FINE ART DETECTIVE

CODEX OF INVESTIGATIONS

# THE METCALFE CRITICAL REVIEW

A CRITICAL REVIEW OF THE SCIENTIFIC REPORT

*"Joseph and Potifer's Wife," attributed to Titian*

**DR JOHN EDWIN METCALFE**

JUNE 2006

# THE METCALFE CRITICAL REVIEW

DR JOHN EDWIN METCALFE - JUNE 2006

This Fine Art Detective edition presents Dr John Edwin Metcalfe's critical review of the scientific report by Ing. Maurizio Seracini on the painting "Joseph and Potifer's Wife," attributed to Titian.

The original review is reproduced as a historical document. Its wording, authorship, dates, organization, scientific commentary and conclusions are preserved without editorial alteration.

Metcalfe's review takes Seracini's scientific data as its starting point, critiques the implications method by method, and proposes further research concerning pigments, the imprimatura and the carbon-14 result.

Fine Art Detective branding is confined to this publication framework and does not imply authorship of the original review.

# REPORT NAVIGATOR

*The complete original eight-page review follows.*

Dr John Edwin Metcalfe,
For Messrs Barrie O'Leary and
Ian Henderson.

# *Joseph and Potifer's wife* commentaries

**A critical review of the scientific report of Ing. M. Seracini on the painting *Joseph and Potifer's wife* attributed to Titian.**

## Introduction.

The painting of *Joseph and Potifer's wife* has undergone scientific testing at the request of Messrs Barrie O'Leary and Ian Henderson by Editech s.l.r.. Two main questions arise that are problematic for the attribution of this painting to Titian; the carbon date is to be too early and the coloured ground layer is of a style and materials currently unknown to have been used by Titian. Stemming from these questions, and general questions of attribution that must be addressed in the course of scientific providence search, the further examination of these issues is suggested along with suppositions as to the possible their probable causes.

The methods of identification used by Editech have been reviewed and the conclusions drawn are commented upon. Specific data are not reviewed here except where a unique measurement is involved.

Some possible re-examination methods are suggested with estimated completion-time scales.

This report is divided into the following sections:



## Section 1. Overview

The structure of this report is threefold and takes, as its starting point the scientific data supplied by Ing. Maurizio Seracini of Editech s.l.r. of Florence, Italy. It supplies an overview of the data with an analysis of all implications. This is dealt with method by method with a view to critique some results. Finally, proposals are made for their investigation to insure accurate interpretations of those data and the appropriate attribution of the painting.

---

## Section 2. Specific analysis

Editech's full scientific report on the painting *Joseph and Potifer's wife* was received from Ing. Seracini on the Monday, 27 July 2026. It contains these sections:

- Scanning electron microscope images of eight sampled sites
- Scanning electron microscope Energy Dispersive X-ray Spectroscopy of eight sampled sites.
- Natural light photographs of the eight samples.
- UV wavelength images of the eight samples.
- Infrared spectrum of the binder used for the pigments.
- Infrared reflectographs of the complete canvas.
- Micro-Raman spectrogram of 1 sample.
- X-radiographs of the complete canvas.
- Lead isotope dating of a sampled site.
- Carbon 14 dating of a sampled site.

Each of these methods is briefly described before their combined implication for the work is discussed.

---

## Section 3. Reduction of data by Methods

### Scanning electron microscope images

#### Principle

Simply put, a scanning electron microscope creates a picture of a sample by using electrons instead of light. No colours can be seen; the black and white images are a result of the reflectance of an electron beam from the sample. It is important to note that the SEM shades bear no resemblance to those created by natural light and produce finer discernible detail than can be obtained in microscopic images. The SEM images in this report were produced as a preliminary stage to the determination by scanning electron probe electrographs (dealt with next ).

#### Data collected

Eight samples from *Joseph and Potifer's wife* were analysed. Each shows a cross section of the painting's ground and paint layers. These different samples all show similar stratification with the ground layer being thickest. There are several layers of paint in most sections. Each sample's photograph is specifically indicated as to where the exact point is for its SEM-EDS measurement. This was done for both ground and paint layers in each sample.

### Implications arising from these results

The most notable aspect in these cross-sectional pictures is the layering of pigment built up upon the canvas. This seems to indicate an early period in the history of oil painting as in later ages a heavy mixing of pigmented paints was made while the oils were still wet.

There is no discernable stratification within the ground layer. This layer is the thickest and is heavily speckled indicating heterogeneous composition. Light and dark components are apparent in roughly 20% each. The remaining 60 percent is in various grey hues. In several cases, the shapes indicate a fractured rhomboid consistent with a ground crystalline mineral.

There is no indication of a layering of the ground layer. Indicating that the support had not been previously painted upon before being used in the production of *Joseph and Potifer's wife*.

---

## Scanning electron microscope Energy Dispersive X-ray Spectroscopy or EDS

### Principle

A scanning electron microscope can be used to identify the gross chemical composition of a sample as it indicates the relative fraction of each of the of the elements present. Interaction of the primary beam with atoms in the sample causes shell transitions which result in the emission of an X-ray. The emitted X-ray has an energy characteristic of the parent element.

### Data collected

Each of the eight samples taken from the canvas were sub sampled to identify chemical components of the various layers. In most cases, four or five different probe analyses were performed on each sample. These include all pigment and ground layers.

Specifically, the imprimatura was sub sampled to provide identifications for its components evident from the SEM.

Lighter particles have an indicated composition of iron and manganese which are indicative of "earth" pigments – umber or burnt umber being likely candidates.

The darker particles show a presence of both calcium and carbon – the ratio of their signals and their particular morphology leads to their assignment of the mineral calcite.

The grey matrix of the imprimatura indicates the presence of lead and sulphur, identified as lead white the commonly used as opacifier, siccative and white pigment.

### Implications arising from these results

The particular pigments of these samples present the possibility of demonstrating a period which painting was created. Pigments have periods in which they are available and /or popular. The incidence of pigment types therefore can indicate a probable period of production or even a particular artist.

The ground is not composed of a pure gesso layer but a pigmented imprimatura made from a number of products.

---

## Natural light photography

### Principle

Regular photography shows the true colours of the pigments used – this can be helpful in assigning pigment types where chemical analysis proves indecisive (for instance when chemically similar samples have different colours; for instance azurite and malachite.

### Data collected

Each of the eight samples was photographed in natural light.

### Implications arising from these results

Each sample's natural light photograph shows a single base layer of a light pinkish hue common to all samples indicating that this picture was painted using a technique called imprimatura. From the SEM-EDS samples we can assign, this colour to the presence of iron and manganese.

---

## UV light

### Principle

When exposed to UV light different chemicals fluoresce differently. The purpose of this very simple procedure helps with the identification of particular pigments as well as the discernment of layering in the sample that may or may not be evident in visible light.

### Data collected

Each of the eight samples was photographed under UV light to aid pigment analysis.

The whole canvas was photographed to discern layers of different varnishes and pigments that fluoresce differently despite their similar optical appearance.

### Implications arising from these results

The identifications of pigments are facilitated by regular photography.

These results have revealed that the painting shows several areas that are the result of over-painting or restoration. Samples taken from these areas must be discounted in the identification of the pigments particular to a period or place.

---

## Infrared spectroscopy

### Principle

Each compound has a natural frequency of vibration and these frequencies coincide with those of infrared radiation. An infrared spectrogram can identify a particular chemical – though not always specifically.

### Data collected

An infrared spectrogram was taken of the surface of the canvas (sample 10) showing a setting oil, probably either linseed or walnut oil, was used as pigment binder.

### Implications arising from these results

The type of oil is not specifically identified. A Raman infrared (see heading) can identify the particular product if necessary.

---

## Infrared photography

**Principle**

Longer wavelengths of Infrared radiation can be used to see beneath the surface of a painting because the reflectance of an area in this wavelength relies also upon the absorbance properties beneath the visible layer.

**Data collected**

Infrared reflectographs were conducted over the whole canvas. These show that no under-drawings are present. Several pentimenti can be seen in the underlying paintwork however. It is not immediately clear if over-painting of a dog and a column are by the original artist or not.

**Implications arising from these results**

The lack of under-drawing is an important clue to the origin of the painting as the vast majority of all painters under-draw before the application of paint. The paint pentimenti are sufficiently characteristic to be noted in other works that can be compared and used as reference material in the search for stylistic providence.

---

## Raman Infrared Spectroscopy

**Principle**

Raman spectroscopy uses an infrared laser to excite particular bond in a compound and looks at the consequent vibration spectra produced by adjacent bonds.

**Data collected**

One sample (4) was analyzed by Raman spectroscopy for the presence of Carbon black.

**Implications arising from these results**

Although unused for this for this purpose in Ing. Seracinis report, this technique could enable an exact identification of the oil binder. This method might help pin down a region where the painting was produced.

---

**X-ray images of the complete canvas**

**Principle**

High energy X- rays can penetrate through all but the heaviest elements and is used to detect different layers and reveals hidden damage where present in a work.

**Data collected**

X-radiographs were produced of the complete painting. They show several finished sections that have then been painted out (finished in that they have white lead highlights). Also areas of damage are evident especially around the edges of the work.

**Implications arising from these results**

This technique – like infrared photography, shows techniques particular to the painter that may aid his identification. The identification of damaged and therefore restored areas must also be accounted for in the assignment of pigment usage.

---

**Lead isotope dating of a sampled site**

### Principle

Upon smelting from its ore, lead contains an isotope, $Pb^{210}$, which decays at a known rate. As with carbon dating, a date for the sample can be determined from the amount of isotope remaining in the sample. This is detected by measuring the decay of the remaining $Pb^{210}$ whose the half life is 22 years. Such a sample is considered decayed after 12 half-lifes.

### Data collected

One sample (10) was analysed using this technique. No activity could be detected. The age is therefore calculated at older than 250 years.

### Implications arising from these results

This result is an indication of the painting not being less than 250 years old.

---

## Carbon 14 dating of a sampled site

### Principle

Carbon dating is a method whereby the ratio of $C^{12}$ to $C^{14}$ is measured in a sample. As the natural ratio of these carbon isotopes exists in the biosphere ($C^{14}$ is continuously created in the upper atmosphere) when an animal or plant dies its level of $C^{14}$ then begins to drop through the natural radioactive decay of $C^{14}$. Several attenuating circumstances exist for this measurement. Not all plants absorb $C^{14}$ (in the form of $CO_2$) at the same rate and not all areas of the globe exhibit the same levels of $C^{14}$ abundance and not all time periods have the same absolute level of $C^{14}$ (Through a variance of cosmic rays which are responsible for $C^{14}$ production).

### Data collected

A gram sample of fibres from the support was extracted by Ing Seracini for carbon dating. The sample was identified visually as linen. Carbon dating was performed in Utrecht, Holland. The sample produced a result of 1304 to 1365 and 1383 to 1449 with corrections.

### Implications arising from these results

The carbon date is considered as most improbable. After contact with Dr. van der Borg, after preliminary results were obtained, a recalculation of the data provided more precise results, producing a split date, but without more accuracy. Sample contamination cannot be ruled out as a cause for this splitting of dates. The cleaning techniques of canvas samples are problematic in this instance. The complete removal of glues used in restoration is impossible. The sample will then prove irrevocably biased.

---

## Section 4. Collation of Results

- The canvas is virgin: there is no indication of a previous ground layer or under-drawings in a style dissimilar to the artist. This is evident from the ground samples 1 through 10 and the Infrared and X-ray photography.
- The painting has been partially over-painted and restored at least twice. The over-painting is possibly an early restoration. This is evident from the X-ray and Infrared photos.
- The carbon date is seemingly incompatible with the style of the painting and it can be considered in error.

- The painting utilises a ground called imprimatura which contains approximately 20% by volume (through ocular estimation) of the mineral $CaCO_3$, or calcite.

---

**Section 5. Conclusions to be drawn from the work of Seracini**

Ing. M. Seracini's report into the chemical and physical compositions of *Joseph and Potifer's wife* is complete and well composed. Three issues stand out:

- Do the pigments of all the original sections match those used at any time by Titian?
- The carbon date is years too early for a virgin canvas painted in the style seen, why then is the carbon date incorrect?
- The existence of the imprimatura is problematic since it is not known to have been used by Titian. Other examples of imprimatura used by Titian are being sought.

These questions need be addressed fully if providence is to be proved.

---

**Section 6. Methodology of future research**

**Addressing the sample compositions**

This is probably the simplest of the tasks. A search of databases for previous Titian pigment analyses should show a variety of pigments identified by the same method of SEM-EDS. Cross referencing these pigments between paintings may reveal any commonality between both. Statistical analysis will also be used to find the incidence of unique samples of pigments used on Titian canvases in any particular period of the painter's career. This will provide an explanative tool, if necessary, to provide the likelihood that any particularly uncharacteristic sample could have been used by Titian. This may take up to one month.

**Addressing the imprimiture question**

The existence of an imprimatura of uncharacteristic composition can be addressed in the simplest methods. Another painting with similar imprimatura by Titian has to be found, though it may mean having to test other works. It is hoped that data in this area already exist. This job may take up to one month.

**Addressing the Carbon dating**

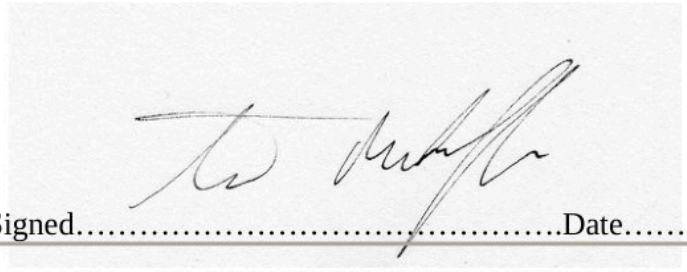
An error of carbon date is in evidence from the fact that the canvas proved to be unpainted before its use for *Joseph and Potifer's wife*. An explanation of the sample preparation methods will be sought, as will the possible need for a recalculation of the figures should incorrect corrections have been inadvertently made. This may take one month.

**Comments on the methodology.**

This researcher will endeavour to utilize the resources of the Opera Dura Library and the Berenson Library at I Tatti to search for correlations between the data obtained in the Editech report and those from other Titian analyses. Permission is being obtained to deal directly with Dr. K. van der Borg, of the Van de Graaff Laboratory, Utrecht University, to re-examine the carbon dating.

## Section 7. Conclusion

Re-examination of suspect data and interpretation of existing data are not inconsequential tasks. Time spans can vary largely, though this researcher is optimistic that a low estimate is in order to bring this project to its scientific completion.



Signed…….Date……Monday, 27 July 2026……