External Ion Beam Analysis of "Tesouro da Vidigueira" Collection

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itn

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CENTRO HERCULES HERANÇA CULTURAL, ESTUDOS E SALVAGUARDA

Outline

- The IBA techniques
- The External ion microbeam facility at ITN
- The Vidigueira Treasure
  - Objects
  - History
- Preliminary Composition Results
- Conclusions and Future work

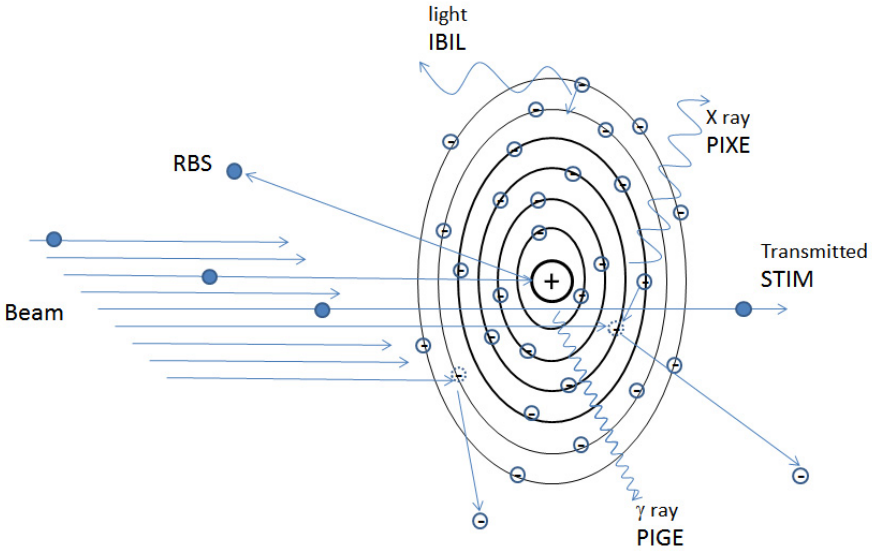
What is IBA?

The IBA (Ion Beam Analysis) techniques is a set of analytical techniques used to study the composition/quality of samples in a non-destructive way, using a high energetic beam of accelerated particles.

The accelerated beam induce in the sample the emission of secondary radiation or particles.

There is a specific IBA technique to study each one:

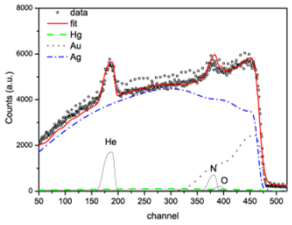
- NRA (*Nuclear Reaction Analysis*)
- ERDA (*Elastic Recoil Detection Analysis*)
- RBS (*Rutherford Backscattering Spectrometry*)
- PIGE (*Particle Induced Gamma Emission*)
- PIXE (*Particle Induced X-ray Emission*)

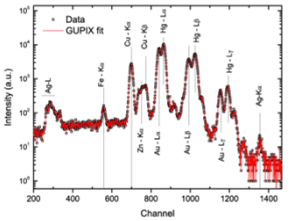


IBA: PIXE and RBS

The combination of 2 or more IBA techniques allow us to know:

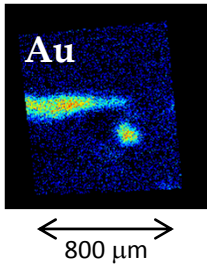
- element identification
- quantification (µg/g sensitivity)
- depth profile



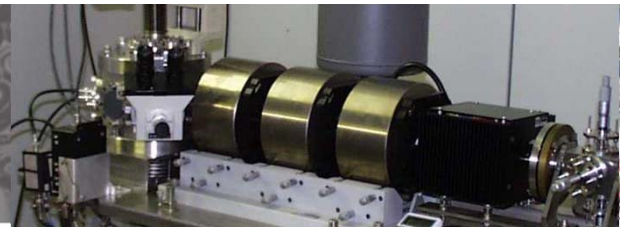


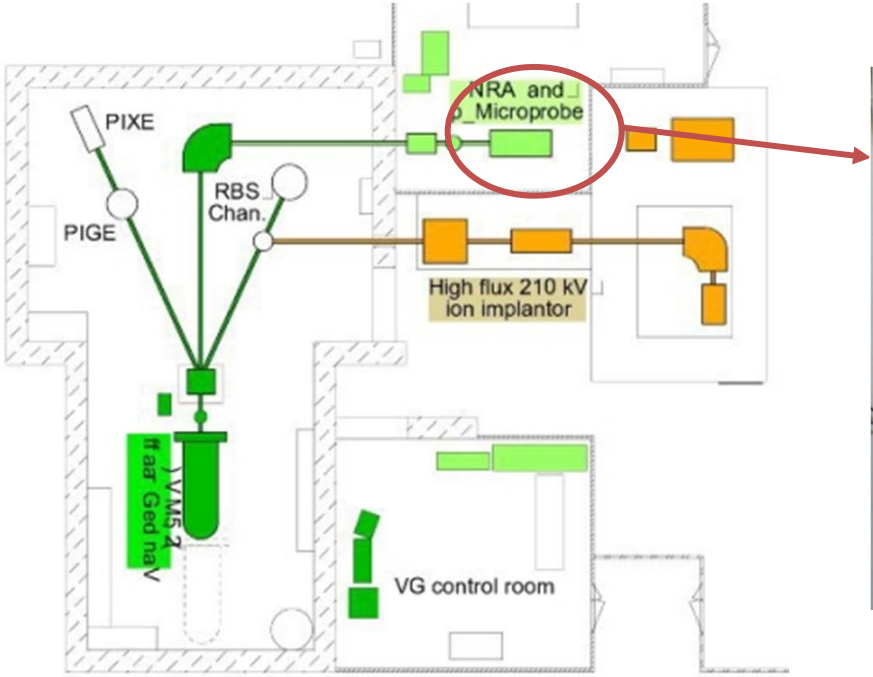
- Non-destructive - low beam currents are used.
- Short time needed for analysis.
- Possibility of point or scan analysis.

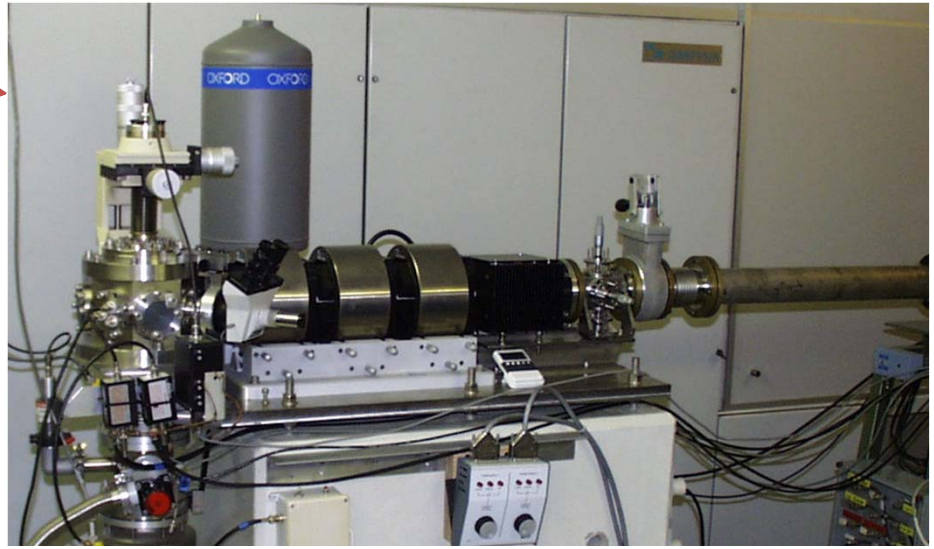
(when using a scanning nuclear microprobe)



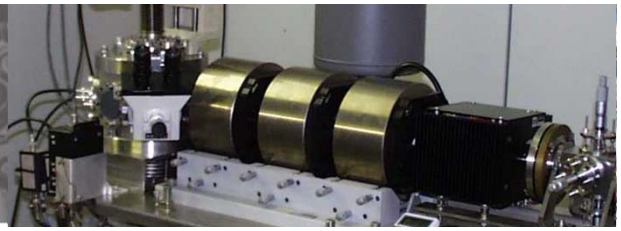
Microprobe at ITN



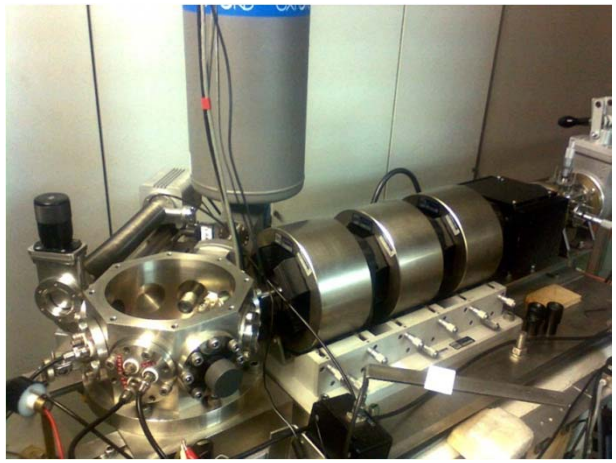


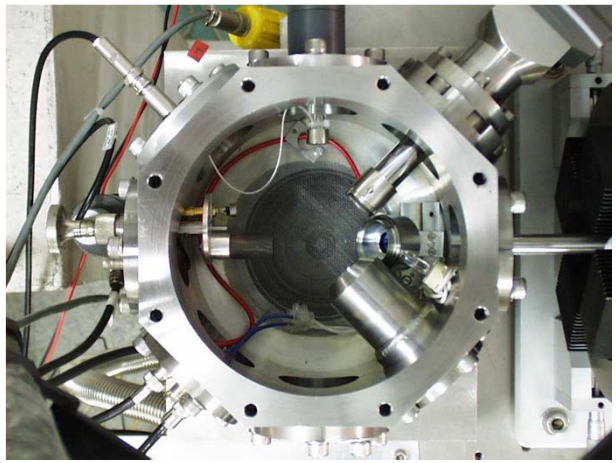


Why External Beam?



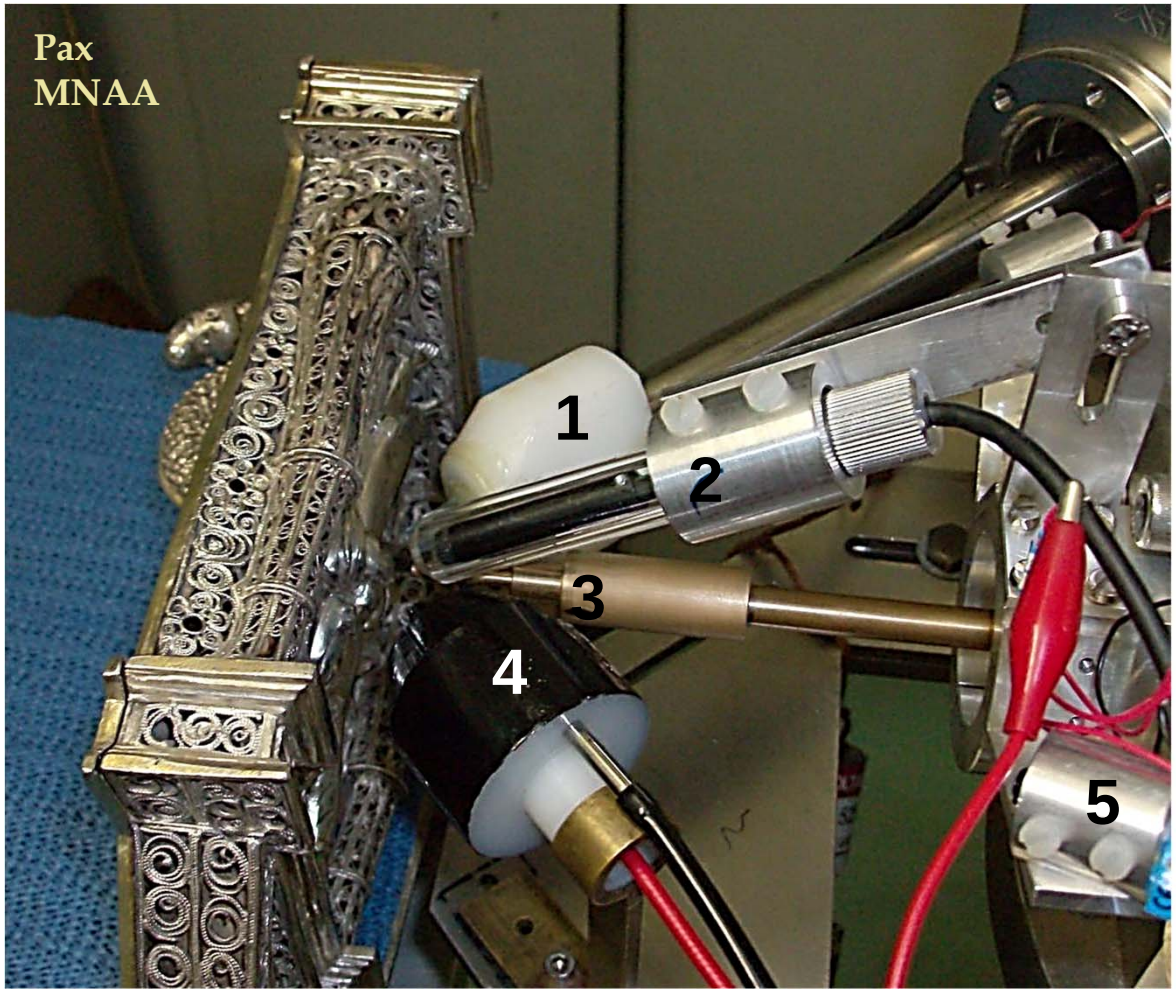
Problems under vacuum conditions:



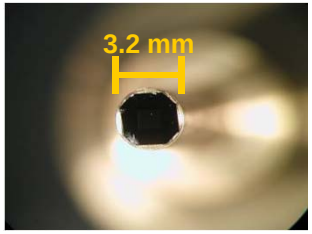


- Size of objects, sampling is needed
- Damage:
  - Heating (thermal damage)
  - Drying
  - Charging (Breaking)
- Difficult sample handling/viewing

The External ion microbeam



1. X-ray detector
2. Micro-camera
3. Exit nozzle with a 100 nm thick Si_3N_4
4. RBS detector with He flux
5. Two lasers



Vidigueira Treasure

The "Vidigueira Treasure", dates from the 1580 decade and was ordered by Padre André Coutinho.

The collection had an Indo-Portuguesse origin attribution . It is composed of three pieces:

- Pax
- Missal Lectern
- Oratory - reliquary

Vidigueira Treasure

Padre André Coutinho

38 years in the Orient

1545
arrives India

1579
first priest to be ordained in China

1583
returned to Portugal with D. Francisco da Gama

1597
buried at Chapel of Our Lady in Vidigueira

Became an important mediator in the dispute between the two patronages in the Orient, the Franciscans and the Jesuits.

Moved to the Convent of Our Lady of the Relics in Vidigueira (property of Gama family).

Began the renovation of the Convent and the building of a new church.

1588
the Chapel of Our Lady of Conception was inaugurated.

Vidigueira Treasure

"I also leave all my silverware for use in church services; my large chalice with its altar cruets and silver dishes so that masses be held with them … – as well as my **silver lectern** – the silver-decorated altar card, **pax**, thurible, incense boat, silver-decorated missal, six silver candlesticks, two large and two small…. – my ewer and partly-gilded silver dish – two incense holders – a silver host-box, so that all this may be used at religious services in my Chapel…

I leave the holy water bucket and its sprinkler… also a silver lamp… so that it may be displayed and lit at all the year's festivities in my chapel. (…) I leave my **reliquary** with its silver-decorated doors, which has a crucifix in whose cross there is a fragment of the True Cross and other relics, so that it may be displayed in my Chapel in the sacrarium that is made on the altarpiece, and in this way it will not be removed except for the purpose of its being used in some solemn procession that is held at the convent."

Vidigueira Treasure

Unfortunately, the belongings were to become scattered around different places, and so far it has proved impossible to discover their trail.

Concerning the Convent of Vidigueira, some were distributed to the Parish Church of Odemira. Kept in reserve at the Mint House in Lisbon were a **missal lectern, a pax, a reliquary and an altar card**. Of this group of pieces, only the location of the altar card is unknown.

In 1883, the three pieces were incorporated into the collection of the Academia das Belas-Artes and later into the MNAA collection.

Since 2006,they have been classified as heritage of national interest (Dec. nº 19/2006).

Vidigueira Treasure

During the conservation intervention performed on the oratory in 2009, with a view to its inclusion in the "*Encompassing the Globe*" exhibition, **Kanji** characters were discovered at the bottom of some of the receptacles and the cavities opened in the wooden box in order to house the relics.

The collection had an Indo-Portuguesse origin attribution.

Can they be attributed to a **Chinese** origin? **Japan** origin?

Vidigueira Treasure: Style

The three pieces: oratory-reliquary, the pax and the missal lectern have a common decorative structure:

- Technically and visually are similar, reflecting that they all had the same origin, namely the Orient.

Oratory reliquary

Pax

Missal Lectern

Vidigueira Treasure: Style

The three pieces: oratory-reliquary, the pax and the missal lectern have a common decorative structure:

- The central figures of all three share the same source for their inspiration: oriental facial features; heavily embossed work to create a three-dimensional effect. Same workshop.

Oratory reliquary

Pax

Missal Lectern

Vidigueira Treasure: Style

The three pieces: oratory-reliquary, the pax and the missal lectern have a common decorative structure:

- The detail of the pyramid shapes that complete the decoration. The stylistic link between the three objects that cannot be ignored.

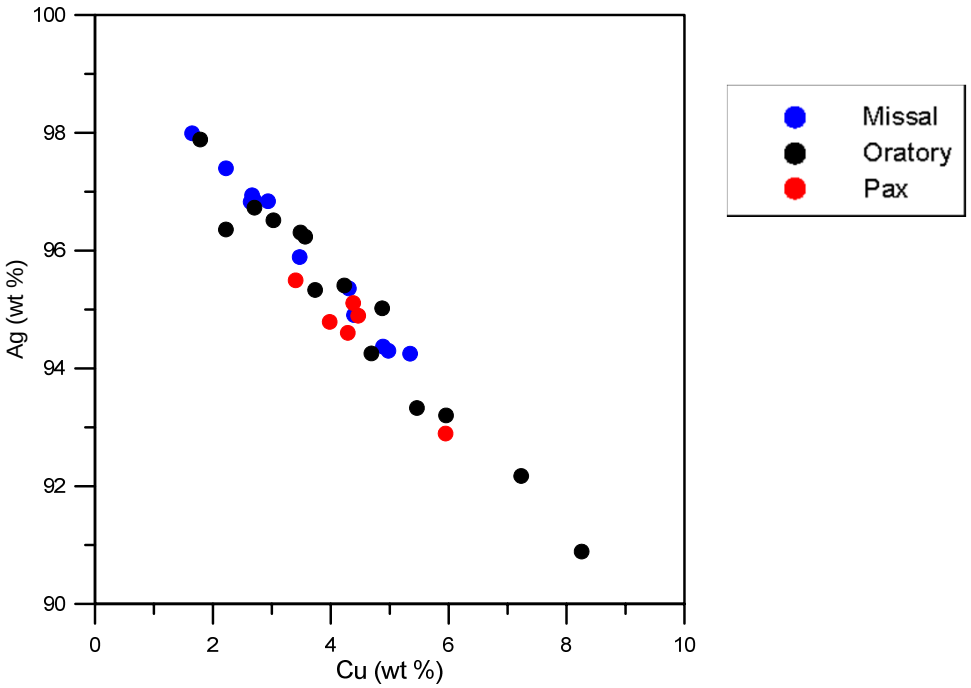
Oratory reliquary

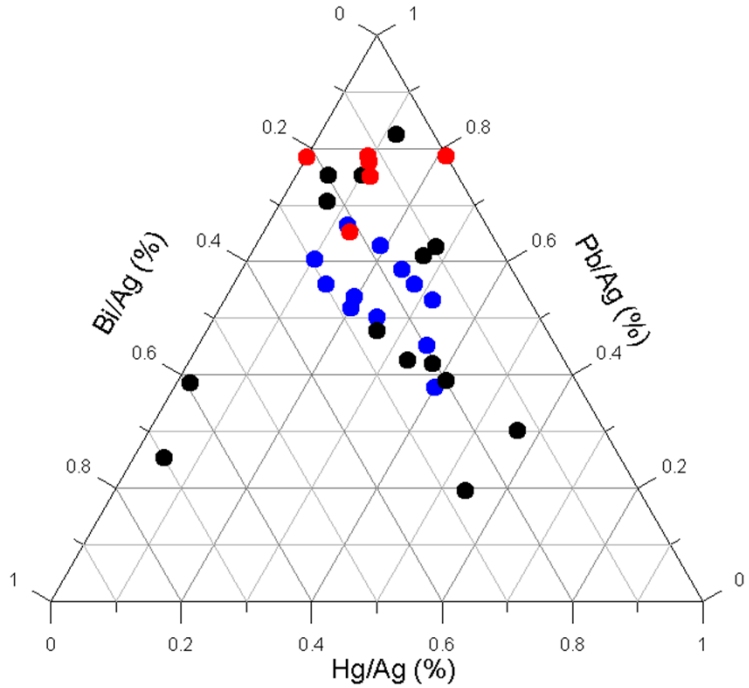
Pax

Missal Lectern

Vidigueira Treasure: Composition

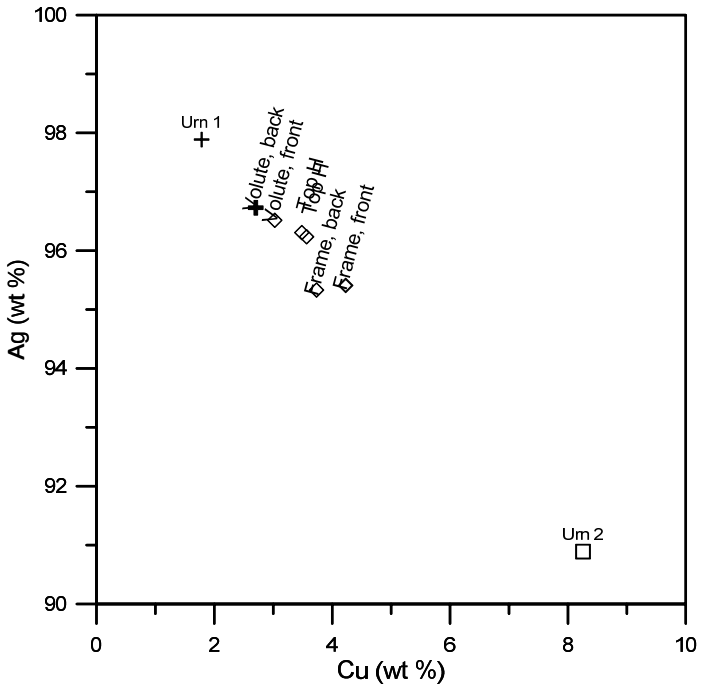
The three pieces: oratory-reliquary, the pax and the missal lectern have a common alloy (Ag:Cu), but with different composition. Also the trace elements have different concentration.

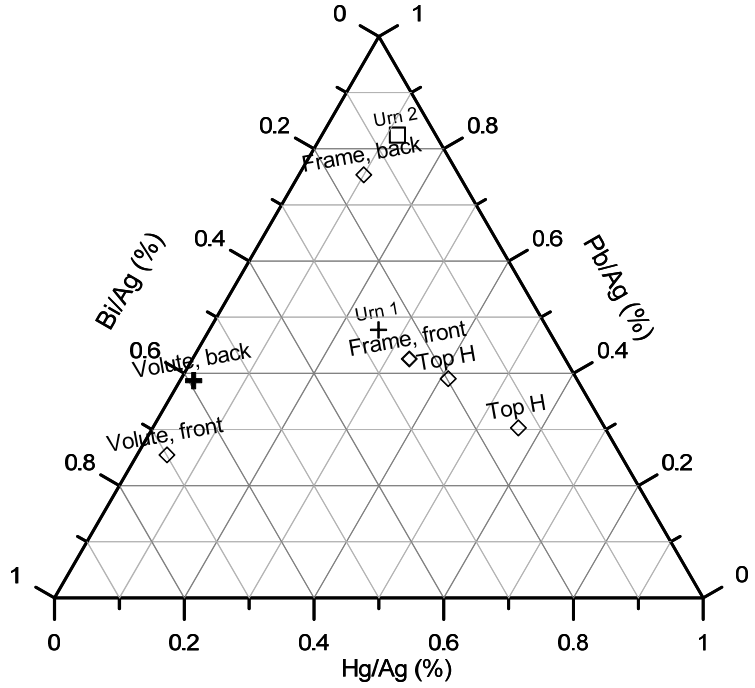




Composition: Oratory

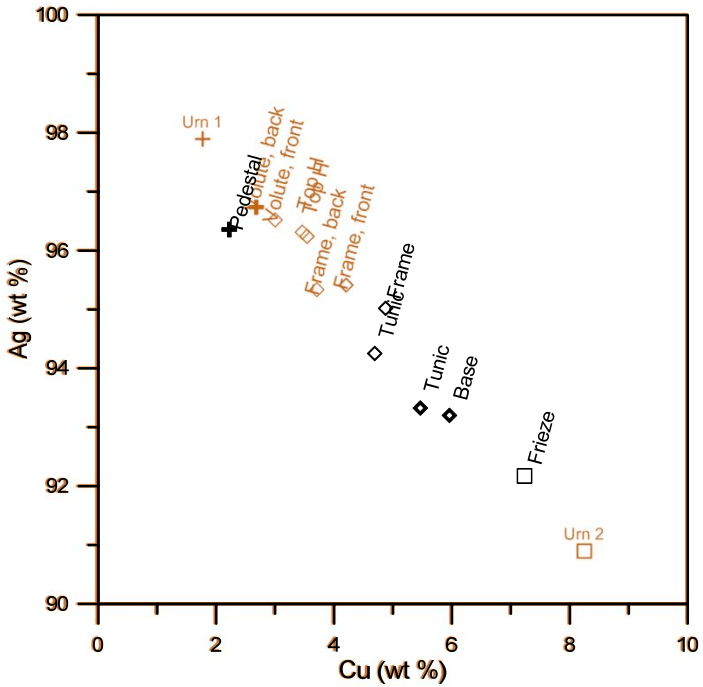
	Ag (wt %)	Cu (wt %)	Impurities
Urn 1	97,9	1,8	Fe, Pb, Au, Bi
Urn 2	90,9	8,3	Fe, Pb, Au, Bi, Zn, Ni
H	96,2	3,6	Fe, Pb, Au, Bi, Zn
Volute, Front	96,5	3,0	Fe, Pb, Au, Bi, Zn
Volute, Back	96,7	2,7	Fe, Pb, Au, Bi, Zn
Frame, Front	95,4	4,2	Fe, Pb, Au, Bi
Frame, Back	95,3	3,7	Fe, Pb, Au, Bi, Zn

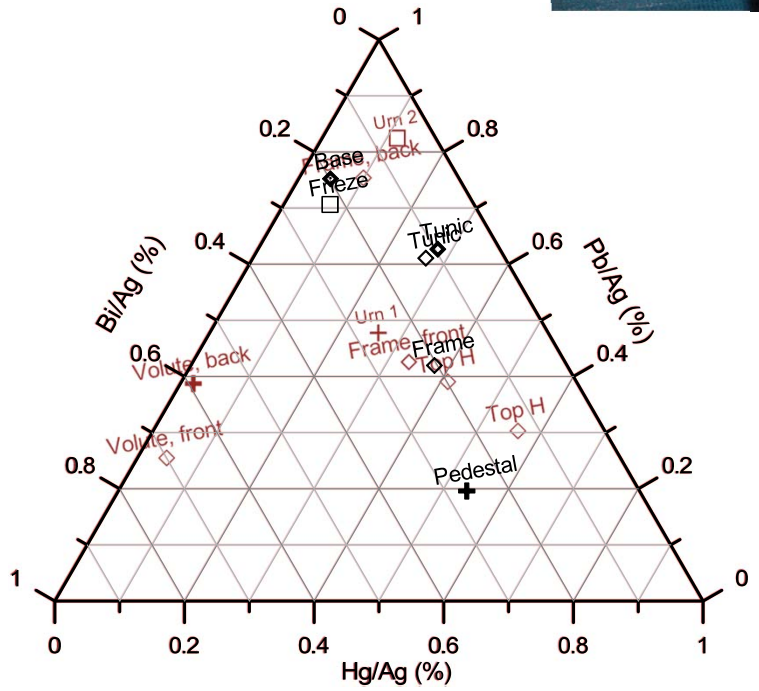




Composition: Oratory

	Ag (wt %)	Cu (wt %)	Impurities
Base	93,2	6,0	Fe, Pb, Au, Bi, Zn, Ti
Frame-Our Lady	95,0	4,9	Fe, Pb, Au, Bi
Tunic	94,3	4,7	Fe, Pb, Au, Bi
Tunic	93,3	5,5	Fe, Pb, Au, Bi
Pedestal	96,4	2,2	Fe, Pb, Au, Bi
Frieze	92,2	7,2	Fe, Pb, Au, Bi

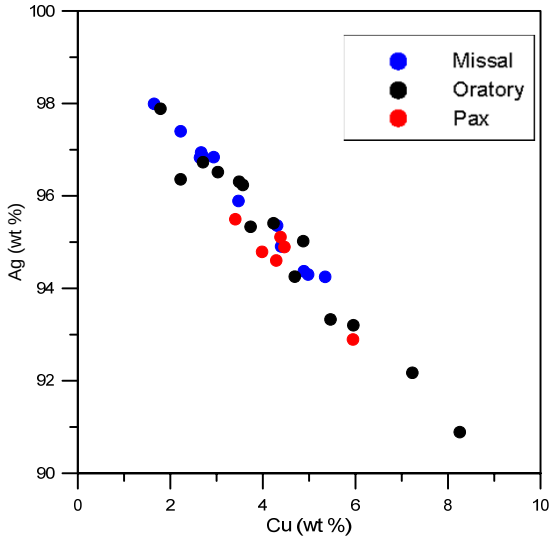




Composition: Missal Lectern

The missal lectern consists of a wooden structure comprising two hinged elements forming a scissor shape and completely covered with embossed silver plaques.

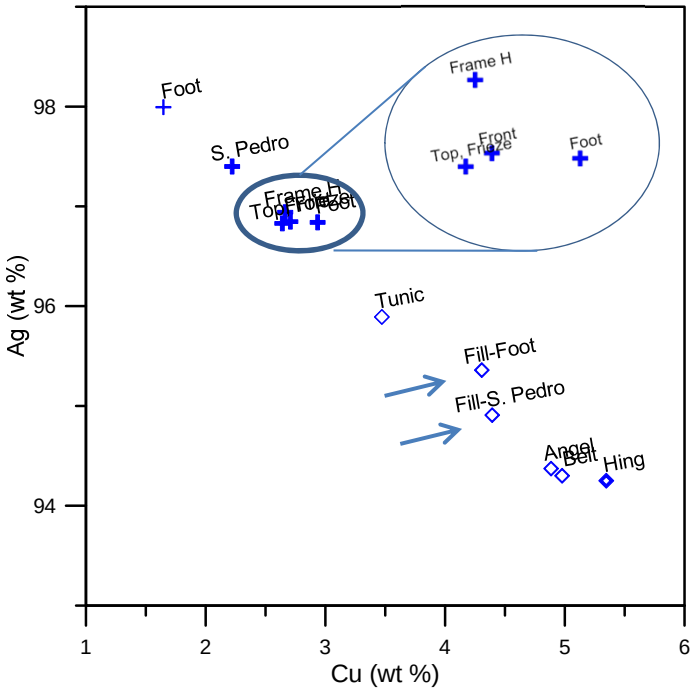
- Serious deformation, frequently handled.
- The silver was broken and displays some gaps that had been filled in with silver leaf: welded or nailed to the piece.

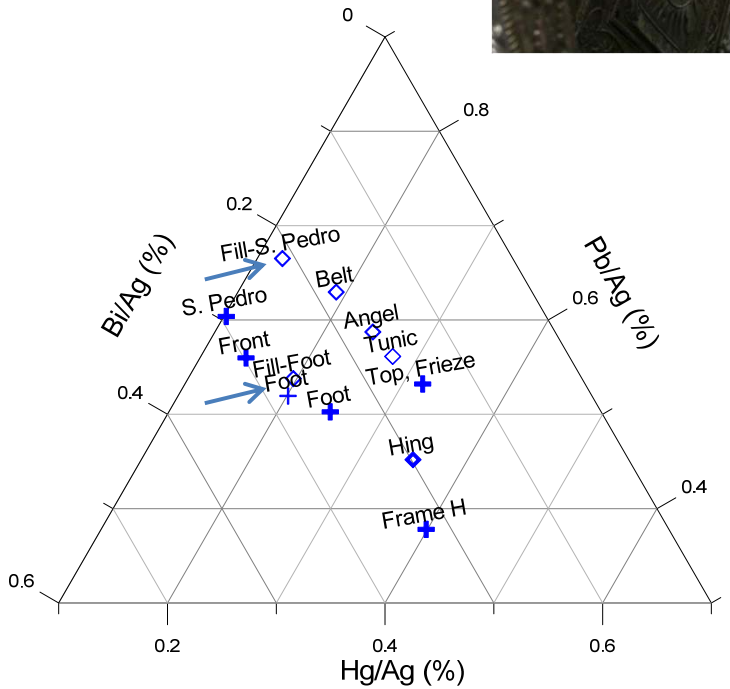


Composition: Missal Lectern

The concentration data are more related when compared with the oratory, with some exceptions.

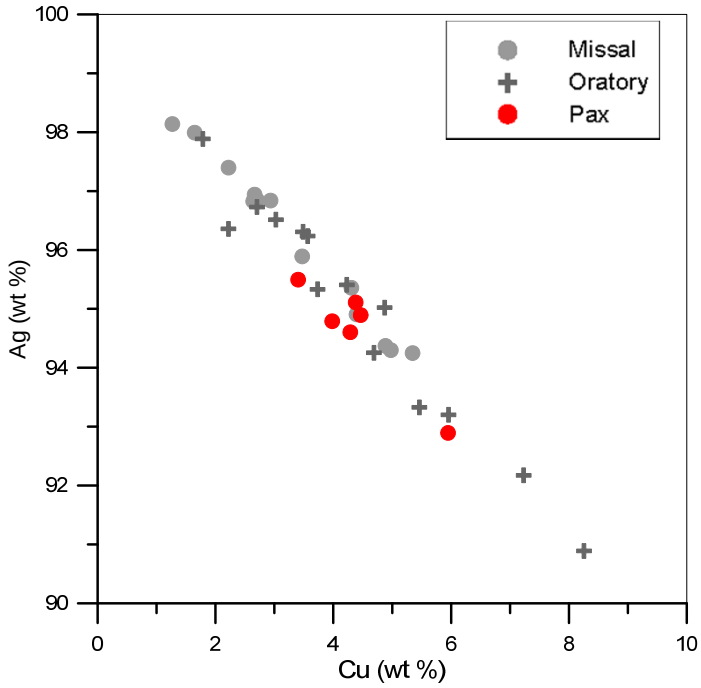
There is no clear differences between the "original" silver leaf and the "fill-silver".

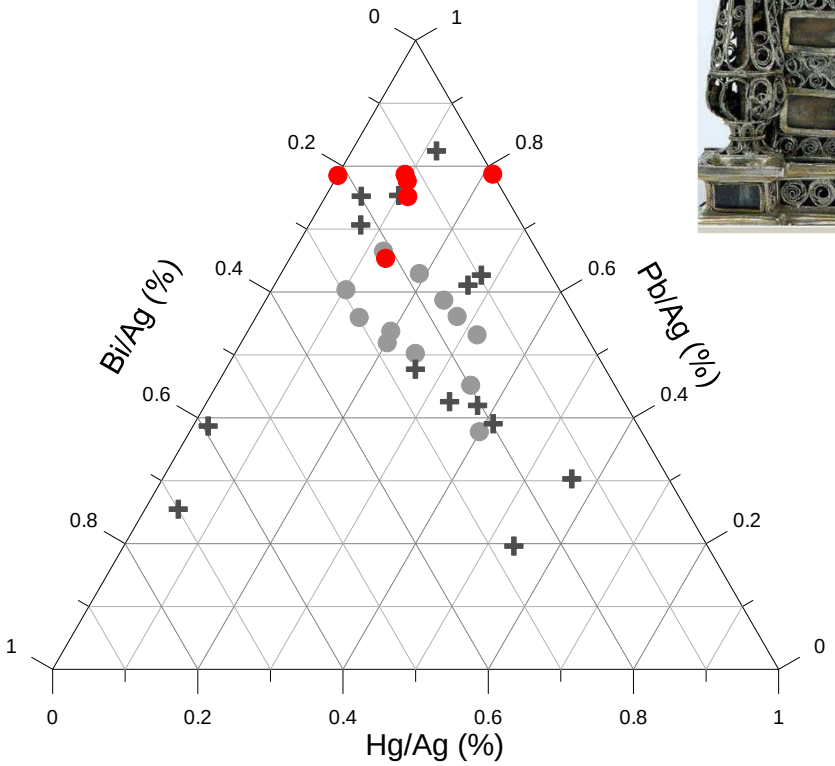




Composition: Pax

The pax is made of partially gilded silver and silver filigree.

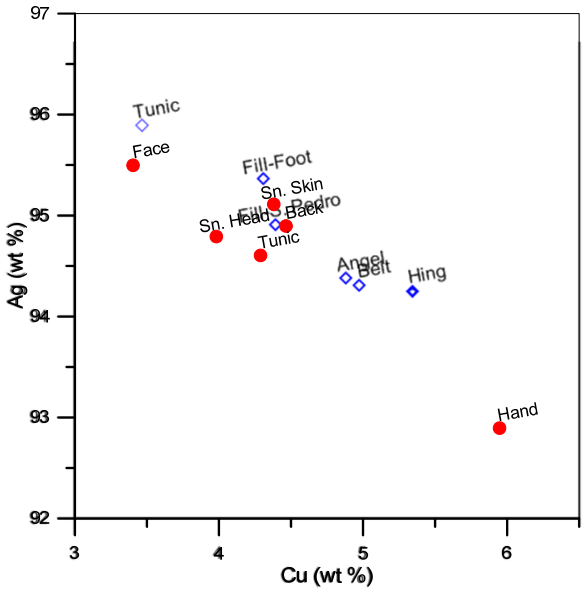


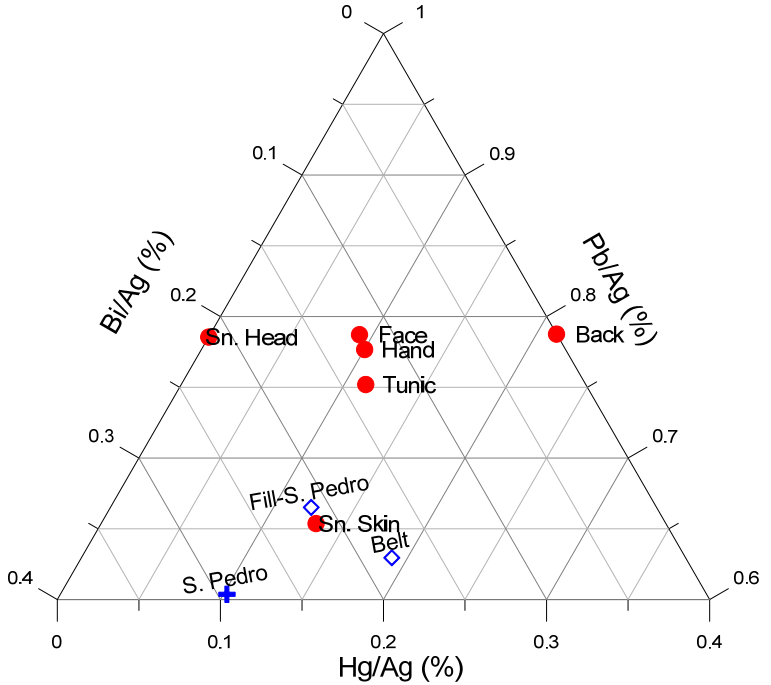


Composition: Pax

During the restoration process, on the back of the figure of Christ, it was possible to detect number of cracks (embossing procedure?) filled in with small patches of silver.

An example is the hand, although the Ag:Cu alloy composition is different, the trace impurities are quite similar when compared with the face or the tunic of Christ.





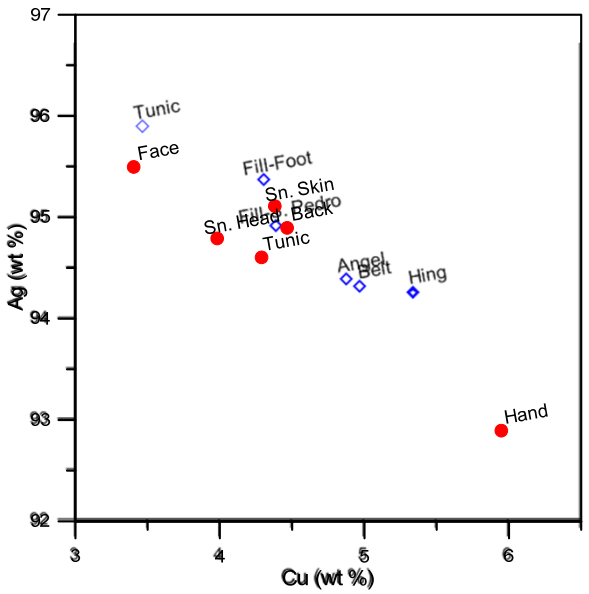
Composition: Pax

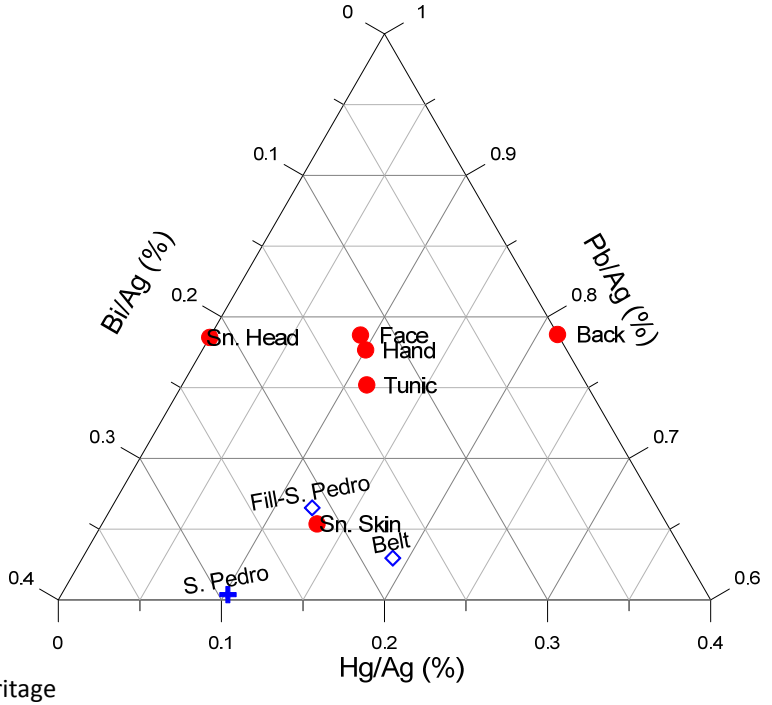
The points analyzed on the back are completely different:

- The silver leaf has a very low concentration of Bi;

- The skin and the head of the snake have different composition.

- In the back, one of the screws has Cu-Zn-Ag (30,7- 7,2 – 59,9 %)





Conclusions

- The three pieces: oratory-reliquary, the pax and the missal lectern have a common decorative structure.

- Compositionally, different silver alloys used: both between the pieces themselves and between elements of the same piece.

- The pattern of the trace impurity concentration is very inhomogeneous.

- Only a urn from oratory-reliquary and one of the screw from the pax have a clearly different alloy.

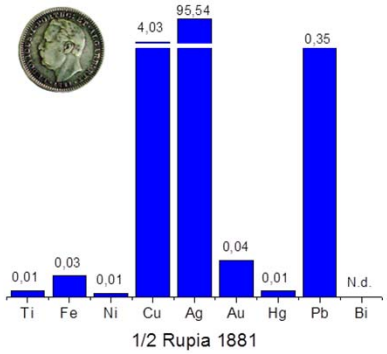
Future work

- Correlate the composition results with other pieces with known Oriental origin.

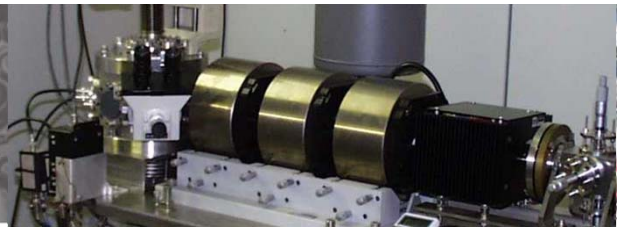
- The copper and silver mined and traded in these areas of the Asian continent or even from the Mexican Area was used to:

  - Mint coins at the Goa Mint?

  - To manufacture typical silver objects from these regions.



Researchers involved



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Gracias

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