

# A Technical Approach to Rembrandt: The Examination of *Head of an Old Man in a Cap*.

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## Introduction

Rembrandt aimed to express the full extent of human emotion. His expressive brush strokes and dramatic lighting have enamoured many for centuries. This research project aimed to determine the materials and techniques employed by Rembrandt to create *Head of an Old Man in a Cap* (ca. 1630) from the Agnes Etherington Art Centre through technical examination. Identifying the materials of a painting is essential for numerous reasons, primarily to understand an artist's working method, which pigments were used to make a certain colour. Material analysis is also important for future conservation treatments, identifying materials and media from previous restoration campaigns. The characterization of materials is also important for narrowing the possible creation date of a painting and can help attribute or de-attribute a painting to an artist. This research is an international project "Rembrandt? Co-operative technical examinations of Rembrandt's *Tronies*", partnering with the Mauritshuis and the Ashmolean Museum to expand the work conducted by the Rembrandt Research Project using cutting edge technology. As the only firmly attributed Rembrandt painting in the project, *Head of an Old Man in a Cap* acted as a point of comparison to those from the collaborating members.



Fig. 1: Rembrandt van Rijn, *Head of an Old Man in a Cap*, ca. 1630, oil on Baltic oak, 20.3 x 24.3 cm

**Experimental**  
**Digital imaging:** UVF, UVR, IR, and topographical imaging (VSC8000/HS)  
**X-radiography:** 4mA 40kV, 45 second duration from 80cm  
**Infrared reflectography:** Opus Apollo Camera (900-1700nm)  
**Microscopy:** High resolution digital microscopy (3D)  
**Handheld p-XRF:** Scans at 40 µA 40kV, 60 second duration  
**Scanning MA-XRF:** Overall: 50kV 600uA, 220um spot size, 200 um step size, dwell time 27ms/pixel.  
**Dendrochronology:** Re-examination of Dr. Peter Klein's 1996 report

**Results and Discussion**  
 Rembrandt used a limited colour palette to render this painting. Calcium was found in high concentrations throughout the painting indicating a chalk based priming layer. Lead and iron were found though the composition likely from lead white and earth pigments directly in the priming or as a *primuversel* layer. Elements that were detected using XRF indicate the use of the following pigments: Lead white, vermilion, azurite, smalt, amber, earth pigments, red lake, charcoal black, bone black

Table 1: XRF Analysis Summary – Major Elements	
Elements	Possible Pigments
Pb	Lead white
Ca	Chalk, bone black, ivory black
Fe	Earth pigments
Mn	Umber, Van Dyke Brown, Cassel Brown
Cu	Azurite, verdigris
Hg	Vermillion
Co	Smalt

## Scratches

Rembrandt deliberately scratched through wet paint using a tool, likely the end of his brush, to reveal the tinted priming layer.



Fig. 2. A) Details of scratches normal light, B) scratches in right eyebrow, 35x C) Scratches in the beard, 35x

## Brush Hairs

Using the Hirox microscope, fragments of paint brush bristles were found imbedded into the paint. The majority were found in the background as a result of the vigorous application of a white scumble.



Fig. 4. A) Brush hair, background, 140x B) Brush hair, cloak, 140x.

## Conclusion

Results show that the materials found in the paint are consistent with those found in other early Rembrandt works. The visualization of a hidden, abandoned composition is not an unprecedented discovery. The reuse of supports in Rembrandt's workshop has been noted more than two dozen occasions. Further examinations of cross-sections will confirm the pigments and layer structure of the hidden composition.

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## Paint Layers

Examining the painting using the Hirox microscope revealed a underpainting visible through the craquelure. This indicates the deliberate planning of the composition. The dark underpainting shines through the surface paint, creating cooler tones. This phenomena is known as the 'turbid medium effect'.

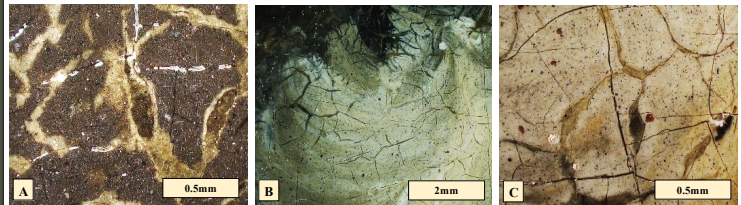


Fig. 3. A) Craquelure in the background, 140x, B) Craquelure in the hair, 35x, C) Craquelure in the forehead, 140x.

## Scanning MA-XRF

The scanning XRF revealed an abandoned composition which was subsequently painted over. The underlying painting contains smalt and either a copper pigment or copper additive. Both of these pigments were likely added into the paint for their siccative properties.



Fig. 5. A) Outline of hidden painting, B) Cu-K (White) and Co-K (Blue) MA-XRF maps overlapped.

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