isetta Tosini described a series of **staining tests** (currently used for the identification of paint media) on metal threads samples to characterize the different nature of materials (proteins, oils, etc.) in mounted cross-section of membrane threads. These tests are not always successful due to the aging of materials. Nevertheless, during the diagnostic itinerary, they are useful to guide further analysis. She introduced some case studies concerning the successful detection of proteins and oils on the cross-sections of metal threads by Amido Black solution and Oil Red solution, respectively.

In conclusion, I learned the importance of these oldest interesting techniques, which constitute a useful tool for the localization of proteins, drying oils and emulsions of proteins and oils on samples. At the same time, Isetta Tosini taught me to develop a critical thinking in the interpretation of these tests, because they are based on visual appreciation of differences in shades or in intensity of colour. Therefore, they must to be confirmed by other analytical techniques.





## **Achievements from the Access:**

The ARCHLAB Access provided me the excellent opportunity to consult OPD studies on metal threads samples. Thanks to the ARCHLAB Access and the scientific data collected in the host institution, I will be able to increase and enrich the *Scientific Reference Data Archive*, which I have built throughout the review of specialized literature.

The collected data will be inserted in this designed database for METHIT, where metal threads studied will be classified according to the different manufacturing techniques.

At the end of the investigation, it will be interesting to evaluate if metal threads with same characteristics (materials and techniques) correspond to the same typology of textiles (with same textile techniques, decorative pattern, dyes and fibers) and if the same typologies of textiles are assigned to the same period and textile workshop.

For a complete comprehension of differences and analogies between manufacturing techniques, in order to relate the choice of materials and techniques to a specific period of time and a textile center, it will be necessary to analyse a large range of samples.

Finally, I would compare my analytical results with those stored in this *Scientific Reference Database*, in order to develop conclusions of scientific validity and evidence on metal threads manufacturing techniques.

## **Conclusion:**

The Access to the OPD provided me with the excellent opportunity to gain knowledge about the contents of their scientific archives, as well as benefit from the knowledge and experience of their scientists. Having the chance to exchange knowledge, information and opinions with the biologist Isetta Tosini, was an incredible and invaluable enrichment.

As a result of an extensive discussion with Isetta Tosini about metal threads investigation, I strengthened my critical thinking skills and I learned that all the analytical data, that I could obtain, need a careful and thorough interpretation in order to disseminate reliable results scientifically proven.



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Therefore, I learned the importance of consulting specialist scientists and taking their advices, which are the outcomes of a consolidated experience, for a young researcher like me.

In conclusion, the ARCHLAB Access has been a great experience and opportunity of professional growth, a guide for the development of my research as well.

Date: 07<sup>th</sup> March 2016

Signature of lead researcher:

Cristina Scibè