Hoe dendrochronologisch onderzoek ‘hout snijdt’ voor een kunsthistoricus

Leonore van Sloten
Conservator
Museum Het Rembrandthuis

Co-researchers, met dank aan:
Petria Noble, Annelies van Loon, Eric Domela Nieuwenhuis, Esther Jansma, Petra Doeve, Peter Klein, René Gerritsen

MUSEUM
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REMBRANDT
& DE GOUDEN EEUW
2019

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Museum Het Rembrandthuis
in samenwerking met:

NICAS (= Rijksmuseum, RCE – Rijkserfgoedlaboratorium, Universiteit van Amsterdam, TU Delft)
Museum Boijmans Van Beuningen
Mauritshuis
zelfstandige onderzoekers


2. Identificatie van verf
5. Lood
Lood (Pb_M)
5. Lood (Pb_M)
Het element lood vuurt twee signalen af op de scanner, een sterk signaal (Pb_L) en een zwak signaal (Pb_M). Hier zien we het zwakke signaal: de loodhoudende pigmenten die aan het oppervlak liggen. Gebruikt voor de huid van de man en zijn witte kraag. Hoe kun je dat zien? Lood wijst meestal op loodwit. Maar het kan ook onderdeel zijn van loodtingeel (geel) of loodmenie (rood).
5. Lead (Pb_M)
The element lead fires two signals at the scanner, a strong signal (Pb_L) and a weak signal (Pb_M). Here we see the weak signal: the lead-containing pigments that lie on the paint surface. In the man's skin and his white collar. How can you see that? Lead usually indicates lead white, but it can also come from lead-tin yellow (yellow) or red lead (red).
3. Titanium
Titanium (Ti)
2. Kobalt
Cobalt (Co)
3. Nikkel
Nickel (Ni)
4. Arsen
Arsenic (As)


OPEN
OPEN


Laboratorium Rembrandt
Rembrandt Junior Lab
Hoe vonden we dit pigment?
How did we find this pigment?
Orpiment
Orpiment
9


Wie maakte dit schilderij?

De onderzoekers - The researchers

Petria Noble

Hoofd restauratieatelier schilderijen | Head of Paintings Conservation, Rijksmuseum

Annelies van Loon

Natuurwetenschappelijk onderzoeker | Conservation Scientist, Rijksmuseum

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René Gerritsen

Kunst- en kunstonderzoekfotograaf | Art & Art Research Photographer

Wie maakte dit schilderij?

Röntgen

Infrarood

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Strijklicht

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MACRO XRF-SCAN

Pb L = lood

→ loodwit

Het diepliggende loodsignaal toont het lood in de onderlagen en laat de structuur van de houtnerven zien

Grondlaag die loodwit bevat

Pb M = lood

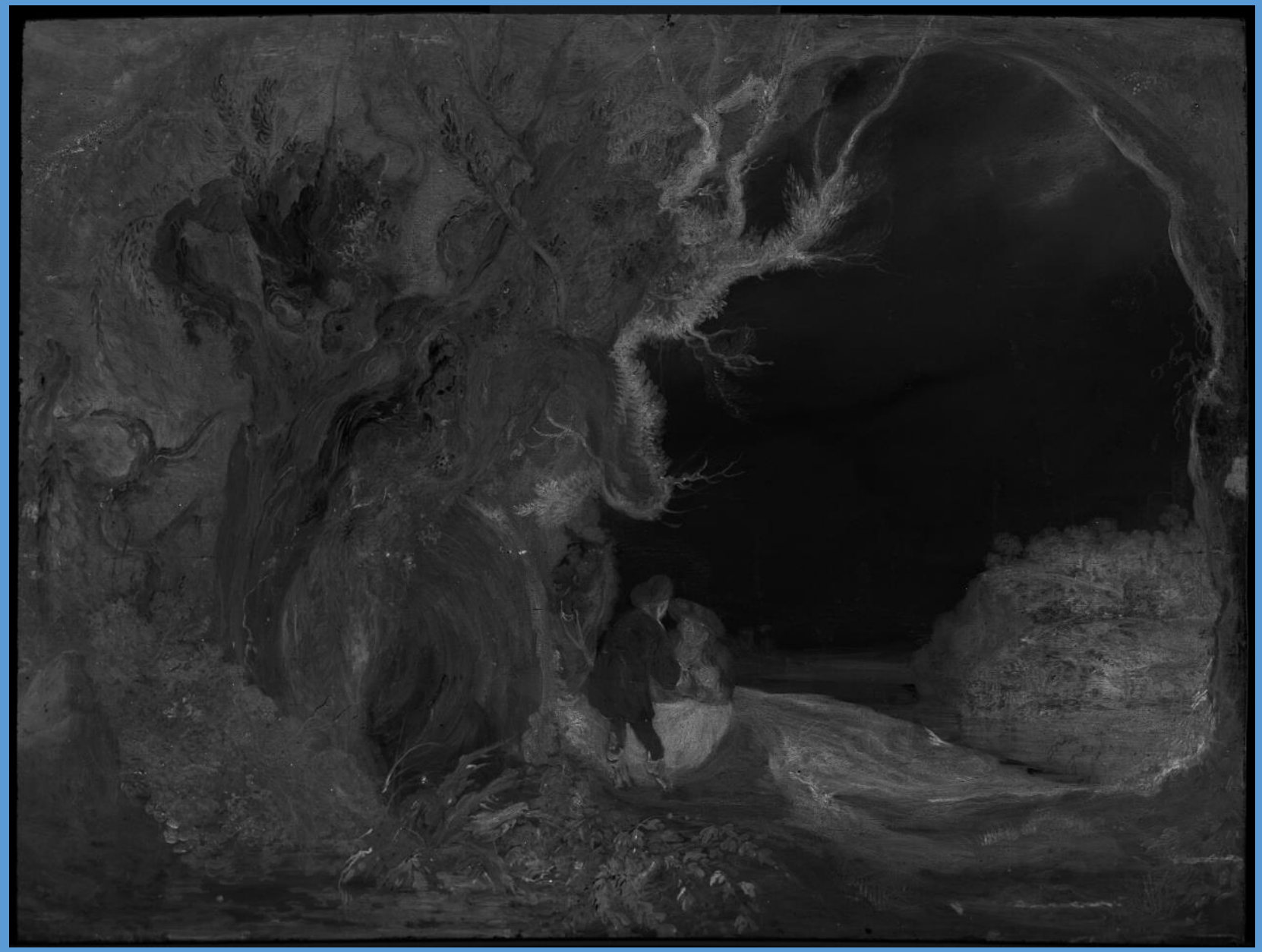
→ loodwit

De luchtpartij is rijk aan loodwit

SN = tin

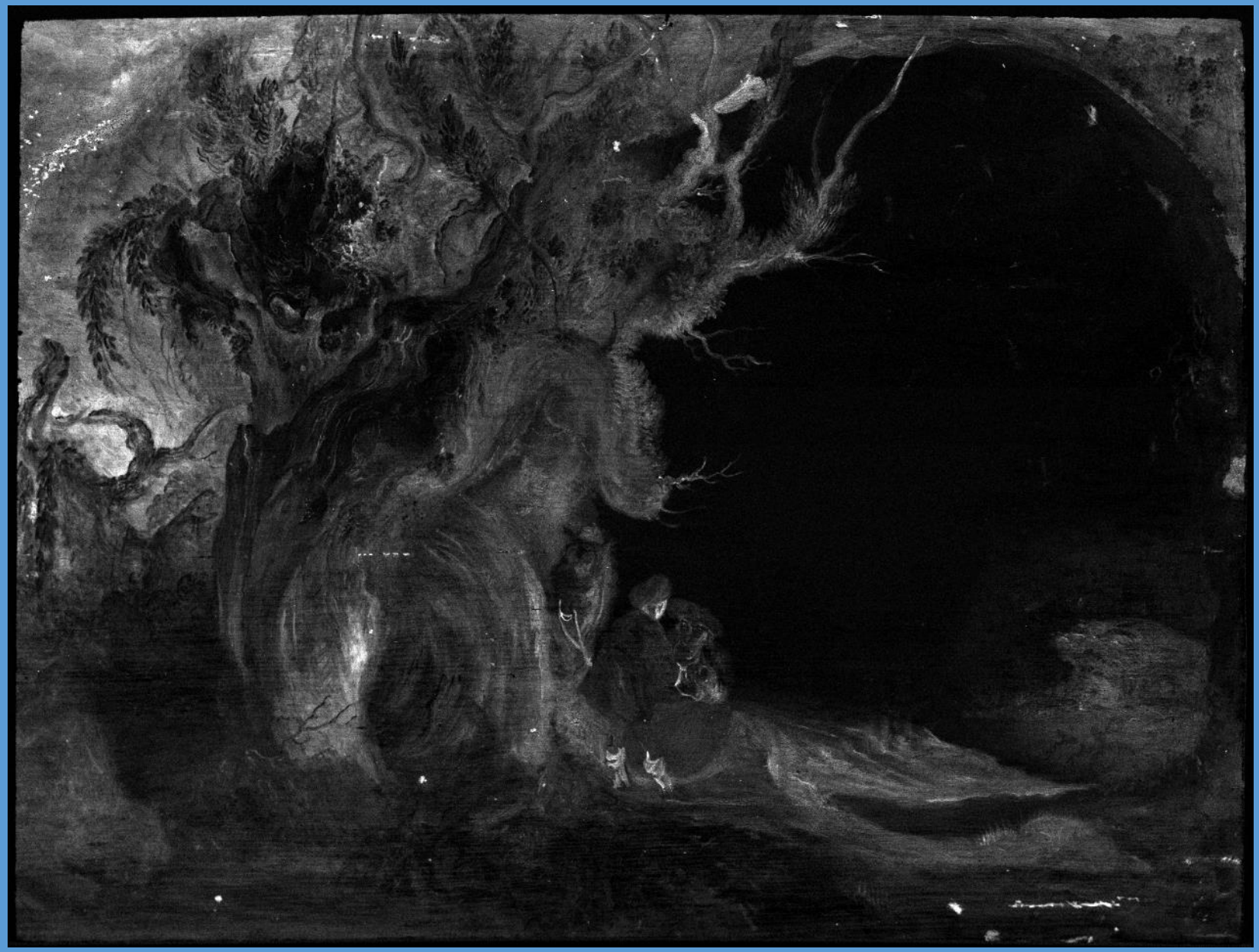
→ loodtingeel

groene bladeren
Gele details in de vegetatie



FeK = ijzer

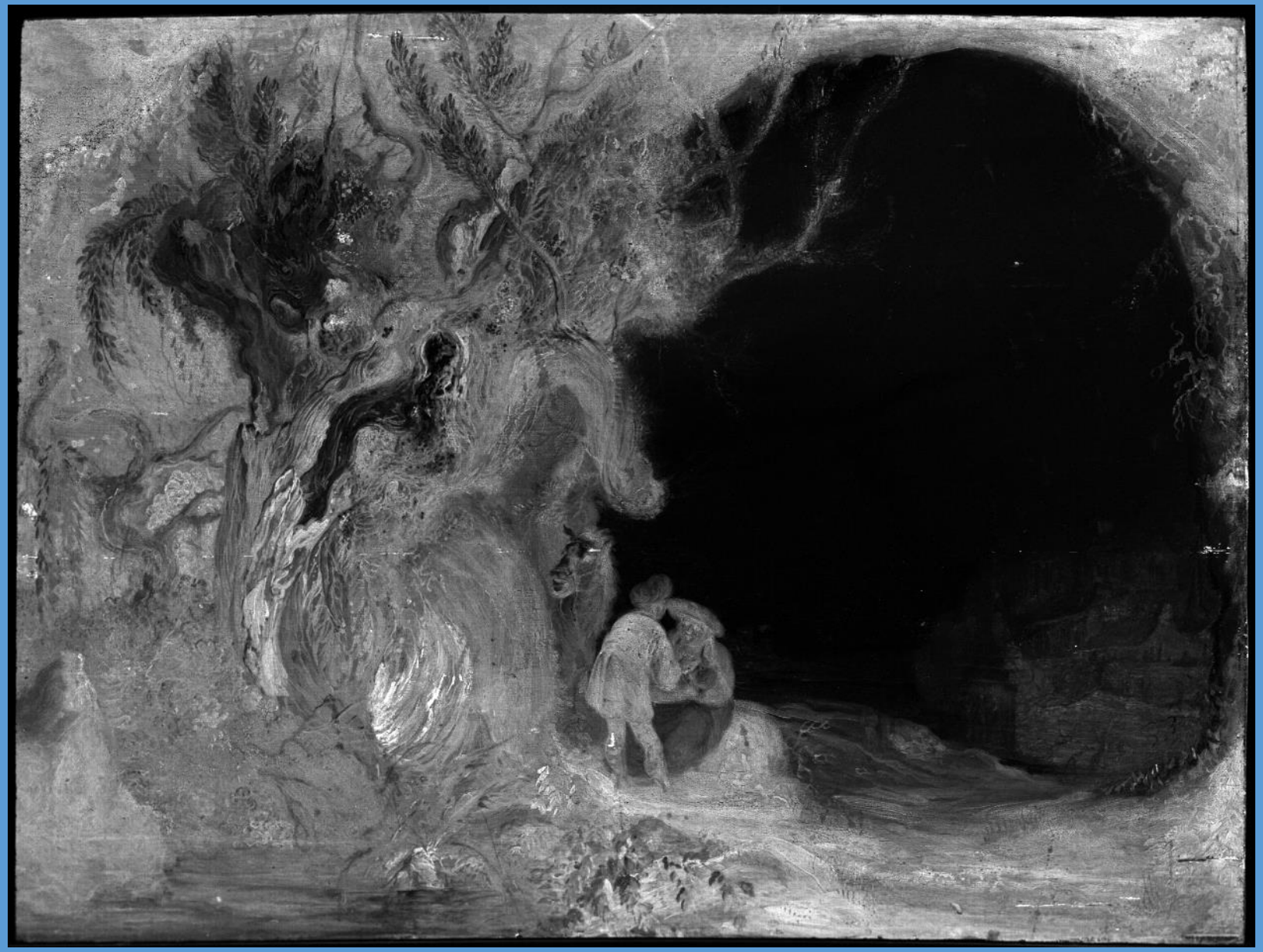
→ Aardepigmenten (okers)

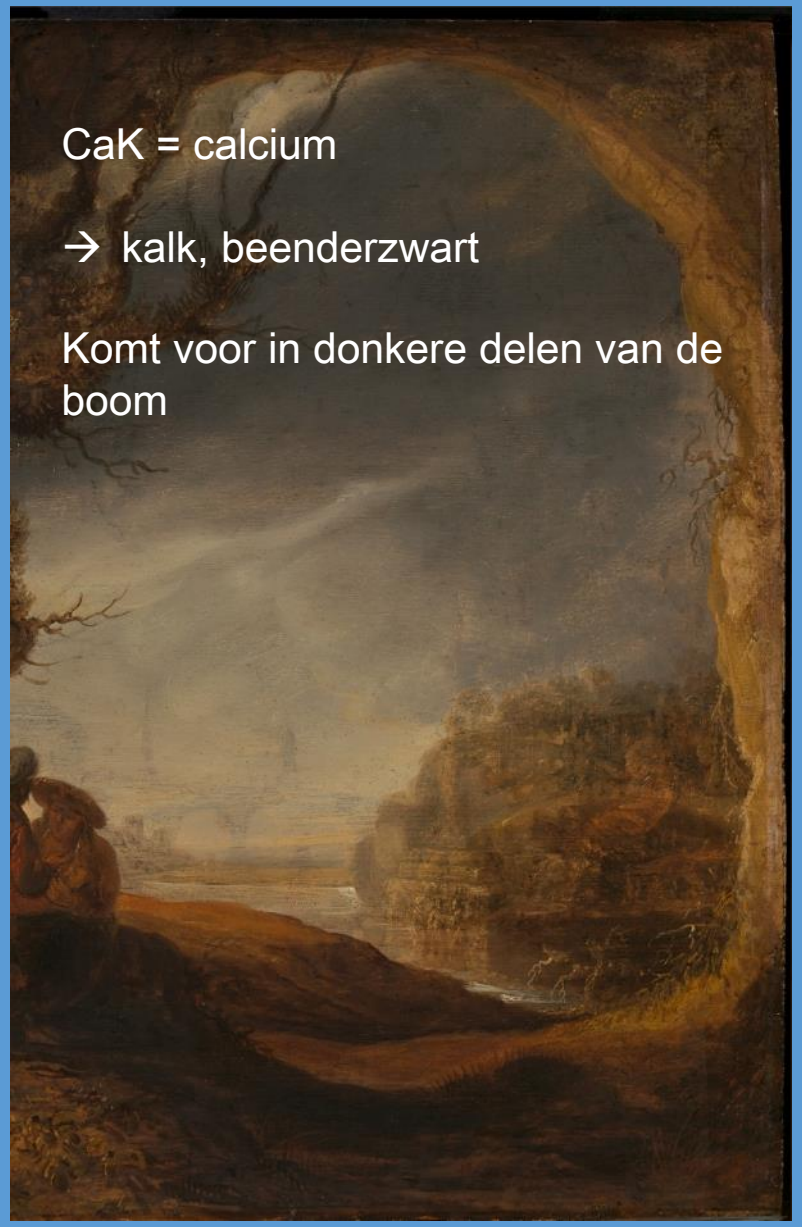


MnK = mangaan

→ in combinatie met ijzeroxide = omber

b.v. de laarzen van Jozef, en de vegetatie aan de andere kant van de rivier





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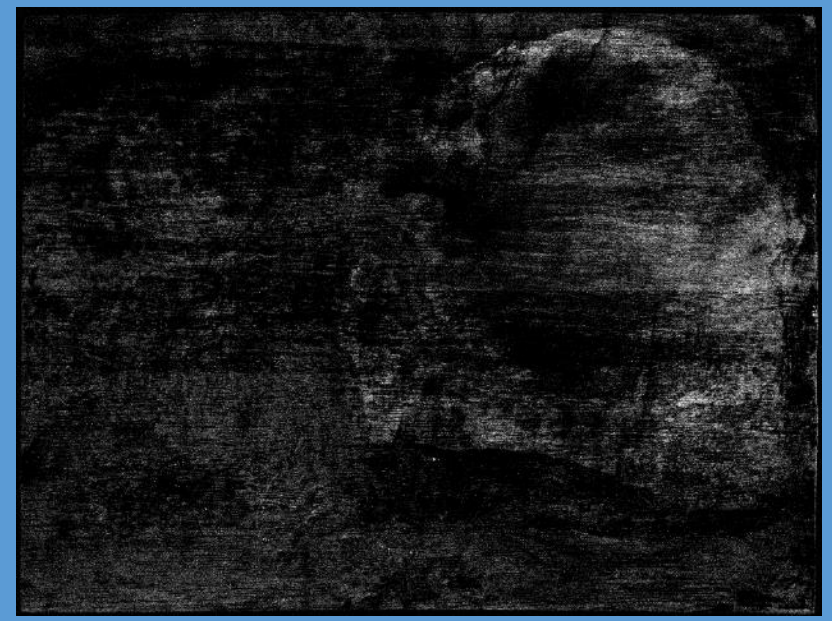

CoK = kobalt

Ni = nikkel

As = arseen

→ Vormen samen: smalt (een met kobalt blauwgekleurd glas, dat werd gebruikt als pigment voor blauw, of als een middel om andere verven sneller te laten drogen)

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Hg = kwik

→ vermiljoen

Rode en bruine details

Conclusie:

Geen ‘palimspest’, deels overschilderd

Reconstructie van de overgeschilderde delen

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Tegelijkertijd vond dendrochronologisch onderzoek plaats naar de drager

NB. door twee onderzoekers, apart van elkaar en zonder vooraf inzage in elkaars rapport:

- Peter Klein, Universiteit van Hamburg

- Esther Jansma en Petra Doeve, RCE

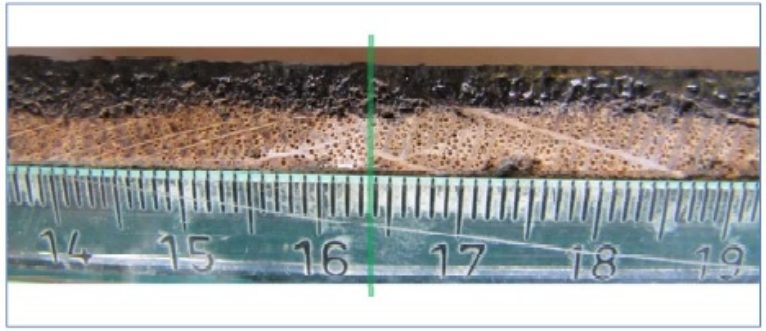
- Het paneel bestaat uit twee horizontale planken.

- Volgens Esther Jansma en Petra Doeve was alleen de bovenste plank relateerbaar aan de databases van Baltisch eiken.

- Beide metingen kwamen voor de bovenste plank (met een minimaal verschil) uit op de conclusie dat het paneel beschilderd kan zijn:

<u>Vanaf halverwege de jaren 1640</u>

Figure 3. Right-hand side of the painting: the edge between the upper and lower board, marked in green.



2. Research question

The panels already had been analyzed and absolutely dated in May 2018 by Prof.dr. Peter Klein (Hamburg University; Appendix A). The aim of the current study was to obtain a second opinion of the calendar age of the tree rings in the panels and of the provenance of the wood. In order to guarantee the independence of this second study, the dendrochronological findings of Prof.dr. Klein were not communicated to us until after the conclusion of our research.

3. Wood preparation and tree-ring analysis

In the Atelier Building of the Rijksmuseum in Amsterdam, the cross-sections of the wood already measured by Prof.dr. Klein were cleaned further using a scalpel, in order to obtain clearer visibility of the tree rings. Next, their growth patterns were photographed in sections of 2.5-5 cm (Fig. 4). After adding chalk to the early-wood vessels, the growth patterns were photographed a second time as an extra reference. Ring widths were measured from the photos using software package CooRecorder (http://www.supershareware.com/info/cybis-coorecorder.html; Fig. 5).

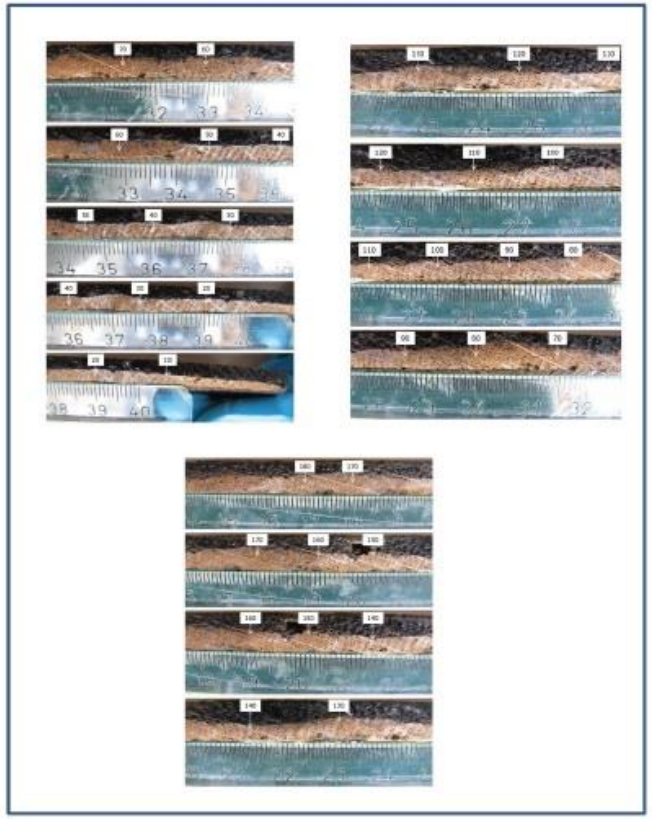
The photo-based measurement series were combined into single measurement series per board, after which the two curves were compared to ca. 150 absolutely dated reference chronologies of oak covering the time interval AD1200 to present. These chronologies represent a wide variety of growth regions in, among others, Belgium, France, Germany, the Netherlands, Poland, Scandinavia, and the UK (see Jansma 2006 for a somewhat dated overview). This collection includes quite a number of Baltic chronologies, which have been compiled by various dendrochronologists using paintings and other categories of mobile heritage studied in among others Belgium, The Netherlands, Portugal and the UK (e.g., Eckstein et al. 1975; Hillam & Tyers 1995; Jansma et al. 2004).

The dendrochronological comparisons were performed using software package PAST4 (Knibbe 2008) and the following statistical variables, which all are common in the field of heritage-based dendrochronology:

- *%PV*, the percentage of parallel variation (also termed 'Gleichlaufigkeit');
- *r*, the Pearson cross-correlation coefficient;

- t_H, the Student's t-value (t), which is based on the value of r between series standardizedd according to the method of Hollstein (1980);
- *P*, the level of significance of the calculated value of %PV, expressed as a fraction of 1.

Figure 4. Growth pattern of the upper plank. The arrows and numbers show each tenth ring, counted from the heart of the tree (oldest ring) in the direction of the cambium (youngest ring).



4. Results

4.1 Dendrochronological age of the painting

The upper plank of the painting contains 186 completely formed growth rings and some early-wood vessels of the youngest, 187th ring. Its growth pattern significantly matches against a variety of Baltic chronologies, giving an end date in 1626 (Tables 1, 2). This implies that the outer ring, which we did not measure since it only is represented by spring vessels, dates to the year **1627**. The strongest match was found with *NW Europe Baltic chronology (composite)* by Jansma 2019 (unpublished; Table 2, Fig. 6). Since the upper plank lacks sapwood and an unknown number of heartwood rings directly underneath the sapwood zone, an estimated minimum number of sapwood rings should be added to the end date of 1627 in order to arrive at the earliest possible year of felling. Using sapwood averages calculated for German oaks represented by samples complete from the inner ring (the pith) to the waney edge directly underneath the bark (Jansma 2007), we estimate that 24 ± 9 (i.e. between 15 and 33) sapwood rings are lacking on the outside of the wood. Reckoning with this range, the *terminus post quem* date of the year of felling is **1651 ± 9**, with **1642** as the earliest possible year. The important issues of (a) how many heartwood rings are lacking directly underneath the missing sapwood zone and (b) the optimal correction for wood-drying time, cannot be answered within this study.

Of the lower plank, due to cracks in the wood in the oldest segment containing 10-20 rings could not be measured. The younger rings could, resulting in a series containing 123 annual values. Regretfully this growth pattern could not be dated, neither against its sister-board in the painting, nor with any of the chronologies in the RCE archive.

Table 1. Selection of reference chronologies used in this study

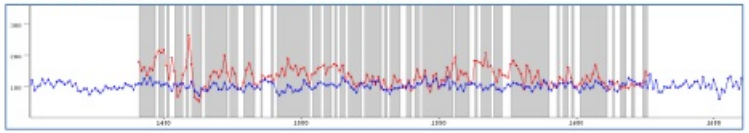
Reference chronology	Location of research	Species	Length in years	First year AD	Last year AD
BE Baltic chronology, by Lambert & Lavier (unpublished)	Belgium, France	Oak	350	1169	1518
BE Wallonia Meuse Valley chronology, by Hoffsummer 1989	Belgium	Oak	1315	672	1986
DE Central European chronology (predominantly Rhineland), by Hollstein 1980	Germany	Oak	1576	400	1975
DE Nedersaksen, by Leuschner	Germany	Oak	1128	865	1992
DK East Denmark, by Bonde (unpublished)	Denmark	Oak	1168	830	1997
DK West Denmark, by Bonde (unpublished)	Denmark	Oak	2095	-108	1986
NL Baltic chronology, by Eckstein et al. 1975	The Netherlands	Oak	529	1115	1643
NL Baltic chronology, by Jansma & Hanraets 2004	The Netherlands	Oak	471	1167	1637
NL Ardennes chronology, by Jansma (unpublished; DCCD internationalization project 2012-2014)	The Netherlands	Oak	671	1049	1719
NL Baltic chronology A, by Jansma (unpublished; DCCD internationalization project 2012-2014)	The Netherlands	Oak	573	1030	1602
NL Baltic chronology B, by Jansma (unpublished; DCCD internationalization project 2012-2014)	The Netherlands	Oak	378	1167	1544
NL North-German Lowlands and adjacent Netherlands , by Jansma (unpublished; DCCD internationalization project 2012-2014)	The Netherlands	Oak	664	988	1651
NL Norway, by Jansma (unpublished; DCCD internationalization project 2012-2014)	The Netherlands	Oak	507	1248	1754
NW Europe Baltic chronology (composite), by Jansma 2019 (unpublished)	NW Europe	Oak	1183	813	1995
PL East Poland, by Leuschner (EU project ADVANCE 10K, EU Contractnr. ENV4-CT95-0127, unpublished)	Poland	Oak	498	1124	1621
PL Northwest Poland, by Leuschner (EU project ADVANCE 10K, EU Contractnr. ENV4-CT95-0127, unpublished)	Poland	Oak	1183	813	1995
UK Baltic chronology A, by Hillam & Tyers 1995	United Kingdom	Oak	442	1156	1597
UK Baltic chronology B, by Hillam & Tyers 1995	United Kingdom	Oak	359	1257	1615

Table 2. Dendrochronological results (upper plank)

Reference	Date of youngest ring	n	r	t_H	%PV	P (%PV)
NW Europe Baltic chronology (composite), by Jansma 2019 (unpublished)	1626	186	0,35	6,91	71,8	0,000000001
NL Baltic chronology, by Eckstein et al. 1975	1626	186	0,37	6,60	71,5	0,000000002
NL Baltic chronology A, by Jansma (unpublished; DCCD internationalization project 2012-2014)	1626	162	0,32	5,31	70,1	0,00000016
UK Baltic chronology A, by Hillam & Tyers 1995	1626	157	0,39	4,97	65,0	0,000085
PL East Poland, by Leuschner (EU project ADVANCE 10K, EU Contractnr. ENV4-CT95-0127, unpublished)	1626	181	0,34	4,77	66,9	0,000003
PL Northwest Poland, by Leuschner (EU project ADVANCE 10K, EU Contractnr. ENV4-CT95-0127, unpublished)	1626	186	0,21	4,62	57,5	0,02
NL Baltic chronology, by Jansma & Hanraets 2004	1626	186	0,21	4,23	66,4	0,000004
DK East Denmark, by Bonde (unpublished)	1626	186	0,32	3,76	59,4	0,0052
NL Baltic chronology B, by Jansma (unpublished; DCCD internationalization project 2012-2014)	1626	104	0,22	3,63	66,8	0,0003
UK Baltic chronology B, by Hillam & Tyers 1995	1626	175	0,25	3,62	69,1	0,00000022
DK West Denmark, by Bonde (unpublished)	1626	186	0,13	2,75	58,9	0,0076
BE Baltic chronology, by Lambert & Lavier (unpublished)	1626	78	0,22	2,20	64,1	0,0064
NL Norway, by Jansma (unpublished; DCCD internationalization project 2012-2014)	1626	186	0,18	2,04	55,1	0,083
NL North-German Lowlands and adjacent Netherlands , by Jansma (unpublished; DCCD internationalization project 2012-2014)	1626	186	0,18	2,00	56,7	0,034
DE Nedersaksen, by Leuschner	1626	186	0,14	1,98	57,0	0,029
DE Central European chronology (predominantly Rhineland), by Hollstein 1980	1626	186	0,06	0,86	57,5	0,021

NL Ardennes chronology, by Jansma (unpublished; DCCD internationalization project 2012-2014)	1626	186	0,05	0,50	53,5	0,17
BE Wallonia Meuse Valley chronology, by Hoffsummer 1989	1626	186	-0,02	-0,216	50,8	0,42

Figure 6. Visual match between the growth pattern of the upper plank (red) and reference chronology *NW Europe Baltic chronology (composite), by Jansma 2019 (unpublished)*; blue). X-axis: calendar years; Y-axis: ring width (0.01 mm). Grey: intervals with synchronous ring-width variations.



4.2 Provenance of the wood

The strong statistical match between the growth pattern of the upper panel and the available chronologies from the Baltic region implies a provenance in this area. Paintings on oak panels from this area have been identified dendrochronologically throughout Europe (e.g. in Belgium, France, Germany, the Netherlands, Portugal, Spain and the UK). Regretfully the exact provenance of these materials within the Baltic region is unknown, although the Scandinavian countries and Poland can be ruled out as areas of origin since the oak chronologies from these countries show too little agreement with the Baltic chronologies to imply a regional overlap between the origin of their underlying materials. This points at an origin of the upper panel somewhere in the eastern Baltic mainland.

5. Summary and conclusion

The upper panel of NK2779 contains 187 growth rings and has an end date in 1627. It was derived from an oak that was cut down *after* 1642. Its provenance is in the eastern Baltic mainland. The growth pattern of the lower panel regretfully does not match with the pattern of the upper panel, nor does it fit with any of the reference chronologies available at RCE. The date and provenance of this panel therefor remain unidentified.

Although the most important research result of Prof.dr. Peter Klein, which is the age determination of the upper plank, could be confirmed, there are some differences between his findings and those reported here. One is the number of growth rings in the upper plank, with 187 having been identified by us and 174 having been identified by Klein. A possible explanation is that Klein did not measure the >10 oldest rings of this plank. Another difference pertains to the results of the lower plank. We were not able to date this plank against any chronology in the RCE collection, whereas Prof.dr. Klein Klein reported a match at AD 1609 with Baltic chronologies. Regretfully Prof. Klein does not share dendrochronological measurement series with his clients and/or colleagues. Therefore we are, and in the future most likely will remain, unable to identify the reasons of the observed differences between the dendrochronological research results pertaining to NK2779.

6. Measurement values

The annual measurement values listed below have been obtained using photos from the right-hand side of the painting. They are shown in the so-called Heidelberg format. The first five lines of this format contain metadata of the measurement series. Below these lines, the annual growth values are ordered from left to right and top to bottom. The width of the oldest ring is placed on the upper side to the left, the width of the youngest, most recent ring is shown at the bottom to the right.

The listed values represent hundredths of millimetres, with a value of 178 implying an actual ring width of 1.78 mm.

```
HEADER:
Keycode= NK2779, Landschap met rust op de vlucht naar Egypte, bovenste plank rechts
Length=186
DateEnd=1626
Species=QUSP
Location=Rembrandt Huis, Amsterdam
DATA:Tree
   178   149   161   134   158   150   193   212   206   216
   166   121   190   148    68    85   134   158   264   169
    65    58    49    88    99    89   130   146   143   129
   146   198   142   114   157   138    94    90   112   149
   172   138   106   102   113   133   126   130   133   116
   136   131   156   133   188   159   152   166   135   154
   158   135   108   138   142   156   162   168   139   158
   163   171   168   148   166   116   140   129   106    98
   108   108   110   135   114   130   106   128    92   119
    86    91    99   132   114   119    96   101   116    87
   121   152   128   116   148   100    84   131   139    94
   118   116   162   126   173   194   120   146   137   140
   113   109   182   180   176   165   204   163   164   142
   112   149   136   134   127   171   182   166   153   138
    89   166   146   111   128   147   103   116   109    95
   111    98   101   128   120   110   162   125    95   100
   106   121   109   132   116   137   168   127   113   111
    98    89   114   108   113    92    99    98    94   106
   101   105   102   110   145   134     0     0     0     0

HEADER:
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Length=123
DateEnd=?
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Location= Rembrandt Huis, Amsterdam
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   161   118   144   134   160   138   108   102   157   124
    95   114   108    97   104   126   145    96    91   101
   128   129   100    91    90   108    79    93    72    87
    87    86    88    83    96   109    80    83    86   112
   110    96    96    83    98    87    84    88    72    84
    63   104    88    93   103    79    94   102   111   112
   126    99   122   131   112   134   113   112   137   173
   139    94   239   212   196   194   242   150   192   148
   185   255   171   183   103   109   150   172    78   117
   152    95   121   108   109   135   120   147   139    89
   122   114   115   107   122   134   126   105   101    78
    84    65   117
```

7. Acknowledgements

This report and the underlying research, including the actual measurement series, have been archived and made retrievable in the dendrochronological e-depot DCCD under identifier P:2018502 (http://dendro.dans.knaw.nl; Jansma et al. 2012; Jansma 2013), thereby conforming to international *best practices* in the field of cultural heritage-based dendrochronology (Brewer & Jansma 2016).

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Zentrum Holzwirtschaft

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Abteilung Holzbiologie
Prof. Dr. habil. Peter Klein

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Datum: 5/30/2018
Unser Zeichen: Kl

Rembrandthuis

Jodenbreestraat 4

NL 1011 NK Amsterdam

Report on the dendrochronological analysis of the panel
"Landscape with the Rest on the Flight to Egypt" (NK2779)

The analysed panel (46,8/47,0 x 62,2/62,4 cm) is made of two oak boards. The wood concerned is originating from the Baltic/Polish regions. Using these master chronologies the boards could be dated as following:

Board I	174 growth rings	1627 – 1454
Board II	133 growth rings	1609 - 1477

The youngest heartwood ring was formed out in the year 1627.

Regarding the sapwood statistic of Eastern Europe an earliest felling date can be derived for the year 1636, more plausible is a felling date between 1640..1642....1646+x. With a minimum of 2 years for seasoning an earliest creation of the painting is possible from 1638 upwards. Under the assumption of a median of 15 sapwood rings and 2 years for seasoning a creation is plausible from 1644 upwards.

Prof. Dr. Peter Klein

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Rembrandt, *Landschap met stenen brug*, ca. 1638, paneel, Rijksmuseum, Amsterdam

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Rembrandt, *De Omval*, 1645, ets en droge naald, Rembrandthuis, Amsterdam

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Slotsom:

Rembrandtleerling of navolger

Landschap met de Rust op de Vlucht naar Egypte

1645-1650

Museum Het Rembrandthuis,
in langdurig bruikleen van RCE

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https://edition.cnn.com/style/article/rembrandt-oxford-painting-analysis-scli-gbr-intl/index.html

A 'fake' Rembrandt painting that was stored in a basement for decades might be real

Written by
Rob Picheta, CNN
London

A Rembrandt painting that was thought to be fake and was stashed in a basement for decades may in fact be genuine, according to experts who believe it was painted on wood from the same tree as other 17th century masterpieces.

"Head of a Bearded Man" was bequeathed to the University of Oxford's Ashmolean Museum in 1951, but the Rembrandt Research Project, a leading authority on the Dutch painter's works, determined in 1982 that it was merely one of a number of copies.

Now, an expert has said that the wood panel on which it was painted came from the same tree used for Rembrandt's "Andromeda Chained to the Rocks" and Jan Lievens' "Portrait of Rembrandt's Mother" -- two works dating to 1630 that were painted when the two artists were working in Leiden.

The portrait is one of a number of dismissed Rembrandt works that have been recently re-attributed to the artist. It means the tiny painting is very likely to have come from Rembrandt's workshop, and may even have been crafted by the Dutch master himself.

Related:
Postcard reveals place where Van Gogh likely painted his last masterpiece

Peter Klein, an expert in tree dating, analyzed the growth rings of the tree to determine when it was felled.

"The Ashmolean's 'Head of a Bearded Man' was painted on a panel which came from an oak tree in the Baltic region, felled between 1618 and 1628, and used in two known works by Rembrandt and Lievens," Klein said in a statement.

A 'fake' Rembrandt painting that was stored in a basement for decades might be real

Related:
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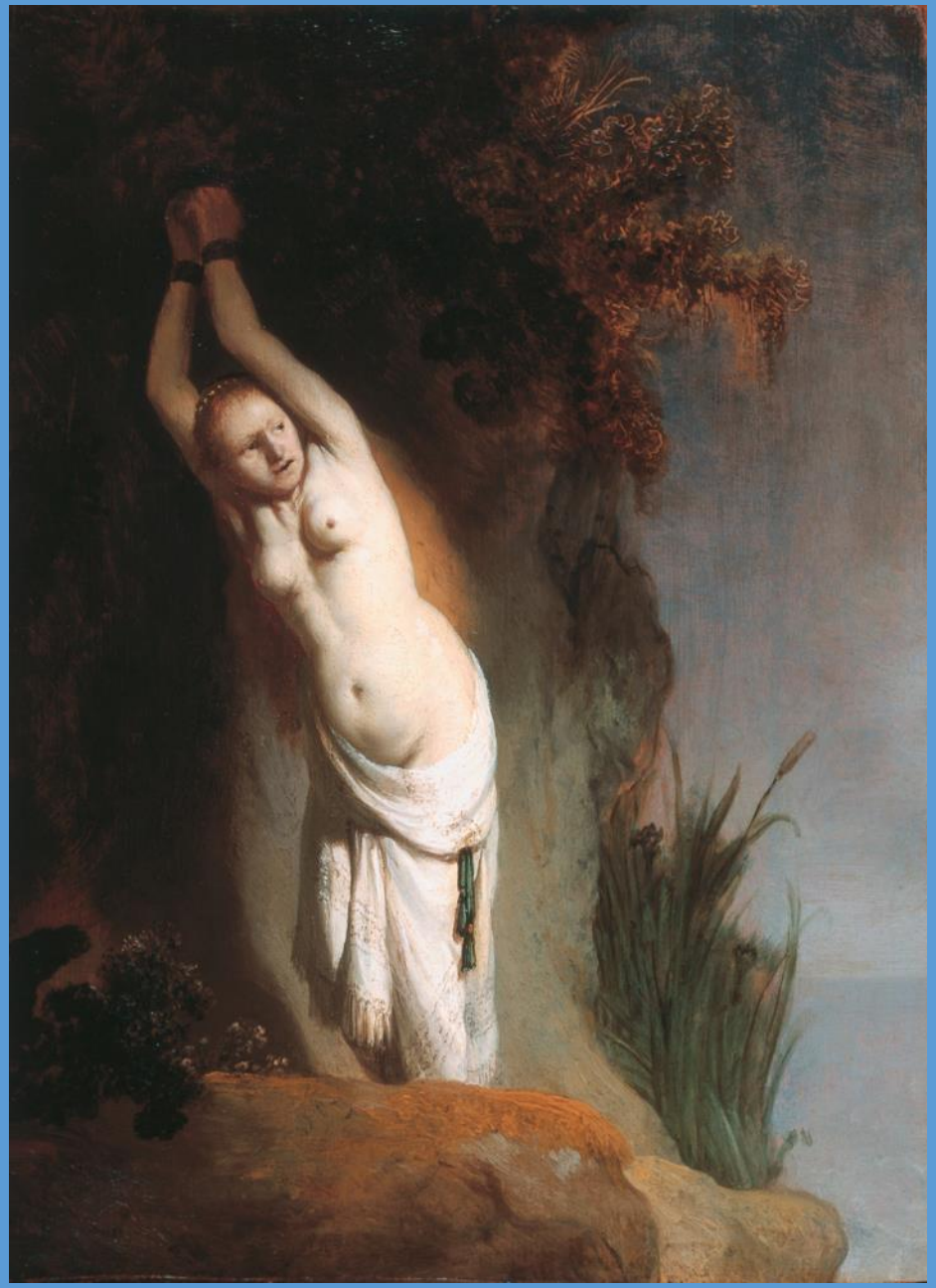
The painting, left, and an infrared version of the image, right. Credit: Ashmolean Museum/University of Oxford




2788.

deVolkskrant

Hoofd van een bebaarde man, dat zo klein is als een ansichtkaart, was door de jonge conservator An van Camp uit het depot gehaald waar het al vier decennia lag, verbannen door de experts. In de jaren tachtig oordeelde een groep onderzoekers onder leiding van Rembrandt-deskundige Ernst van de Wetering dat het een imitatie was, mogelijk lang na de dood van de schilder gemaakt. Ze baseerden hun oordeel op de manier waarop het vlees op het verweerde gezicht van de man was afgebeeld. Dat zou niet in de stijl van Rembrandt zijn.

Aan de hand van infraroodscans is gebleken dat er indertijd wat correcties en aanpassingen waren aangebracht in het schilderij. Beeld Ashmolean Museum/University of Oxford

Dat het schilderij, sinds 1951 in het bezit van het museum, een Rembrandt zou zijn is nog niet helemaal zeker. Na de tentoonstelling wil Van Camp nog een röntgenfoto laten maken. In zijn beginjaren deelde hij zijn atelier met zijn vriend Jan Lievens. Er is een kleine kans dat Lievens, de schilder die door Rembrandt zou worden overvleugeld, de maker is. Op de genoemde eik is ook het portret geschilderd dat Lievens maakte van Rembrandts moeder.

Het lijkt Van Camp in ieder geval uitgesloten dat het om een imitatie gaat, temeer omdat aan de hand van infraroodscans is gebleken dat er indertijd wat correcties en aanpassingen waren aangebracht in het schilderij. Zoiets zou een imitator niet snel doen.

Dank voor jullie aandacht!

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MUSEUM
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