

Terrestrial Globe by W.J. Blaeu



**FINAL RESTORATION REPORT
AUGUST 2023**

Before Restoration







Scientific Research

Restorers analyzed the globe and its structure with the help of induced ultraviolet fluorescence, infrared false color, and X-ray images.

Regarding ultraviolet fluorescence and false-color infrared, due to the difficulty of focusing on artifacts with curved surfaces as in the case of the globe, numerous frames with different planes of focus were acquired and processed using Photoscan automatic photogrammetry software (Nikon 850 camera) to obtain a three-dimensional model in the ultraviolet, infrared and visible ranges.

The report includes screenshots taken from the 3D models.

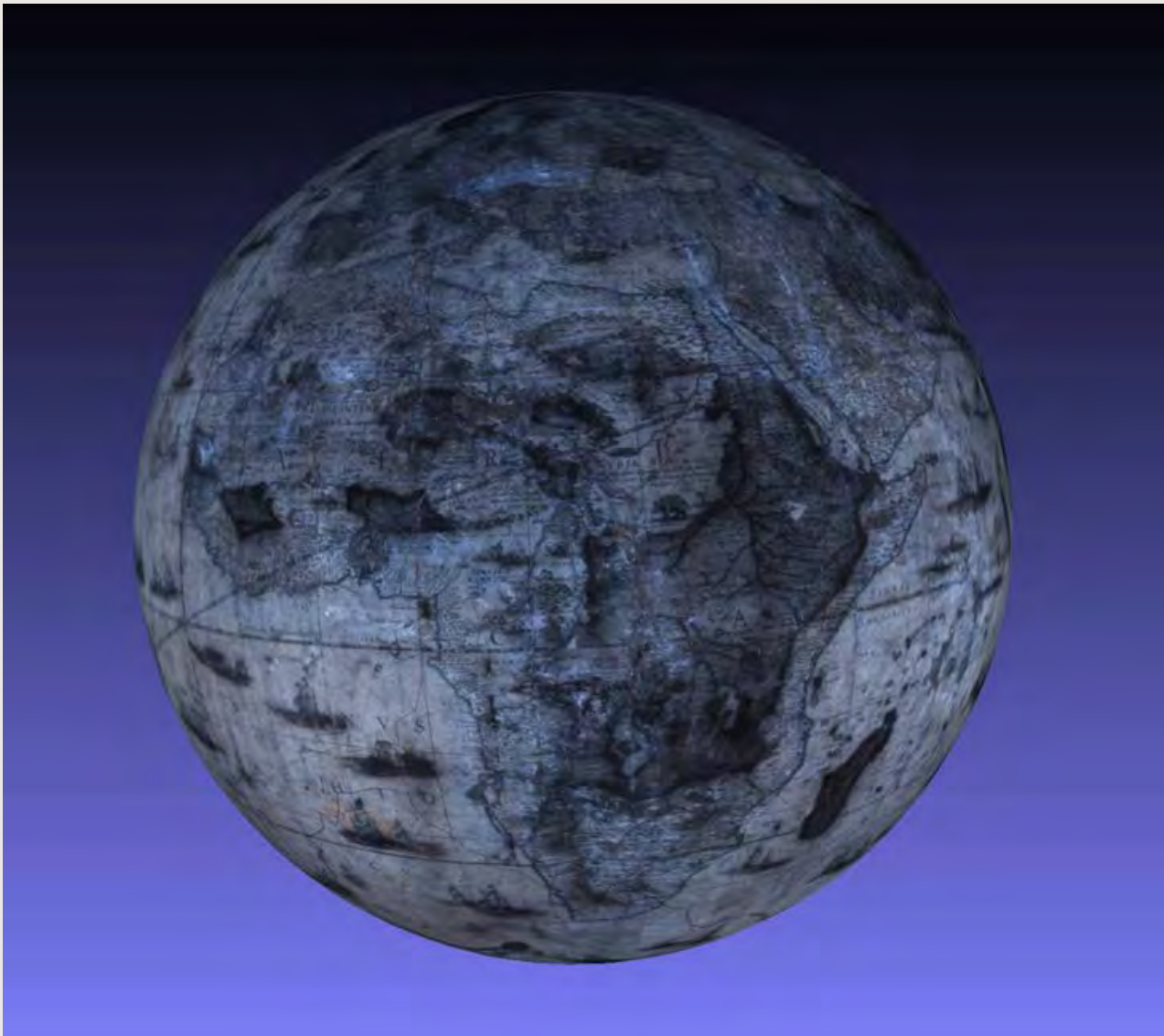
In addition, based on the results obtained from the X-ray images, using Rhinoceros software (software for modeling sculpted surfaces), the model of the globe was designed and then 3D printed, to better describe the construction technique of its internal structure.

A Fluorescence X-ray fluorescence (XRF) analysis campaign was also performed on the artifact to study the color fields (23 measurement points).

Using X-ray fluorescence (XRF) analysis, it is possible to determine the chemical elements ($Z \geq 11$) contained in the pigments on the artifact.

Induced Ultraviolet Fluorescence

The images of the induced ultraviolet fluorescence offer a general blue fluorescence.



In addition to the blue fluorescence attributable to the paper, there is a light brown fluorescence, which is visible on the lower part of the globe, especially in correspondence with the sea (e.g., Mare Arabicum and Bay of Bengal, fig. 2) and highlights the state of preservation of the paper by accentuating the brown spots present (fig. 3).



Induced ultraviolet fluorescence - Detail

In lighter-colored areas (areas characterized by a poor state of preservation and a more reflective surface), such as the portion of the globe between Africa and India, there is light-colored fluorescence (Fig. 4). In some parts of the globe (e.g., area to the right of Italy and over Arabia, Fig. 5) there is blue-colored fluorescence due to the presence of overlying substances.



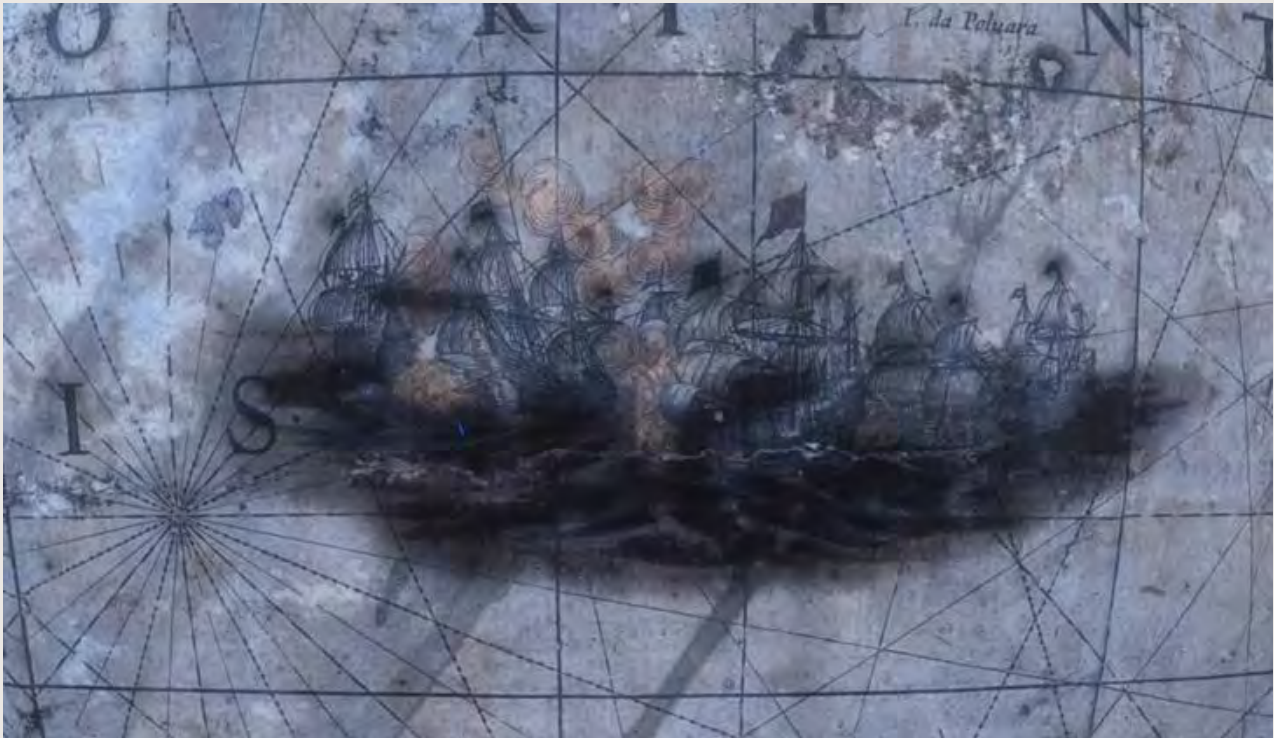
On the brown-colored areas (e.g., Madagascar, China, and waves under ships, Fig. 6), there is the presence of very dark fluorescence attributable to a restoration with copper-based pigments that do not emit at the wavelength of 365 nm (see X-Fluorescence Analysis).



On the red backgrounds, e.g., corresponding to the reds of the characters holding the scroll (lower area of the globe, fig. 7), the incarnate of the figures holding the scroll (upper hemisphere near the America Septentrionalis inscription), the red flag under the island of Sumatra, and along the red borders of the island of Iava, there is red fluorescence due to the probable presence of organic dyes.



In correspondence with white areas, such as the clouds above the group of boats over the inscription Sea of India and Pacificum (figs. 8 and 9), the white of the robe of the right-hand character holding the cartouche, there is a very intense orange fluorescence attributable to the presence of recent restoration work.



Infrared False-Color

From analysis of the infrared false-color images, restorers observed that the brown/dark green areas are characterized by red metamerism (fig. 10). The blue backgrounds of the robes of the characters holding the scroll (lower hemisphere of the globe, fig. 11) and of the boat flag near the Picus inscription, are marked by a purplish metamerism from the presence of pigments that do not absorb in the infrared mixed with copper-based pigments (see Fluorescence X Analysis).



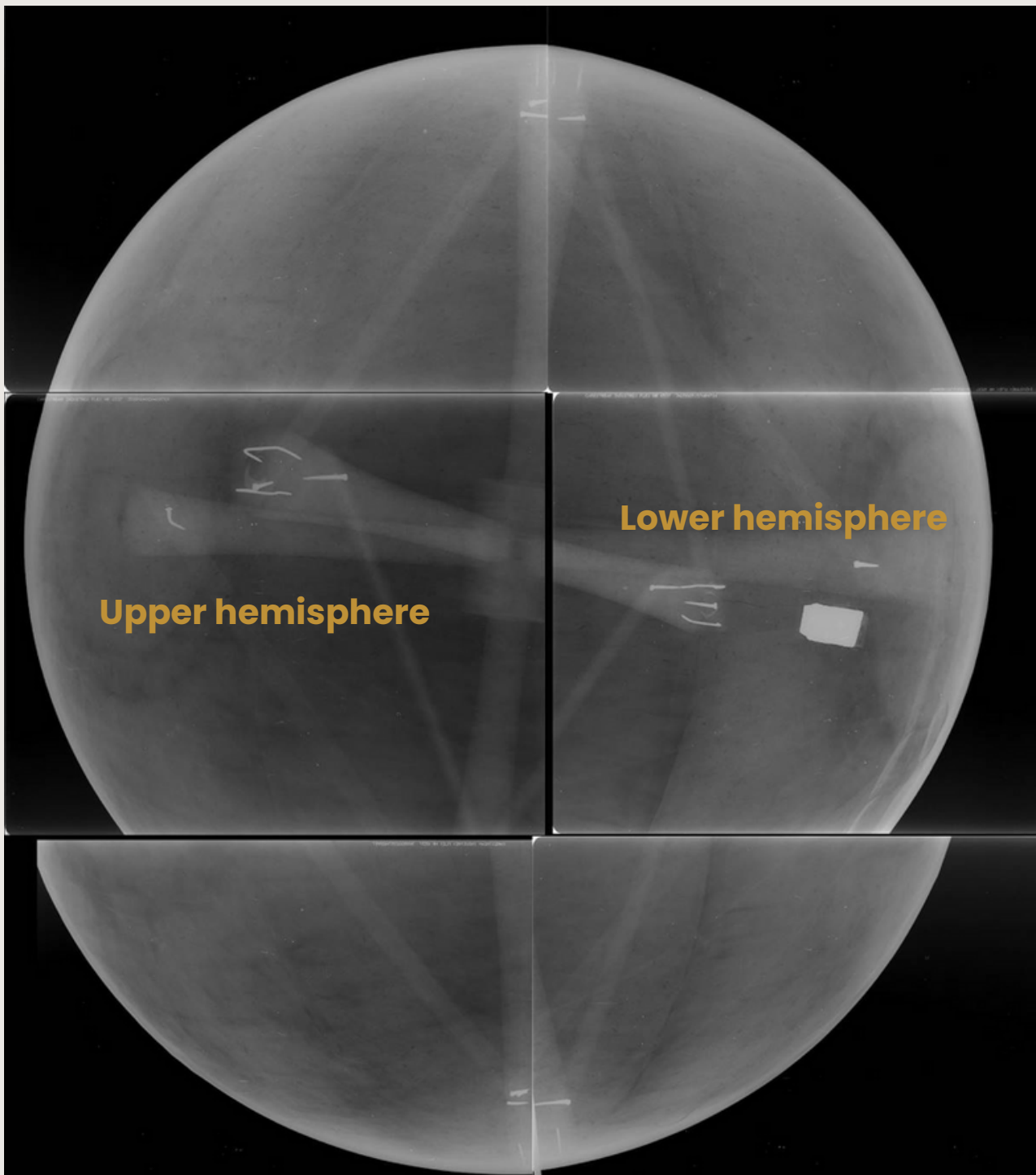
Infrared false-color

In general, the red pigments present (e.g., red robes and cities, Figs. 12 and 13) have yellow metamerism due to the presence of cinnabar (see X-Fluorescence Analysis).

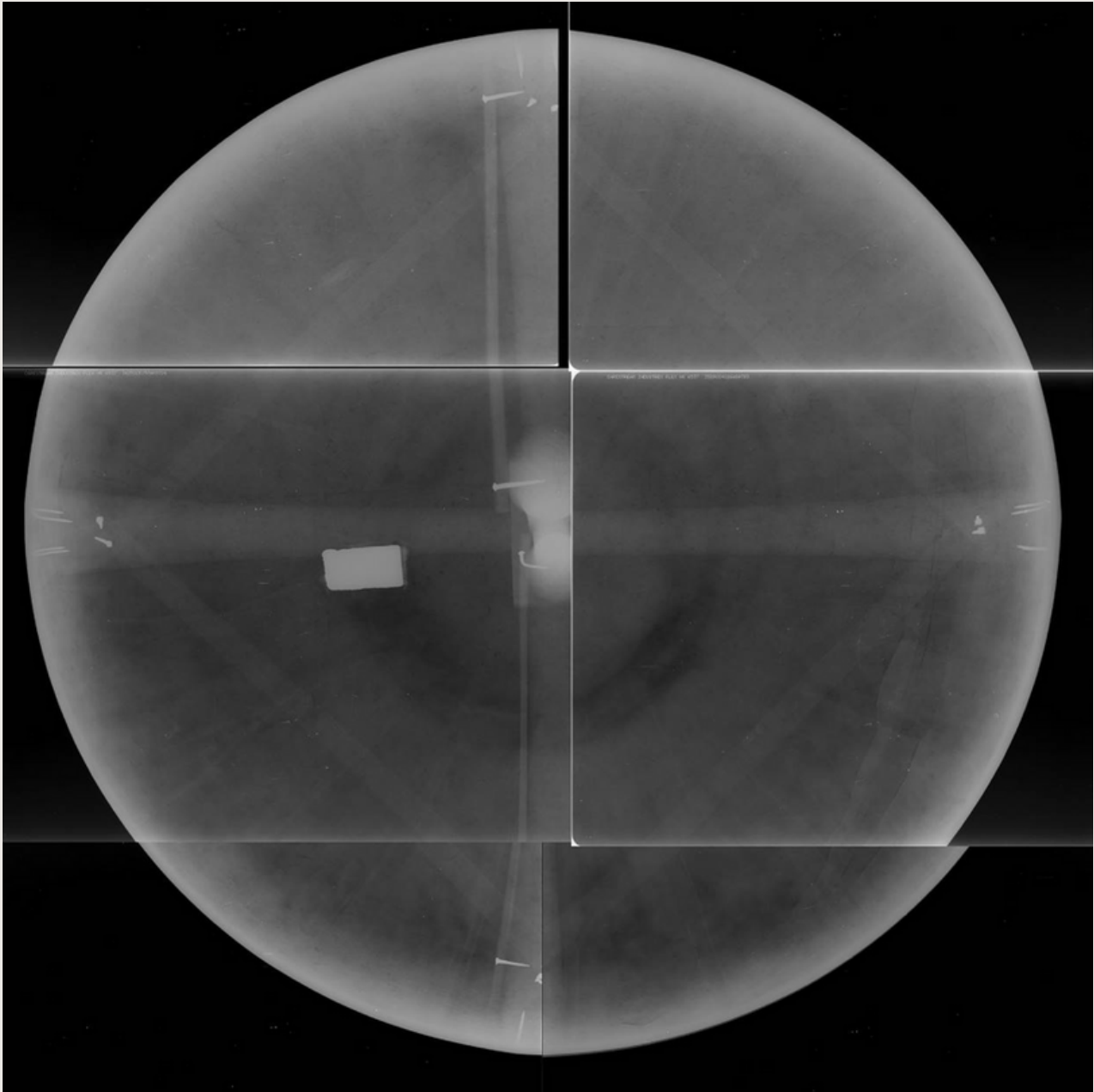


X-Ray Imaging

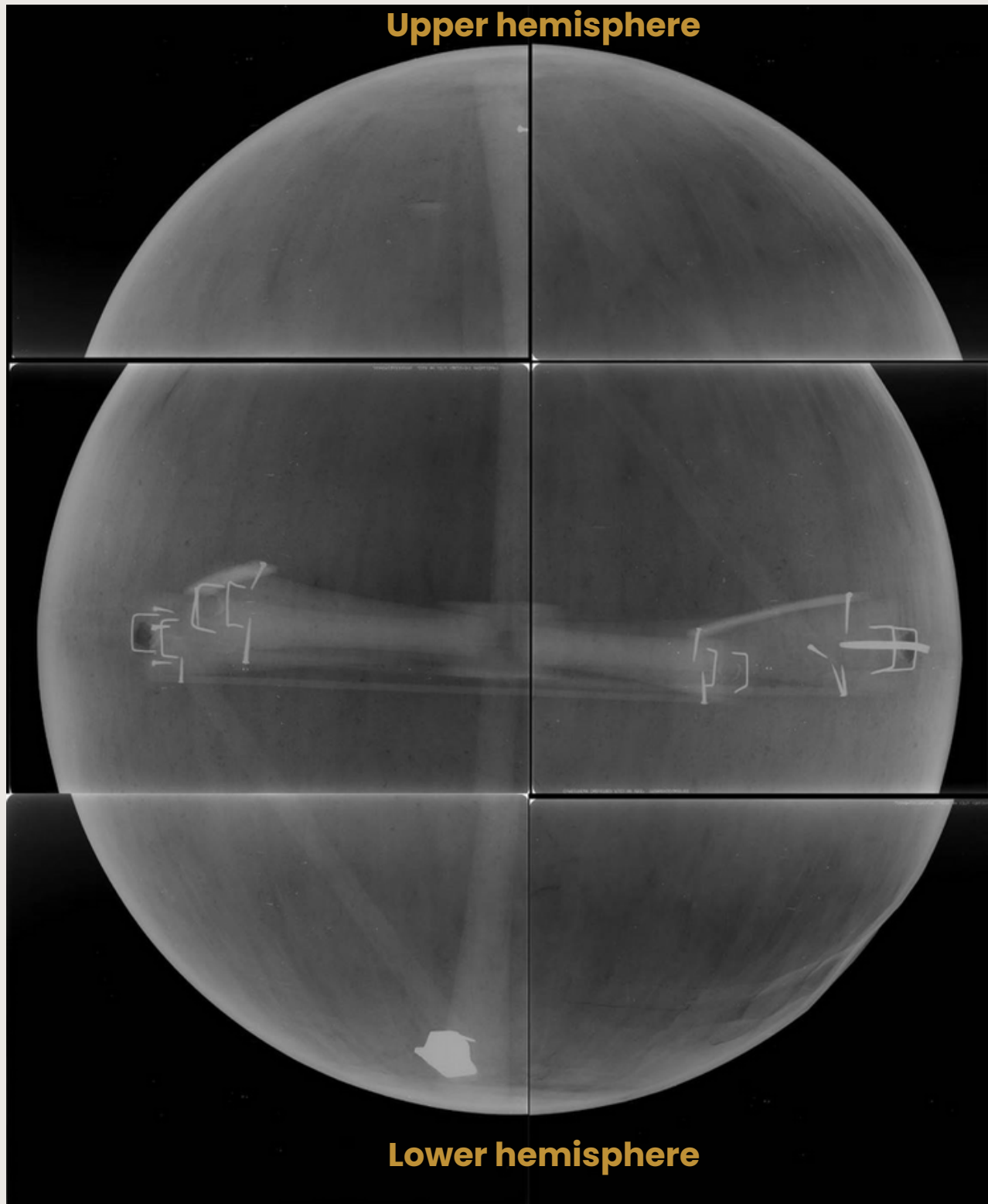
From the X-ray images, it is possible to observe the construction technique of the globe, which consists of two hemispheres. There is a fracture line that follows the entire perimeter in the center of the sphere (Fig. 14).



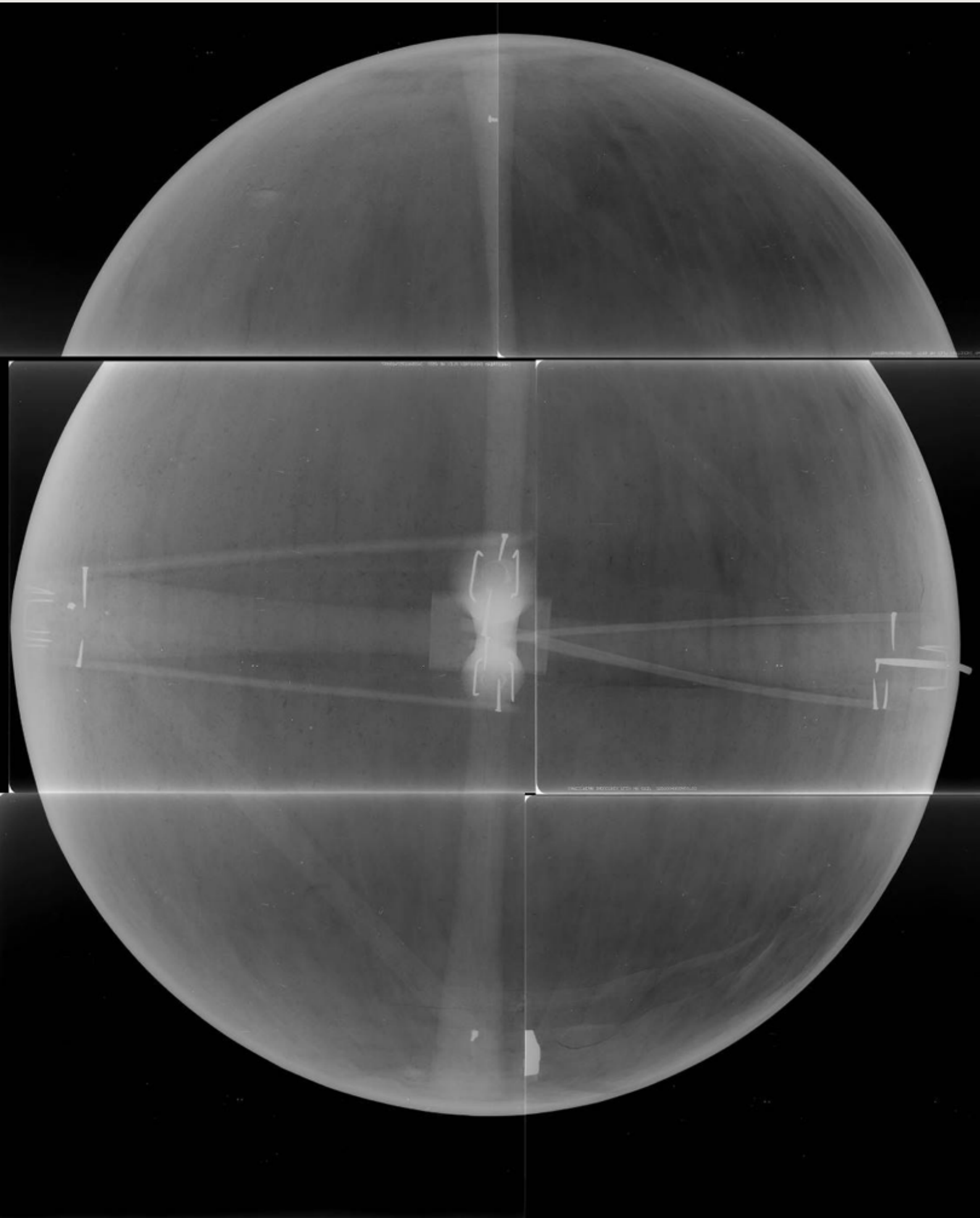
Inside the Globe is a wooden structure consisting of two horizontal axes. They measure the length of the diameter of the sphere and intersect perpendicularly. At the ends of the two axes, there are two circular shapes that are more radiopaque than the rest of the Globe. The metal elements previously attach the two axes to the Globe (Fig. 15).



At the intersection of the two axes, there is a parallelepiped-shaped joint and an additional wooden axle (dead man's stick that is not bound to the Globe by metal elements) in a vertical position. The two axes are connected by four wooden planks (assembly 15 and 16), and the two horizontal axes with the vertical axis are assembled together by two wooden planks creating a rhomboid shape. All the wooden planks, that make up the structure, are held together by metal elements such as nails and staples.



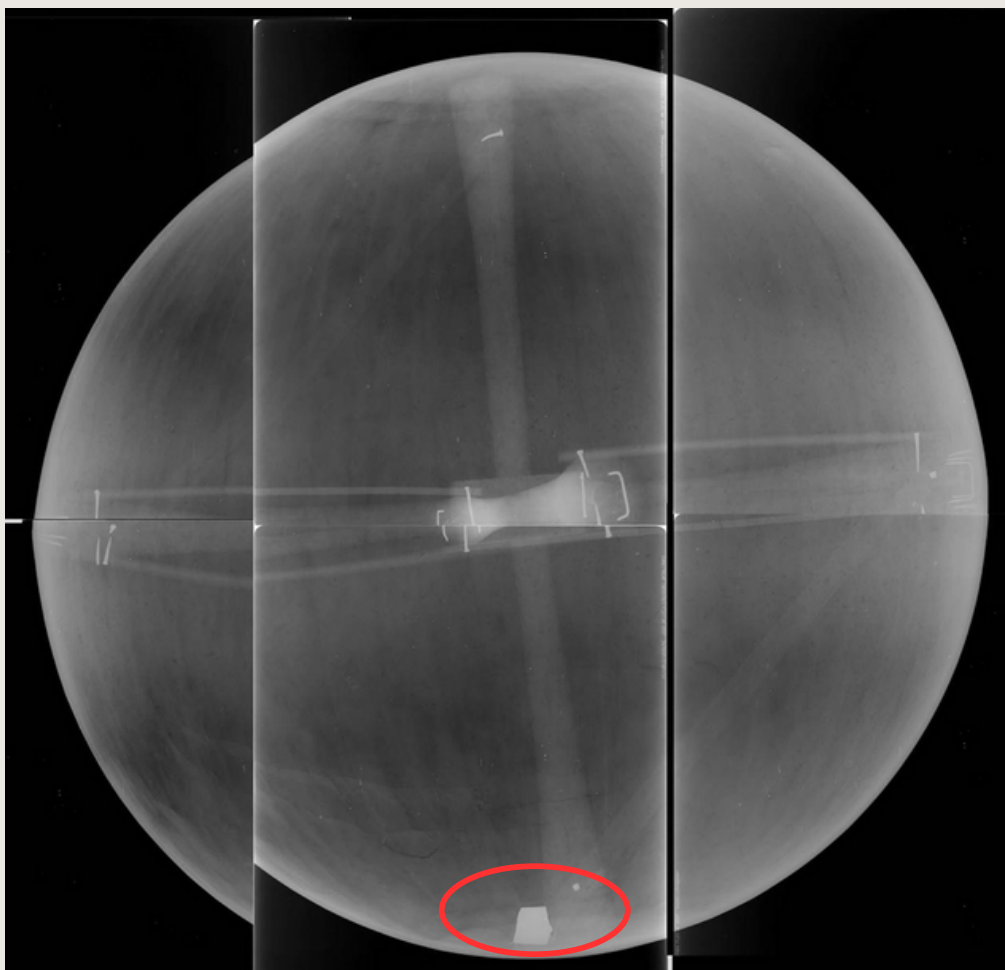
Upper hemisphere



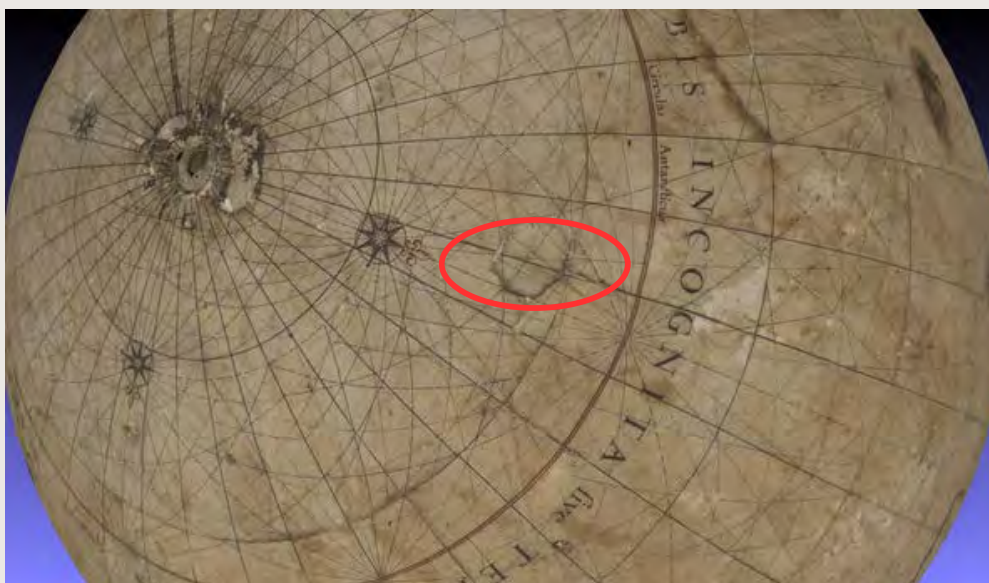
Lower hemisphere

Furthermore, from the X-rays, it is possible to examine the state of preservation of the surface of the globe; in fact, thin cracks are visible, especially in the area where the surface of the globe has suffered damage (lower hemisphere at Africa, figs. 17 and 18). At the dead man's stick (lower hemisphere), there is a radiopaque object of defined shape, and at the external surface, an insert is visible (figs. 18 and 19, red box)

Upper hemisphere

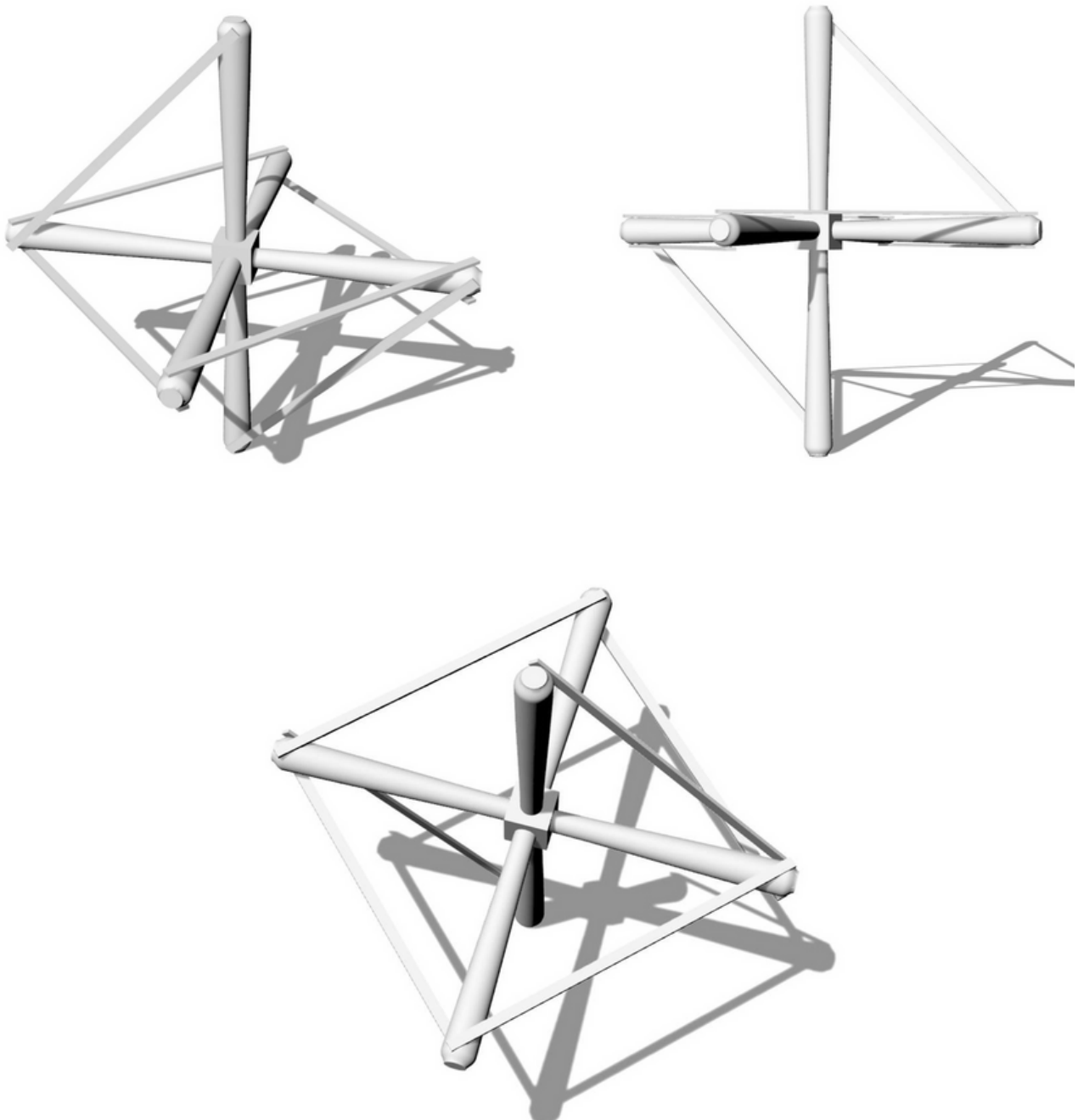


Lower hemisphere



3D Modeling

Based on the results obtained through X-ray imaging and to better understand and visualize the assembly of the internal structure, a 3D model of the globe's internal structure was designed using Rhinoceros modeling software. Finally, in addition to the virtual simulation of the construction technique of the artifact, there was 3D printing of the individual pieces that make up the internal structure of the globe (Figs. 20, 21, and 22) and a hollow sphere was created to simulate the globe itself.



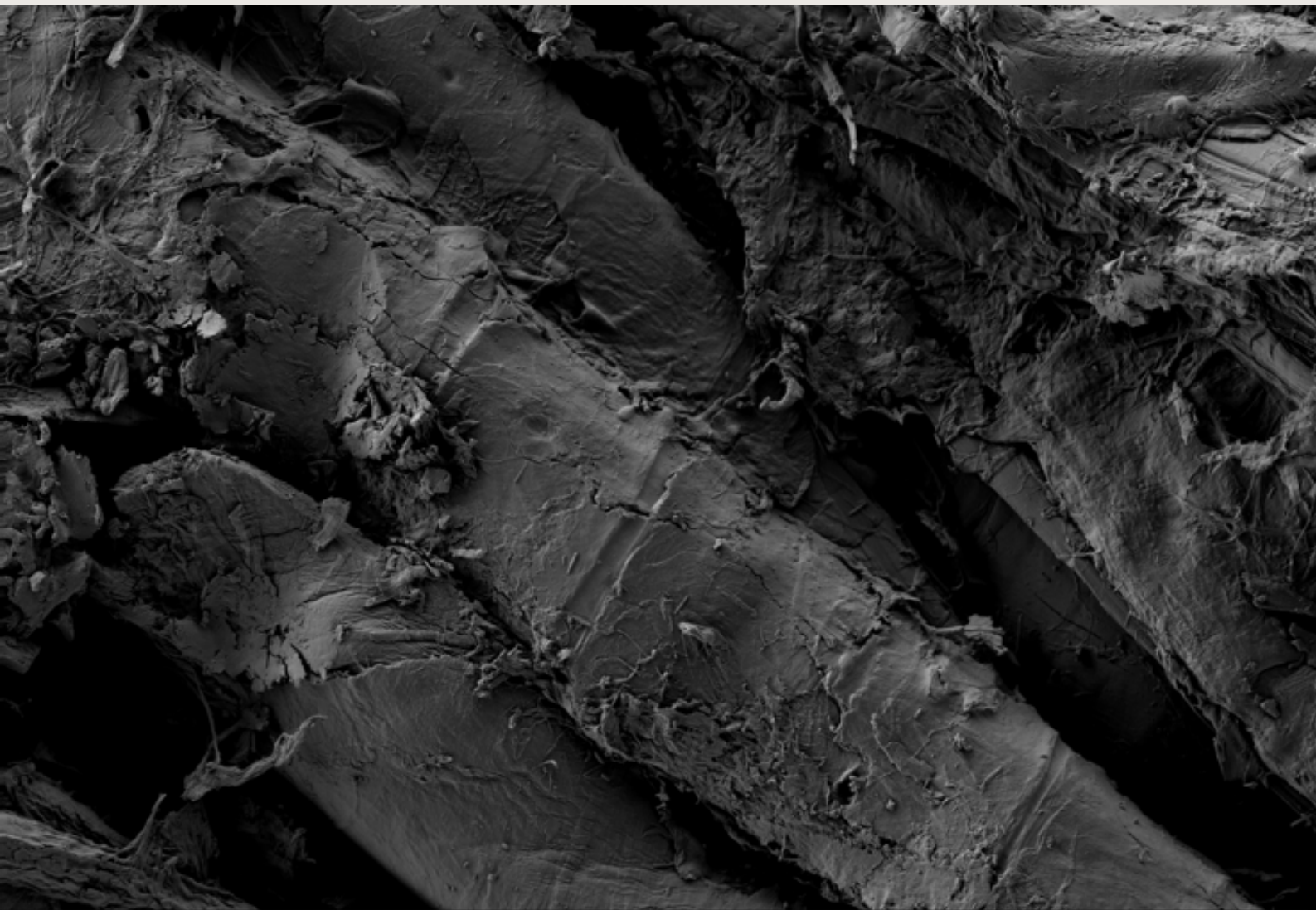
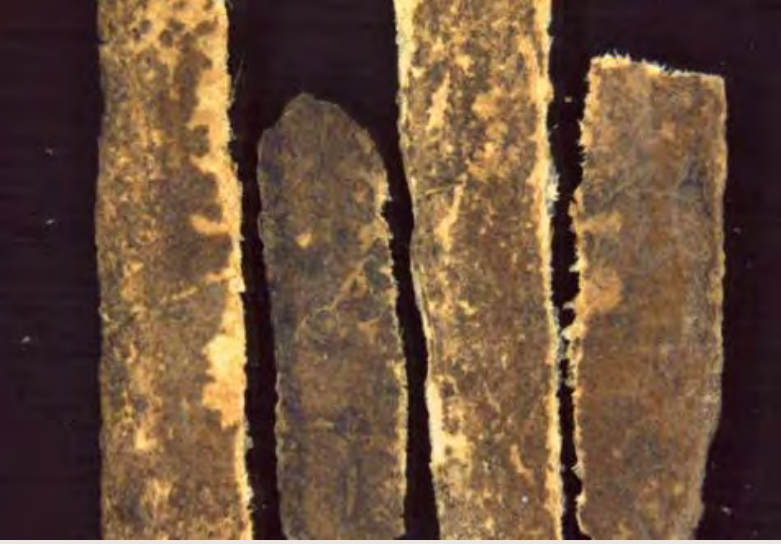
3D Model Reproduction



Study of the Paper Substrate

The study of the paper substrate of the Terrestrial Globe was carried out through the investigation (optical and scanning electron microscopy) of two fragments of paper detached from a gap on the horizon line (fig.1). The work is in a considerably degraded state of preservation due to the chromatic alteration of the decorated surface, extensive gaps, and surface deformations evident throughout the work. The following table and images list the sampling points of the tests under examination, with the relevant analytical questions and investigations carried out.





10 μm | EHT = 1.00 kV | Mag = 2.80 K X | Signal A = SE2 | Date :10 Dec 2021
I Probe = 260 pA | WD = 3.0 mm | CC Pressure = 0.0 % | 70157-01 2800X .tif | ZEISS

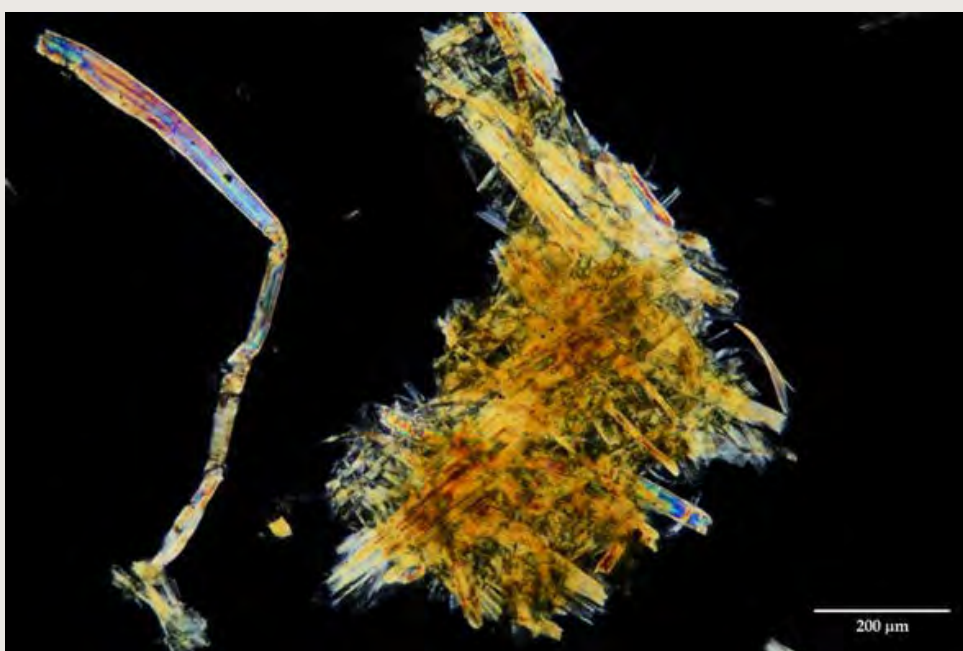
**FESEM image, 2800X magnification, secondary electrons:
detail of some fibers**



**Photo of the sampling in reflected visible light, magnification 25X:
in (a) front part; in (b) back part**



**Photo of the sampling in reflected UV light, 100X
magnification**

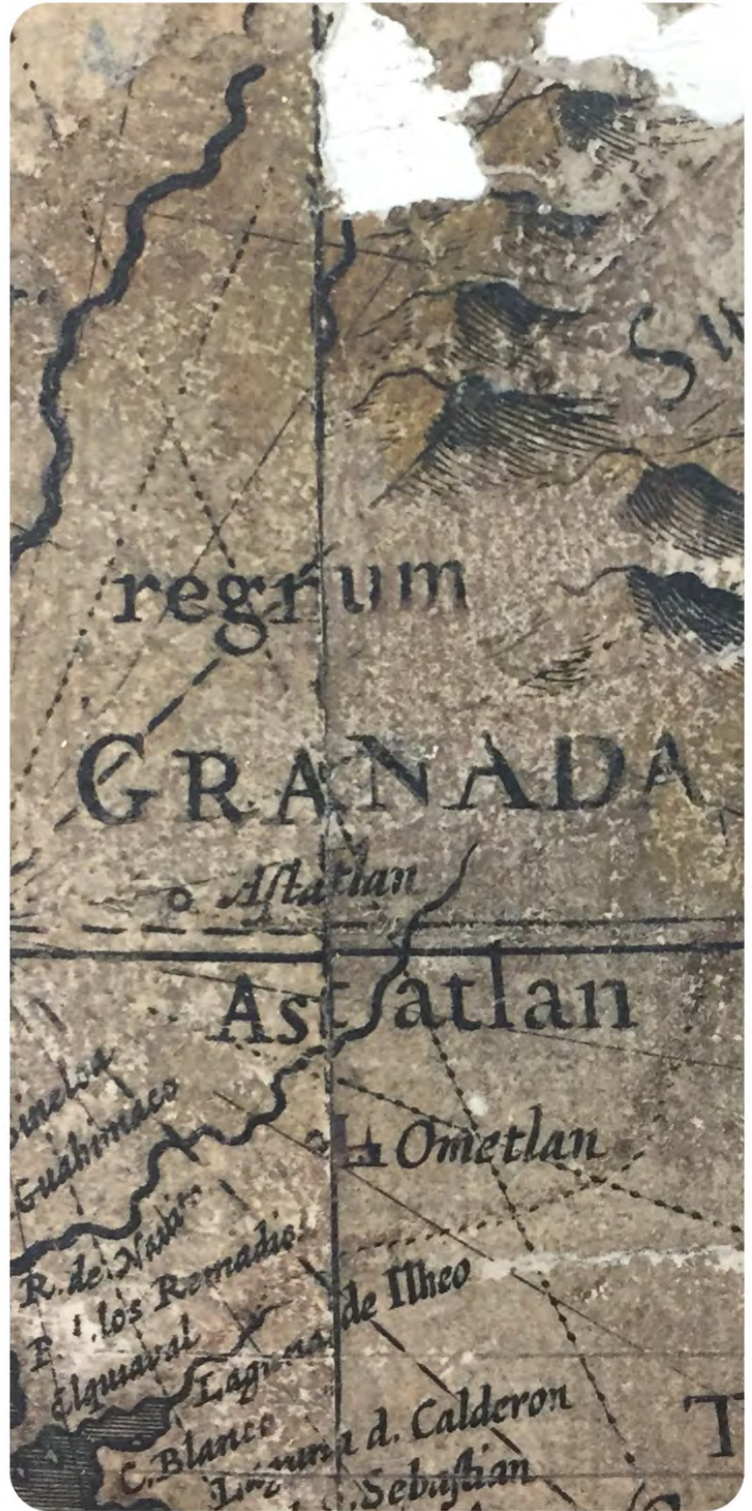


**Photo in transmitted visible light,
crossed nicol, 100X magnification**

Cleaning



Chromatic Rebalancing





Lowering of gaps using abrasive sponges



Grouting during restoration

After Restoration





Capaschi

Calicuas

Lacus iste quantum
ex acolis collis
potuit creceat ut
minimum miliaria
in longitudine n. pateat

SINUS
MEXICANUS

ERLICHICHI

Tova

IA

NOVA

La Bermosa

I. d'Arenas

Trianga

Guati

Honduras

Nica

Nicaragua

EVBA

I. Cosumel

S. Catarina

S. Andree



R





Pontiani
Marcelli
Anthony



Sihel pa
Circensis
Vetus
Calendarium
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Circensis
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Agnes
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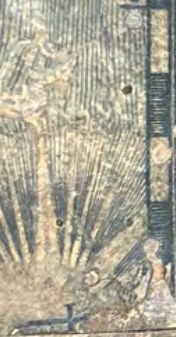
NOVARIUS

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14 g
15 a
16 b
17 c
18 d
19 e
20 f
21 g
22 a
23 b

Agathe
Dorothee
Apolonie
Scholastice



11 d
12 e
13 f
14 g
15 a
16 b
17 c
18 d
19 e
20 f
21 g
22 a
23 b

11 d
12 e
13 f
14 g
15 a
16 b
17 c
18 d
19 e
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22 a
23 b

Relocation

From the Paper Laboratory
to the West Belvedere Corridors - Pauline Hall n. 1





















PORTATA Kg. 800

Capacità 600 Litri

VERBA
SP. A

ATTENZIONE
NON SUPERARE
QUESTO LIMITE

























NICOLANUS P. P. V. LITERATIS
MIRIS PER OMNEM EUROPEAM
MISSIS LIBROS CONVIRIT
BIBLIOTHECAM PONTI-
FICIAM AUGEAT



















NICOLAUS PONTIUS LIBERATI
MISERERE OMNIA IN VERGAM
MISSIS LIBROS CONQUIRIT
BIBLIOTHECA PONTI
SIGILLUM AVE

PAULVS PONTI MAX SACELLVS
SACRARIORVM S. MARIE AD VERA
SERRA QVINTI FELICIANO
ORDINIS PONTIFICI







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