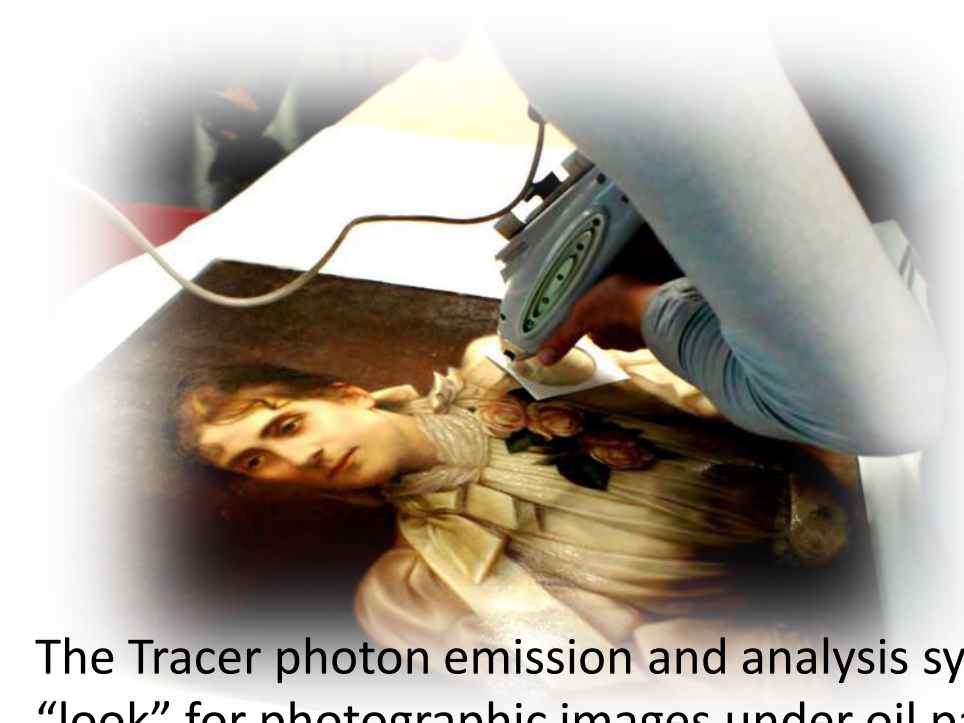
Does a photograph lie underneath?

Sarah Hillary, Ute Larsen and Heike Winkelbauer use the Tracer to “see” underneath the oil paint of a Lindauer portrait at the Auckland Museum

Gottfried Lindauer' s paintings are highly valued . Although Lindauer painted some of his subjects from life, he relied primarily on photographs.

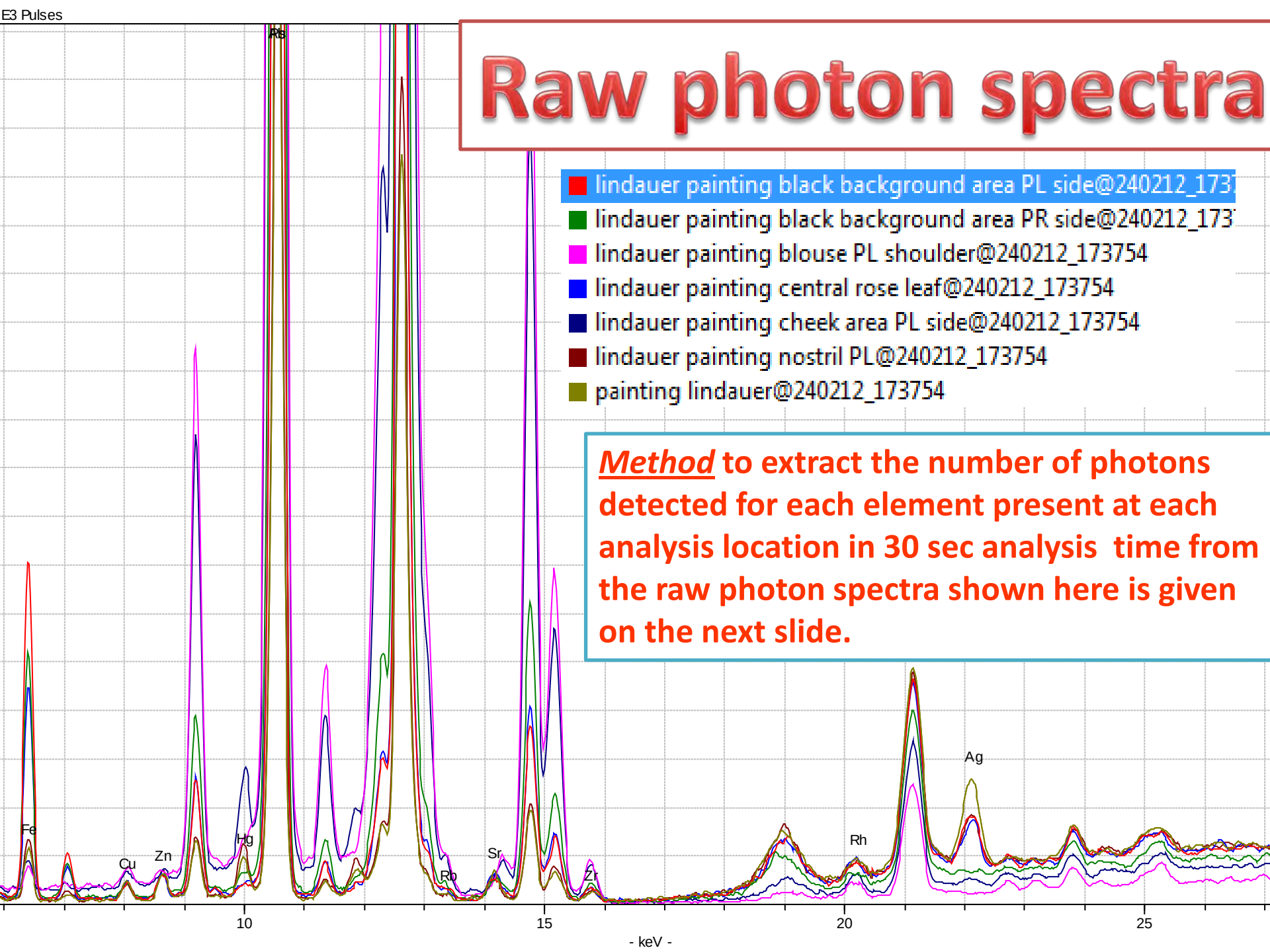
Lindauer became closely associated with the photographer Samuel Carnell, who was known for his photographic studies of Maori.



Painters routinely sketch what they are about the paint on the canvas. Some have actually been known to paint over a photographic image of the subject. It was thought that Gottfried Lindauer may have painted over photographs for some of his paintings. Lindauer was closely associated with the photographer Samuel Carnell, so he certainly would have had access to a very good source of photographic skills and techniques.

The Tracer photon emission and analysis system offers a very unique capability to "look" for photographic images under oil paint for 7 reasons:

1. Photographic images are composed of a variation of Ag density depositions, the darker the location on the image the more Ag atoms present the whiter areas have less Ag atoms present.
2. The Tracer is capable of "shining" photons (up to 45,000 eV) on to the painting that go through the over layer of oil paint and that then can interact with the Ag atoms and remove the k shell electron from the Ag atom.
3. When Ag atom has a k shell electron removed it quickly replaces that K shell electron with one from the L shell or the M shell
4. When the electron moves from the L or M shell down to the K shell it gives up the excess energy it has between the L or M shell and the K shell as a 22,000 eV or a 25,000 eV photon, respectively.
5. These energy photons, which have much more energy than the visible photons of 1 to 3 eV, can easily come through the overlaying oil paint.
6. The Tracer is then also capable of measuring the photons coming from the painting determining both the number and the energy of each photon and thus determining which, if any are from Ag.
7. Thus if one measures white (low Ag) and dark (high Ag) areas on a painting one can determine whether a photographic image lies underneath the paint, because Ag is not typically used as a pigment in oil paint.


E3 Pulses
Raw photon spectra
lindauer painting black background area PL side@240212_173
lindauer painting black background area PR side@240212_173
lindauer painting blouse PL shoulder@240212_173754
lindauer painting central rose leaf@240212_173754
lindauer painting cheek area PL side@240212_173754
lindauer painting nostril PL@240212_173754
painting lindauer@240212_173754
Method to extract the number of photons detected for each element present at each analysis location in 30 sec analysis time from the raw photon spectra shown here is given on the next slide.
Rb
Fe
Cu
Zn
Hg
Rb
Sr
Zr
Rh
Ag
10
15
20
25
- keV -

Method **to extract the number of photons detected for each element present at each analysis location in analysis time from the raw photon spectra collected.**

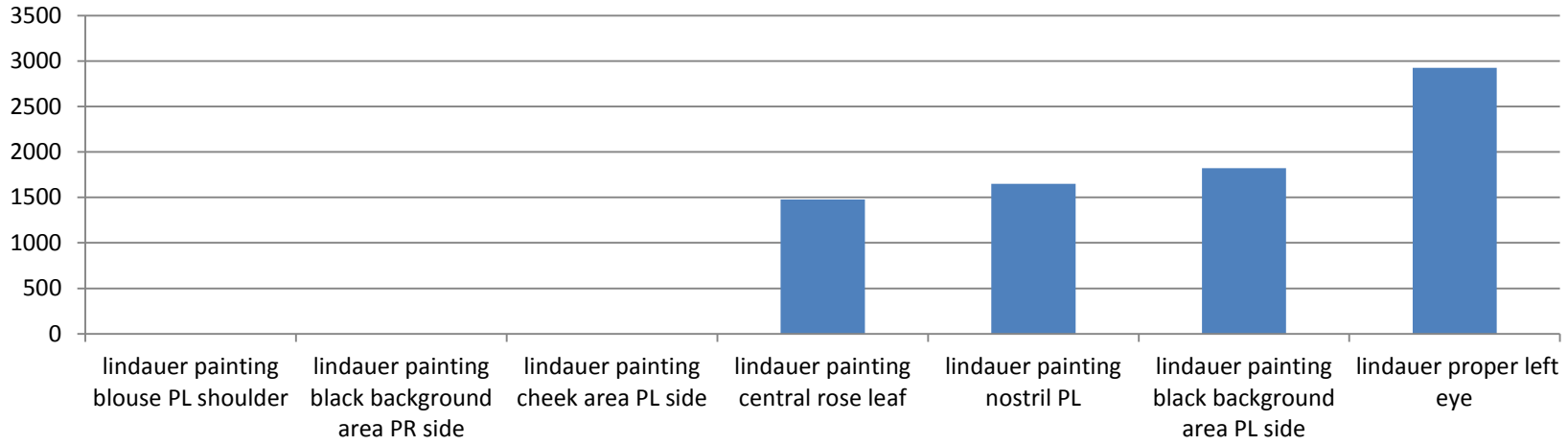
Net area analysis in Artax 7 spectra analysis software provided with the Tracer

1. In ARTAX, click on 'File', click on "open spectrum", file the folder that has all your txt spectrum files, highlight them all and click open
2. Click on "project", click on "new project", right click on "object", click on "add node", enter "Points" in name box. Highlight this folder.
3. Go back to "Project" tab. click on "Add spectrum".
4. Click on "File", click on "save project", give a name (.rtx), click on "save"
5. Click on "spectrum" tab
6. Go to method list and pick your method! See below
7. Highlight the Points folder
8. Click on “Analyze” and then on “Evaluate Results”, a progress bar should appear as all the spectra are being evaluated with “your named method”
9. Then click on “Export” and then on” Results to Excel” Then a box will appear so you name the excel file and put it in a folder that you want the results to be in!
10. Now immediately resave your project file because it now contains your spectra and your results. Use the same name you did before and save on top of the old version of the rtx file.
11. Now go to the folder you saved your results in and open the file and got to the Points tab to see all your net area data. You then edit out the area that gives you no information.

Method Creation

•To create a method open a spectrum that is typical of the spectra you want to analysis, get the periodic table and LABEL ALL THE ELEMENTS THAT ARE IN THE SPECTRUM, YOU CAN NOT SKIP ONE JUST BECAUSE YOU ARE NOT INTERESTED IN IT, YOU MUST LABEL ALL THE ELEMENTS THAT THE SYSTEM HAS DETECTED IN YOUR SAMPLE.
•Then click on the Method editor that is to the left of the method name.
•Click on Identification and make sure the dot is in the Preset list option to the left of the periodic table
•Then click Get elements
•Then go to the Name box and type in whatever name you would like for your method
•Click on Corrections then set cycles at 9 and then pick your energy range for fitting, typically the range of analysis.
•Then click on add
Then click on ok at the bottom of the popup method editor window. Your

Ag photons detected in 30 seconds at locations indicated



	Ag	Photo expectation
lindauer painting blouse PL shoulder	0	white low Ag
lindauer painting black background area PR side	0	white low Ag
lindauer painting cheek area PL side	0	white low Ag
lindauer painting central rose leaf	1477	backgd shading medium Ag
lindauer painting nostril PL	1650	shadow medium Ag
lindauer painting black background area PL side	1823	dark high Ag
Lindauer proper left eye	2924	black high Ag

Not only can we look for the Ag under the oil paint which from the above analysis is shown to be clearly present in the expected image locations, but one can also determine the paint content and pigments that were used.

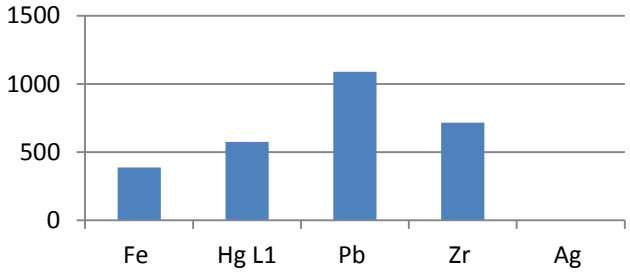
The oil paint is Pb based oil paint with HgS used to give the pink tones, Fe used for the dark pigments, Zn was used to give the white colouration .

This is all apparent in the data shown below with photographs of the various analysis locations.

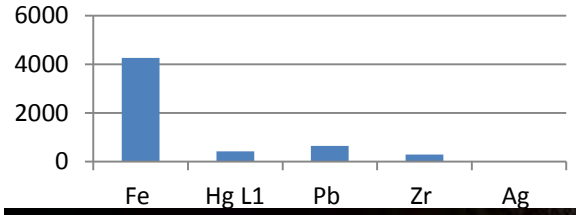
The plots below indicate the number of photons detected for each element noted at each location noted in 30 seconds

Number of photons detected for each element noted at each location noted in 30 seconds

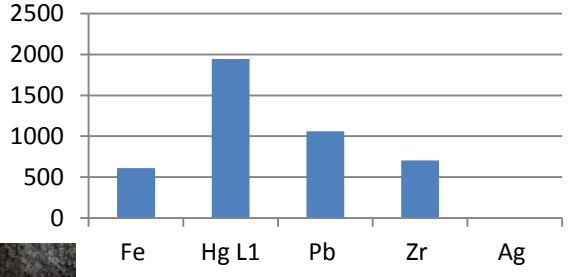
1 Lindauer painting blouse PL shoulder



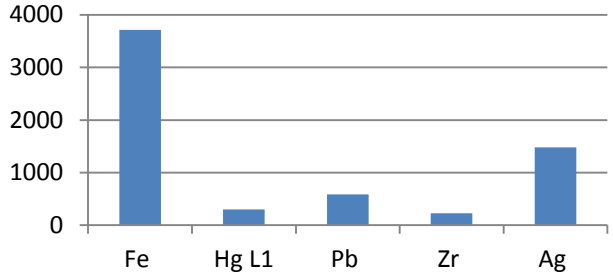
2 Lindauer painting black background area PR side



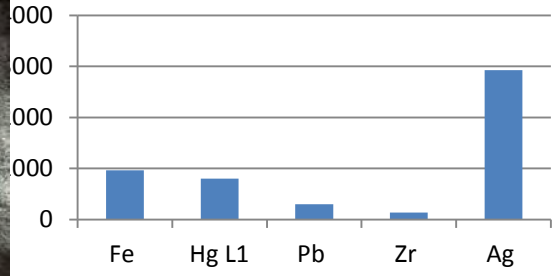
3 Lindauer painting cheek area PL side



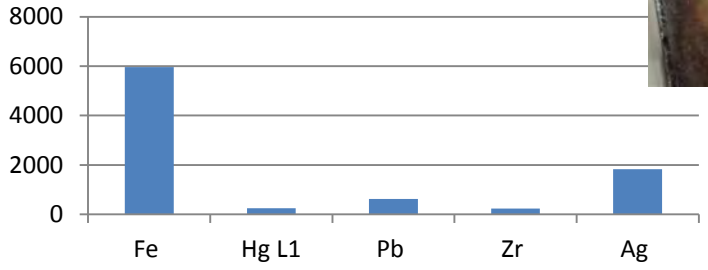
4 Lindauer painting central rose leaf



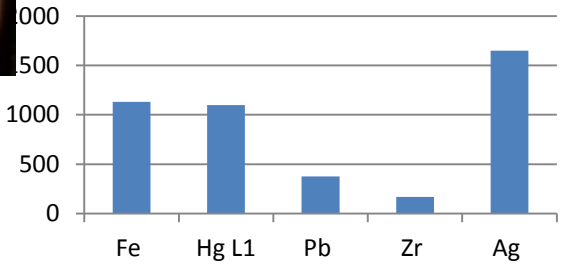
5 Lindauer proper left eye



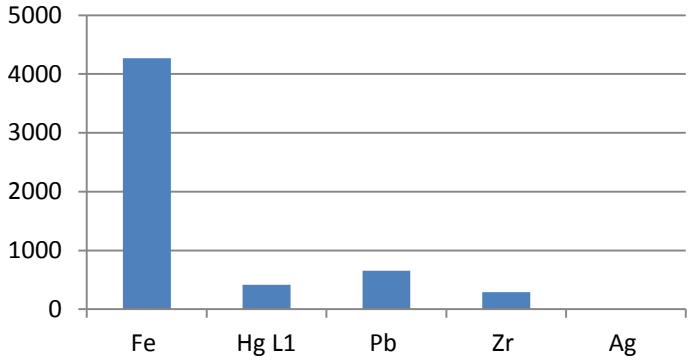
7 Lindauer painting black background area PL side



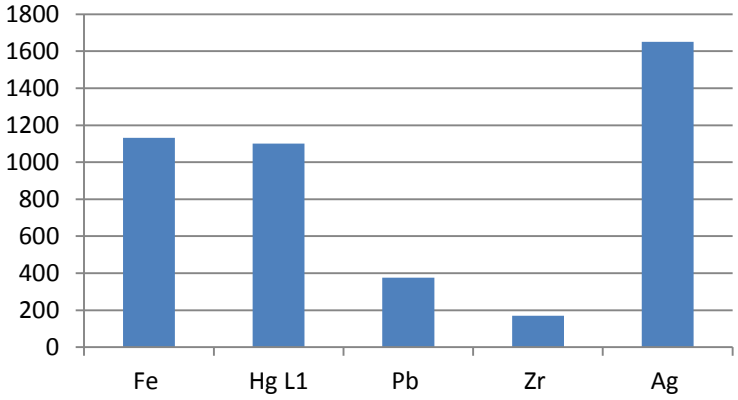
6 Lindauer painting nostril PL



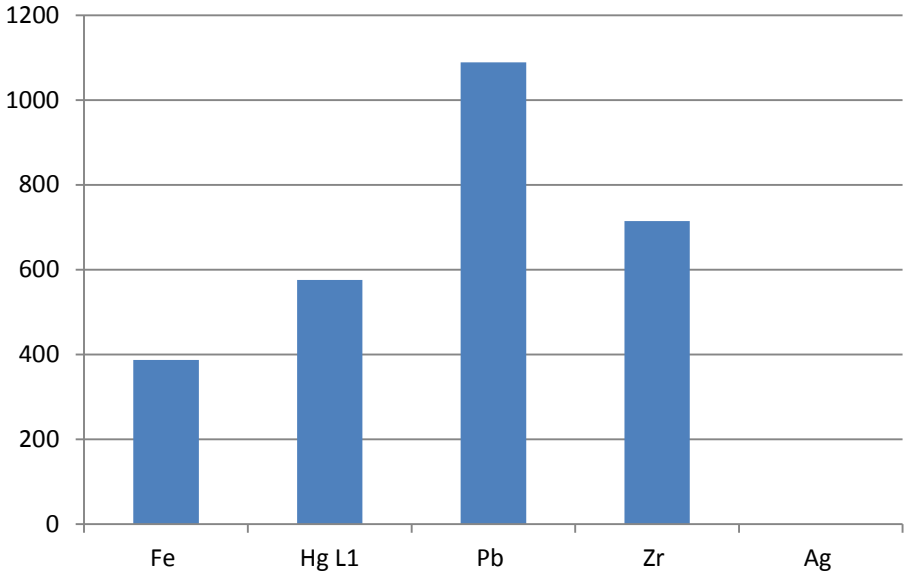
2 Lindauer painting black background area PR side



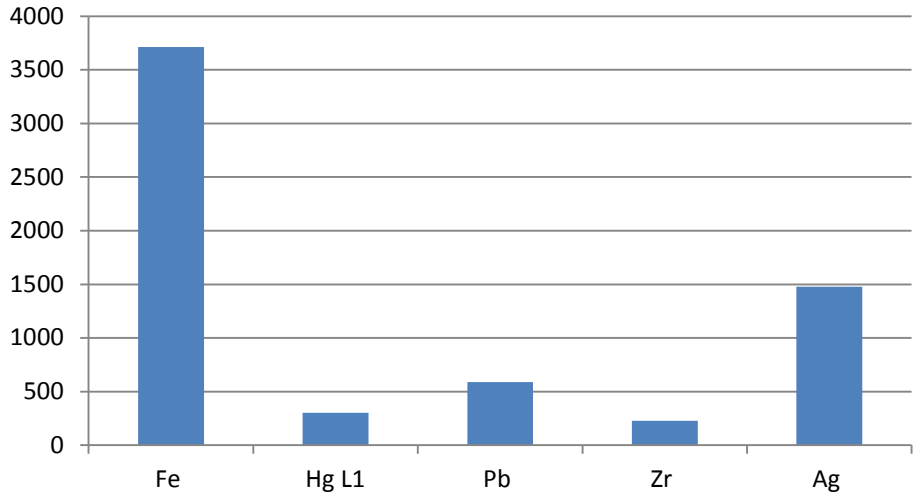
6 Lindauer painting nostril PL



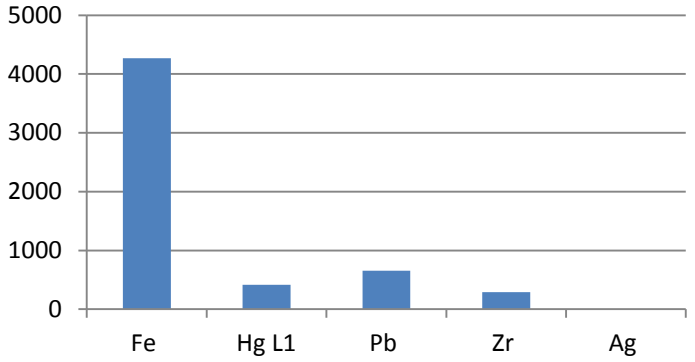
1 lindauer painting blouse PL shoulder



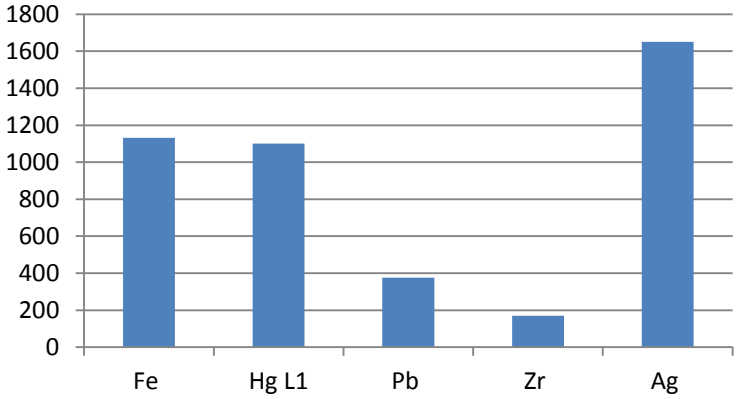
4 lindauer painting central rose leaf



2 lindauer painting black background area PR side



6 lindauer painting nostril PL



Conclusions:

1. It is apparent from this analysis that Ag is indeed under painted image in the locations one would expect if there was a photograph underneath the entire image

2. The oil paint is Pb based oil paint with HgS used to give the pink tones, Fe used for the dark pigments, Zn was used to give the white colouration .