Art Analysis & Research

ANALYTICAL REPORT

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Still Life, 1907-12 (?)
Mikhail Larionov
Collection Museum Ludwig, Cologne, Inv. ML 1487

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Summary

A painting on canvas by Mikhail Larionov, *Still Life*, belonging to the Museum Ludwig (reference: ML 1487), that has been dated to c. 1907-12 (it is inscribed with the initials 'M.L.', but not dated), was examined and analysed by Art Analysis & Research, Ltd. in cooperation with the Museum Ludwig, and funded through a grant from The Russian Avant Garde Research Project (RARP). This artwork formed a part of a group of fourteen well-provenanced paintings by the Russian artist couple Natalia Goncharova and Mikhail Larionov, held in the collection of the Museum Ludwig that comprised the focus of this work. The goal set for this research was to investigate these paintings in order to characterise similarities and differences, with the objectives of 1) providing detailed studies of the specific paintings, 2) obtaining wider information on the artists' methods, 3) defining a blueprint for promising methodologies to develop further on other works by these artists and with an aim of applying such information in support a *catalogue raisonné*, and 4) creating the foundation for applying similar methodologies and techniques to other artists of the genre. To this end, each of the paintings are described in individual reports (as here) accompanied by a summary report under separate cover. The results of the program of examination, material analysis and technical imaging will be set out herein.

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A. Introduction

The painting known as *Still Life* (**Plate 1**), by the artist Mikhail Larionov (1881-1964), a work on canvas measuring 460 mm high by 810 mm wide, is part of the collection of the Museum Ludwig, Cologne (Inv. ML 1487). It is inscribed 'M.L.' (lower right) but is undated (**Plate 1.a**). A date of c. 1907-12 has been proposed for its creation. It has been examined as part of a larger technical study of fourteen paintings by Goncharova and Mikhail Larionov in the Museum Ludwig, as part of a project funded through a grant from the charity the Russian Avant Garde Research Project (RARP). The project goal has been to generate detailed technical profiles on authentic paintings by Goncharova and Larionov to expand the data available for art historical study and technical characterization of their work[1]; consequently, fourteen well-provenanced paintings by the Russian artist couple held in the collection of the Museum Ludwig were thoroughly examined and analysed[2]. The short-term goal of the project was to define a blueprint for promising routes of research to develop further on other works by these artists and with a long-term goal of contributing such information to support a technical *catalogue raisonné*; these recommendations are laid out in a summary report[3].

The information in this report therefore provides a detailed technical and material account of the painting. In addition, this is considered in light of the conservation history and provenance information relating to the painting, held by the Museum Ludwig; the supplementary reports produced by Verena Franken in the course of her work on the RARP project summarises this material[4]. Some of the information concerning examination of the painting has been included here, as relevant, as are a representative selection of the extensive documentation photographs she made.

The structure of this report is as follows. First, the primary findings of the visual examination and technical imaging will be described in **Section B**.

Materials analysis on micro-samples taken for pigment and binding medium identification and cross-sections is described in **Section C**.

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[1] There is limited specific information available. This includes: Rioux, J.-P.; Aitken, G.; Duval, A. 'Étude en laboratoire des peintures de Gontcharova et Larionov', pp. 220-223. In: *Nathalie Gontcharova, Michel Larionov* [exh. cat.], Éditions du Centre Pompidou: Paris (1995). Rioux, J.-P.; Aitken, G.; Duval, A. 'Matériaux et techniques des peintures de Nathalie S. Gontcharova et Michel F. Larionov du Musée national d'art moderne', *Techne* **8** (1998) 7-32. Gallone, A. 'Œuvres de Michel Larionov et Nathalie Gontcharova: Analyse de la Couleur', *Le dessin sous-jacent la technologie dans la peinture: Colloque XI 14-16 septembre 1995*, R. Van Schoute and H. Verougstraete (eds), Louvain-la-Neuve (1997) pp. 137-141, Pl. 74-76.

[2] These include: Natalia Goncharova: *Paysage de Tiraspol (Tiraspol Landscape)*, 1905, ML 01483; *Rusalka*, 1908, ML 1304; *Still Life with Tiger Skin*, 1908, ML 1305; *The Jewish Family*, 1912, ML 1369; *The Orange Seller*, 1916, ML 1484; *Portrait of Larionov*, 1913, ML 1319.
Mikhail Larionov, *Still Life with Coffee Pot*, c. 1906, ML 01486; *Still Life*, c. 1907/1912, ML 1487; *Still Life with a Crayfish (Nature morte à l'écrevisse*), c. 1907, ML 1331; *Portrait of a Man (Anton Beswal)*, c. 1910, ML 1306; *Rayonism, Red and Blue (Beach)*, 1911, ML 1333; *Saucission et maquereau rayonnists (Rayonistic Sausage and Mackerel)*, 1912, ML 1307; *Venus*, 1912, ML 1332; *Rayonistic Composition*, inscribed 1916, ML/Z 211/134.

[3] *Summary Report of the RARP Goncharova/Larionov Project, with the Museum Ludwig,* Art Analysis & Research Inc. (2017).

[4] See reports: *AAR0955.H ML 1487 Conservation*, Franken, V. 'Report on the examination of the painting *Nature morte/ Still Life* by Mikhail Larionov' (2017a) and *AAR0955.H ML 1487 Archives*, Franken, V. 'Report on the content of the Museum Ludwig archives, concerning the painting *Nature morte/ Still Life* by Mikhail Larionov (2017b).

Inferences drawn regarding the painting on the basis of these investigations will be discussed in **Section D**.

The methodologies and protocols used in each case may be found described in the general **Protocols** supplement, appended to this series of reports.

B. Examination, imaging and analysis of the images

B.1 Methodology

The painting was initially examined visually under normal lighting conditions and with ultraviolet light (UV), then with a stereo binocular microscope.

A range of technical imaging techniques were also employed (**Appendix 3**), generating a variety of images and imaging datasets[5]. These are presented as follows:

- High-resolution visible colour (**Plates 1, 4**);
- UV luminescence (**Plates 2, 5**);
- Oblique illumination (**Plate 3**);
- Short-wave infrared (SWIR), 1600-2500nm (**Plates 6, 7**);
- X-radiography (**Plates 8, 9**).

Additionally, weave analysis (including thread counting) was conducted on the basis of the X-radiograph (**Plates 10.a-d**). Some exemplar images recorded as part of the surface microscopy and macrophotography are also reproduced here (**Plates 11-15**).

The imaging revealed a range of aspects regarding the use of materials, structure and technique of production of the painting that are complementary to the visual observations made. Consequently, specific observation will be made to each in this section regarding the interpretation of these specific forms of analysis, while a summary overview in the context of the painting technique is presented in **Section D**, below.

B.2 General observations

The painting is executed on a plain weave canvas, which has not been lined, so that both the recto and the verso of the artwork could be studied. The wooden strainer upon which the painting is stretched appears to be original; the visible painting was revealed to overlie an unfinished academic figure study. Thus, the canvas is ‘recycled’, although pending further stylistic evaluation, it is not

[5] Additionally, a visible-NIR multispectral dataset was collected to examine its suitability for study of paintings of Goncharova and Larionov. As it did not offer information significantly different or superior to that derived by the SWIR imaging, this has not been otherwise reproduced or further analysed here but is available for extramural studies in the future.

possible to say whether this is an early work by the artist, or, a canvas by a third party reused as a painting support. The work is in relatively good condition. The surface has not been varnished.

B.3 Imaging

Each form of imaging offers different types of insight into the various material aspects of the painting. The most relevant are introduced, in brief, here.

B.3.i Photography with ultraviolet illumination

Excitation by ultraviolet (UV) light can induce luminescence[6] in some materials, commonly seen as a weak re-emission of light in the visible region. Many natural varnishes have this property, emitting a characteristic weak greenish luminescence. While some pigments (notably zinc white, as found here, and certain 'lake' pigments) are also active in this way, paints otherwise often do not luminesce. Because of the luminescence of varnishes, which are typically applied as a continuous coating across the surface of a painting, this can provide a means of determining if any disturbance has occurred, such as partial cleaning of the surface or addition of later restoration, where the changes show in contrast to the luminescent areas. Consequently, UV light is commonly used to reveal the presence of retouching. When paintings are not varnished, as is the case with the present work, differences between the colour of the luminescence of the different paints and any added retouching paints can also indicate later stages of intervention (none is visible here; **Protocol 3.2** and **Plate 2**).

In the UV image of this work, the zinc white paint used in the visible image shows a bright yellow green tone. Equally, the exposed ground (based on lead white), left uncovered by the paint in some areas, especially around the edges, also images in a yellow white tone, though less brightly than the paint. Apart from the zinc white, no strong luminescence was noted from any of the original paints. In the UV image, the use of dark paint (dull grey colour in the image) along the right-hand edge of the painting is notable. Unlike the other marks made in the painting, these brush strokes are less purposeful, and do not relate to any of the elements of the composition. Nor do they seem to relate to the underlying painting, as shown in the IR image (**Plate 6**). At present, their function in the construction of the image is unexplained.

The verso of the painting, as viewed under UV illumination (**Plate 5**) throws the markings on the verso into higher contrast. The white rectangle on which the inscription 'M. LARIONOW', is rendered (**Plate 4.a**) images in a very similar tone to the white areas on the recto of the painting, suggesting that this may be contemporary with the *Still Life*. As is visible in normal light, the canvas is stained with an unidentified material on the left side (verso orientation), with most of the left side affected apart from irregularly shaped areas and the leftmost edge. The staining has a curved, specked border on the right side. In contrast, the right side (verso orientation) shows only isolated stains. The cause of the slightly wavy line of

[6] Commonly referred to as 'UV fluorescence', the word *luminescence* is used here as a broader term that may encompass not only fluorescence phenomena (prompt re-emission of light), but also phosphorescence (slow re-emission of light due to transition via forbidden quantum states). In both cases emission is typically at longer wavelengths than the excitation; here, the excitation is in the UV to blue part of the spectrum (hence 'UV'; in practice, so-called UV-A) and emission in the visible region.

darkened canvas, along the bottom edge, just above the level of the stretcher bar, is likewise unclear.

B.3.ii Short-wave infrared (SWIR)

The interest in technologies capable of imaging artworks past the red end of the visible spectrum, in the 'near' ('NIR') or short-wave ('SWIR') infrared regions, has primarily developed out of the long-standing application to reflectography, exploiting the phenomenon of variable transparency of paint films at different wavelengths to enable visualisation of features lying beneath the surface. Imaging of underdrawing has been a major contribution to the study of authorship in paintings, permitting a fuller comprehension of artists' working practices and extending the evidence used in attribution questions. Practical experience (as well as theoretical consideration) has shown that deeper IR cameras can confer additional benefits in terms of penetration to underlying layers; consequently, a system capable of operating in the SWIR region was used here (see **Protocol 3.4**).

In the SWIR image taken (**Plates 6, 7**), the most striking features are not those of the visible image, but of an unfinished, underlying painting, apparently a female nude study, which served as the basis for the present work. While most of this is rendered in brush, there is a drawn line that runs horizontally through the figure's thighs (in vertical direction, to the left of the centre in the orientation of the composition *Still Life*). It is not fully clear whether this line was made in the context of developing the underlying figure study, or during the rendering *Still Life*.

The SWIR image (**Plate 7**) reveals that from the knees up, the figure is set against a dark background; this field of colour is most likely that which continues over what comprises the left side tacking margin of the *Still Life* (**Plates 13.b, 13.c**).

Comparison with the image currently visible, and with the X-ray (**Plates 8, 9**) reveals that the form of this figure has not been integrated into the current composition. In both cases, the thickly applied white areas of the fish and the sheet of 'paper' on which a man's profile is rendered block both the passage of the IR and X-ray.

B.3.iii X-radiography and weave analysis

X-radiography shows internal structures in paintings because the transmitted X-rays are blocked to different degrees by virtue of the inherent absorption and thickness variations of the constituent materials. For example, pigments based on lead (such as 'lead white') stop the passage of X-rays more effectively than materials based on organic compounds (such as carbon blacks or the binding medium of the paint), while a thicker application of a material will block more than a thinner one. This allows visualisation of sub-surface features, such as abandoned or altered earlier phases (*pentimenti*), use of techniques such as superimposed forms as opposed to forms left in reserve, characteristic brushwork and so forth.

As in the IR, the X-ray (**Protocol 3.6**; **Plates 8, 9**) reveals the underling image of a figure study, but in different detail; here the dark areas of background are not visible, but rather the heavy build-up of paint used to contour the body.

Infilling of the interstices of the threads comprising the canvas support with the priming and paint also allows the canvas weave to be visualised in the X-ray. Even if a painting is lined, making direct access to the original canvas difficult or impossible, X-ray images can permit the primary weave structure to be examined in detail. A common characterisation of canvases (apart from weave type) cited in the study of paintings is the 'thread count', or number of threads per unit in warp and weft directions. Conventionally determined by hand-measuring a number of representative areas, this is now done by applying an image processing algorithm to the entire X-ray image, which has the benefit of providing both greatly enhanced determination of thread counts as well as density and thread orientation information across the whole painting (see **Protocol 3.7**; **Plates 10.a-.d**).

As no selvedge edge was present, warp and weft could not be unambiguously determined. The thread count of this work - painted on a plain weave canvas (**Plate 11.a**) - was determined as 17.2 threads per centimetre in the horizontal direction and 15.7 in the vertical. The irregular cusping distortion around the edges of the canvas (**Plate 10.a**), which are much stronger on the lowermost edge, raises questions regarding whether the painting retains its original format. This will be discussed further, in **Section D**.

C. Sampling and analysis

C.1 Introduction

Samples were taken of the support, ground preparation and paint layers of the work for analysis by different means in order to determine the range of materials (canvas, pigments and binders) used in the painting, the nature of the preparation layer and the sequence of layering employed in building up the painting.

To this end, a series of seven locations (see **Table App.1.i and Plate 16**) selected over a representative range of the painting were micro-sampled for identification of the pigments (**Table App.2.i**), with four micro-samples of paint taken for analysis of the binding media (**Tables App.2.ii-2.iv**). Two further samples were taken for preparation as cross-sections to study the layering in the selected areas, with the aim of elucidating the development of the painting (**Plates 17-19**). Finally, canvas threads were taken for fibre identification and radiocarbon dating (**App.2.iv, Protocol 2.7** and **App.2.v, Protocol 2.8**).

Micro-samples for analysis were taken from locations that were adjudged to be original (that is, were clearly contiguous with those below and adjacent to them, and not retouching or repair). Locations were also further selected to represent as wide a range of the colours – and therefore probably pigments and media – as possible. Thus, the materials identified and discussed below therefore represent, as far as can be determined, the full extent of the original palette used by the artist.

The micro-samples taken for pigment characterisation were subjected to systematic analysis by polarised light microscopy (PLM) combined with UV-visible-near infrared micro-spectrophotometry, scanning electron microscopy-energy dispersive X-ray spectrometry (SEM-EDX) and Raman microscopy (**App.2.i**).

Organic components were identified by Fourier Transform Infrared Spectroscopy-Attenuated Total Reflectance (FTIR; **App.2.ii**; **Protocol 2.4**) and subsequently by Gas Chromatography-Mass Spectrometry (GCMS; **App.2.iii**; **Protocol 2.5**).

All of the analytical techniques applied are standard methods within the field, capable of allowing the kinds of differentiation required for this type of work. Comparison was also made between samples from the painting and examples of similar pigments from a large collection of reference standards previously analysed by multiple means[7]. Certain differentiations cannot necessarily be made from this range of techniques, although for present purposes the level of discrimination is thought to be largely or wholly sufficient. All materials were generally identified through a combination of the techniques applied; however, certain key diagnostic features were specifically determined through one or other method.

C.2 Support

The canvas was identified as being based on linen (*Linum usitatissimum* L.) in both warp and weft directions (**App.2.iv**; **Protocol 2.7**).

C.3 Radiocarbon dating

Radiocarbon dating was applied to fibres from the canvas support (**App.2.v, Protocol 2.8**).

The radiocarbon date was determined as 82 years b.p. ±23 years. After calibration, this yielded a date distribution for which the most relevant period for the origin of the canvas lies 1812-1920 at the 95.4% probability level, pre-dating the so-called ‘bomb-pulse’ period that begins in the mid-1950s.

C.4 Ground

The ground (visible in cross section in Samples [8 and 9], **Plates 17-19**) was found to be composed of two layers. The upper layer of the ground (Sample [5]) was found to be composed of lead carbonate hydroxide (‘lead white’). It is bound in a drying oil (**App.2.ii**). Below this layer, a thin but discrete layer of a beige coloured, transparent material is visible in cross-section (**Plates 17-20**). This was found to consist of calcite (as identified in situ on both Samples [8 and 10] in cross-

[7] The pigment reference collection belongs to the Pigmentum Project (see: http://pigmentum.org) and runs to around 3500 samples of both historical and modern origin. Analysis of this collection includes PLM and SEM-EDX as well as other techniques such as X-ray diffraction and Raman microscopy. Access to this research collection is gratefully acknowledged. Reference to specific specimens in the text of this report is to the Pigmentum collection number [Pxxxx]. An organic binding media reference collection is also held by AA&R; samples in this set are cited as [AARxxx].

section); this was confirmed by FTIR analysis of the remains of ground on the sample submitted for radiocarbon dating, which was found to consist of calcite, with a minor component of calcium sulfate in the presence of a protein-based medium (not identified, but traditionally animal-skin glue) (**App.2.v**)[8].

C.5 Underdrawing

No underdrawing, per se, was found. However, the presence of some loosely rendered lines, apparently in pencil, was noted.

C.6 Paint layers: Pigments

The following pigments (**Tables App.2.i, App.2.ii**) were identified in the paint of the visible image, which utilises a very simple palette:

- Zinc oxide ('zinc white')
- Lead carbonate type white ('lead white')
- Barium sulfate
- Cadmium sulfide ('cadmium yellow')
- Earth pigment, yellow, with goethite and kaolinite clay minerals
- Earth pigment, brown, containing manganese (such as a 'sienna' or 'umber')[9]

The barium sulfate, a common 'extender' pigment, was identified as a minor component in white, brown, yellow and bright yellow paint samples, together with zinc white, earth pigments, goethite and cadmium yellow respectively. The lead carbonate was present only as a minor component in the white paint, which is primarily zinc oxide.

The white paint is principally composed of zinc oxide, with barium sulfate as a minor component and traces of a lead carbonate type white, possibly a result of contamination of the ground layer. Due to the thin applications of paint in the visible image, and the use of a lead white based ground,

The underlying painting was found to contain the following pigments:

- Lead carbonate type white ('lead white')
- Barium sulfate
- Chromium oxide hydrate ('viridian')
- Ultramarine, synthetic (blue)
- Iron containing earth pigments, with aluminosilicate clay minerals (red tones)

The cross-section of Sample [9] (see below, **Plate 19**) contains an intermediate paint layer probably related to the underlying painting with green particles clearly embedded in it.

[8] Raman microscopy performed off the cross section prepared from Sample [8], **Plates 17, 18**, indicated the majority presence of calcite. FTIR analysis of the canvas sample for radiocarbon dating – Sample [10] - indicated the presence of calcium carbonate (calcite type), calcium sulfate (gypsum type), a proteinaceous material, and possibly an oil, in addition to the cellulose of the fibre.

[9] Other types of earth pigment may also be present but were not further characterised from samples.

C.7 Paint layers: Binding media

All samples analysed by FTIR (**App.2.ii**) indicated the presence of a drying oil. Additional analysis by GCMS (**App.2.iii**) on three samples indicated the presence of linseed oil.

FTIR also indicated the presence of metal soaps, probably of lead and zinc, assumed to be reaction products between pigments and binding medium.

C.8 Stratigraphy

The preparation of cross-sections allowed for examination of the overall stratigraphy and composition of the priming and paint layers.

Sample [8], a yellow area laid over grey from the left-hand edge (**Plates 17-18**), has a thick off-white ground layer of calcite, followed by a thinner layer of lead white and fragmentary grey and yellow paint layers, visible only at the right-hand side of the sample. The thin layer above the lead white priming layer contains both red and green particles.

Sample [9], from an area of white paint (here, the preparation layer is not preserved), exhibits a thick white layer lowermost (containing barium sulfate and lead carbonate, possibly other materials not detectable by Raman microscopy), followed by a thin grey-brown layer containing black, red and some large green particles (probably belonging to the lowermost painting, that is quite similar to the layer noted in Sample [8]), before the uppermost application of white paint pertaining to *Still Life* (**Plate 19**). The uppermost layer contains some particles displaying the green UV luminescence that is characteristic of zinc oxide; it also contains some lead carbonate. The intermediate layer most probably relates to the underlying figure painting, as it is present in both Samples [8] and [9].

D. Discussion of the findings

D.1 Support, ground and preparatory work

D.1.i The support

The painting has been executed on a plain-weave, linen canvas (**Plates 11.a, 11.b**), with thread counts of 17.4 threads per cm in the horizontal direction and 15.7 threads per cm in the vertical direction (see **Plate 10.d**). Neither of the selvedge edges are preserved and the tacking margins show fraying at the cut edges of the canvas (**Plates 12.a-c, 13.b, 13.c**). The weave is quite open (**Plate 11.a**), with distinct interstices between most of the threads.

The canvas is of a rather fine, uniform aspect, suggesting it is a purpose made artists' canvas (**Plates 11-13**). While some slubby and irregular threads may be noted, they are neither very numerous, nor much thicker than the other threads (**Plate 11.b**). Given the presence of a canvas stamp of a French colourman, Chabod (see below), the quality may be identified

with what is known as the *étude* or *pouchadé* weights of canvas, which were inexpensive types of canvas made for sketching (as used here)[10].

The canvas is unlined, so the verso is fully visible (**Plates 4, 5**). It is affixed to what may be its original strainer (with a central support bar) by means of what appear to be the original, round headed tacks (**Plates 12.b, 12.c**); in the few cases where these tacks are missing, the original tacking holes are characterised by the presence of circular impressions. The tacking margins generally extend over the edge of the strainer (**Plate 12**). The canvas appears to be stretched in original configuration on its original strainer; some slackness of the canvas may be observed in raking light, which reveals the tension lines of the somewhat slackened support (**Plate 3**).

A stamp on the verso of the canvas gives the information of the colour merchant the widow Chabod (**Plate 5**); the visible and legible parts of the stamp, which reads as follows, are indicated in bold, below:

Vve M. CHABOD [& Cie] / [Mds de COULEURS] / **EXTRA FINES** / **TOILES à TABLE**[AUX] / **RUE JACOB** [20][11]

Madame Chabod must have taken over the running of the business after the death of her husband, Mr. Chabod, who supplied some of the students of the *École des Beaux-Arts* in Paris by means of a weekly visit[12]. The stamp was known to have been in use for a period of five years, from 1900-1905[13]; implications for dating will be discussed below.

The presence of the canvas stamp raises other implications regarding the size of the canvas. In late 19th century Paris, canvases were produced to standard sizes, although the shift in format in is not well documented. The dimensions here, however – 81 x 46 cm – do not match those of the standard formats noted slightly earlier (in the later 19th century). The narrowest width produced for a canvas of 81 cm in length was 56 cm, which corresponded to a 'marine' format[14]. The measure 46 cm was known to have been produced as a standard size support bar; it was simply not combined with the 81 cm length. Equally, the cusping deformations observable on the canvas (**Plate 10.a**) are much stronger along the lower edge, than on the upper (corresponding to left and right sides of the original figure in vertical format), suggesting that a balanced cusping stress pattern might indeed have been conceivable, if the format was more to the order of a standard measure such as 81 cm x 56 cm. On the other hand, the figure of the underlying painting is centred in the middle of the present format of the canvas and the tacking edges appear to exhibit unpainted canvas, except for the left edge (top in the original format) where the dark background of the

[10] Callen, A. *The Art of Impressionism*, New Haven and London: Yale University Press (2000) pp. 31, 32, figures 45.-48.

[11] The full text may be found on the following website: *Guide Labreuche. Guide historique des fournisseurs de matériel pour artistes à Paris 1790-1960*, consulted 24 October (2017): http://www.labreuche-fournisseurs-artistes-paris.fr/fournisseur/cabod-veuve

[12] Labreuche, P. *Paris, capitale de la toile à peindre, XVIIIe-XIXe siècle*, Paris: CTHS / INHA (2011) p. 289.

[13] Note: The same stamp was found on the canvas of the artwork *Le Bossu* (1905) by Lucien Jonas. Website *Guide Labreuche*, as cited above, note 12.

[14] Labreuche (2011) *op. cit.* pp. 298-303.

underlying figure study extends over the tacking margin to the cut edge[15]. It is possible that, for figure studies, a tall thin support was used, stretched with an inexpensive study grade canvas, as is found here, which would have been a practical solution for such works. Thus, for the present, the configuration of this canvas will be accepted as the original, as the evidence, though not highly regular, does not strongly suggest otherwise.

In addition to the Chabod stamp on the canvas, there are a number of inscriptions, stamps and labels present on the verso of the painting (both stretcher and canvas) that are less directly related to the original creation of the artwork (**Plates 4, 5**)[16].

D.1.ii Priming

The canvas has been primed with a white ground layer, that appears to have been applied industrially by a specialist supplier, as it is of a very even aspect (**Plates 11.c, 12.a, 12.b, 12.c**) and extends over the tacking margins to the cut canvas edges (**Plate 12**).

Analysis of the ground indicated the presence of two layers. The lower layer is composed of calcium carbonate (calcite) and some calcium sulfate bound with protein. Although the binding medium was not specifically analysed to determine the nature of the protein, it assumed to be animal skin glue, as was traditional practice for calcite ('chalk' type) grounds. Equally, it may be presumed that the canvas was first sized with a layer of pure glue, so help seal the interstices between the canvas threads (**Plate 11.a**), before the white priming was laid. The second, upper layer of priming is composed of a thick layer of lead white and a small proportion of clay minerals, bound in oil. This structure may be clearly seen cross sections prepared (Samples [8 and 9] **Plates 17-19**). As such, it was applied over the first calcite layer as an overall isolation layer in order to produce a less absorbent surface for painting in oil.

D.1.iii Underdrawing

The IR and X-ray images taken of the painting (**Plates 6-9**) reveal the form of an unfinished, painted full length sketch of a nude woman. In the IR image however, the extent of the figure is better resolved (**Plates 6, 7**); the body has been laid in with brushy, loose lines and the space around the upper portions of the body set against a darker tone. These appear to have been rendered in brush in a thin, dilute paint offset with heavier working up of the highlights (as suggested by the X-ray image). In contrast, there is no evidence for underdrawing of this figure, although some rather loose lines, apparently in pencil, are visible (**Plate 7**). These are visible in part through the transparent paint of the *Still Life*, and it is unclear which program of work they relate to.

[15] The canvas may have been stretched after the painting was completed, or, the painter may have simply extended the paint over the foldover edge.
[16] These are described in more detail in Franken (2017a) *op. cit.*

D.2 Paint, pigments and binding media

D.2.i General observations

The condition of the painting is generally very good although the canvas is somewhat brittle. Although the paint layers exhibit cracking (**Plate 14.b**), this has not led to loss of paint, and there is no observable retouching present.

The painting is executed in a very sure and spontaneous manner apparently without an underdrawing, suggesting that the shapes were roughly laid in as the artist progressed the composition. The prepared surface of the canvas is largely but not wholly covered by the application of paint, which extends over the tacking margins in some areas while allowing areas of ground to remain visible in other areas of the painting. Exposed areas of ground occur primarily on the right side of the painting, which corresponds the lower register of the figure study where the ground was not painted over (it was painted with a dark tone in the upper half, to the left of the painting in present orientation) (**Plates 2, 13.a**). No evidence for complex layering was seen; areas are worked quite directly, with mixing both on the palette, and wet-in-wet directly on the canvas (**Plate 14.b**). It has not been varnished.

D.2.ii Paint: pigment and binding medium

The palette used in this work is quite limited in scope, encompassing a white ('zinc white'), a yellow (cadmium yellow), and earth pigments of red and yellow tones. Lead carbonate ('lead white') and barium sulfate were found used as additions to the various formulations (not as primary pigments). It is worked in almost a warm 'monotone' effect of yellows and browns. The paint looks to have been applied in a very fluid state, and is very glossy. No secondary ground or subsequent preparation was applied before *Still Life* was begun; it lies directly over the figure study below.

The underlying figure study is based on a canvas prepared with a double ground: below with a layer of calcite ('chalk' – either synthetic or natural) (presumably glue bound, though this was not specifically analysed) bound in protein, finished with a layer of lead carbonate ('lead white') bound in oil. Pigments noted in this earlier work include: chromium oxide hydrate ('viridian') green and synthetic ultramarine blue, in addition to earth pigments (with use of barium sulfate as an extender).

Analysis of the paint samples indicated that they are bound with linseed oil (**App.2.iii**). Both the evident fluid handling of the paint, and a phenomenon noted in many areas of the painting – a build-up of yellowed transparent material – suggest a very medium rich paint, slightly over bound, in which the medium has separated out to a minor degree, causing these passages of transparent yellow to form (**Plates 14.a, 14.c, 15.a**).

The cross-sections prepared confirm the observations made on the surface, and with the various forms of imaging: that the paint was worked freely and directly with considerable use of wet-in-wet application of paint (**Plates 15-19**). Mixing has taken place both on the palette, and on the brush, sometimes directly on the canvas. This direct application has led to

quite thin passages where the canvas weave and lumpy texture of the ground remain fully visible, while in others where it is fully obliterated by a heavy build-up of impasto.

Examination under magnification shows that the first painting had clearly dried, forming cracks, before the current work was applied over it. Cracks in the underlying layers, that do not penetrate the paint of *Still Life*, may be noted in many areas (**Plates 14.c, 15.a**). It also seems that some accumulation of surface dirt may have occurred prior to reuse of the canvas; there are many black particles visible on the pink flesh tone (as seen in **Plate 15.a**), though further investigation would be recommended to confirm this observation (there is a possibility that these particles relate to other features, such as toning, or a friable underdrawing, though this admittedly seems less likely). Despite the care taken to paint out the underlying figure study, now, due to the increasing transparency of oil paint as it ages over time, parts of the underlying image are visible, such as the head of the figure (**Plate 15.b**).

D.2.iii Materials analysis and implications for dating

The painting has been broadly dated in the range of 1906-12 on stylistic grounds, although other dates have also been proposed for it ranging to as late as 1927. Given the results of this investigation, it is indeed the latter that seems the most plausible. Although this painting has been dated to c. 1906, there is a similar painting in terms of format and motifs which has been dated to approximately 1912[17] and yet another conceptually related piece that has been dated c. 1930 (discussed further, below)[18].

The radiocarbon measurement of the canvas gave an origin for it between 1812-1920 at the 95.4% probability level, though pre-dating the so-called 'bomb-pulse' period that begins in the mid-1950s. Typical of C14 data for pre-bomb curve dates in the 20th century, the date range is broad. In addition to the year of harvesting, a period of 3-5 years typically needs to be allowed for processing into canvas and use by the artist. This addition to the data suggested would be compatible with the stylistic dates suggested. Equally, the figure study upon which the visible image sits had fully dried before the current painting was executed; consequently, the date of creation of the visible painting might be further displaced from that of the canvas date.

The materials otherwise identified in the painting would not be incompatible with the supposed dates that have been suggested (although they also continued in use after that time).

[17] Illustrated in: *Ibid*. p. 7. From: Chamot, M. and Gray, C. (Eds?) *Larionov and Goncharova: a retrospective exhibition of paintings and designs for the theatre* [exhibition catalogue, 9 September to 16 December 1961, Leeds City Art Gallery; Museum and Art Gallery, City of Bristol; Arts Council Gallery, London], London: Arts Council (1961) unpaginated (with photo), cat. no. 38, *Still Life*. The painting is of the same format as the two works *Still Life* and *Still Life with Coffee Pot* in the Museum Ludwig. It would be of interest to establish its present whereabouts.

[18] Éditions du Centre Pompidou Paris, *Nathalie Gontcharova, Michel Larionov*, Imprimerie Le Govic: Saint-Herblain (1995) p. 149, Cat. 126.

Therefore, the most significant aspect of the work in terms of its importance regarding establishing a date of creation is the reuse of the industrially prepared canvas, which is stamped with the mark of the colour merchant the widow Chabod, who was in business from 1900-1905. Given that the canvas was used and subsequently the painting executed on it well dried (to the extent where brittle cracks had formed, which are seen to pass under the paint of the visible painting) it seems unlikely that it could have been used at bare minimum less than 10 years after it was stretched. A minimum *terminus post quem* for the visible composition might, therefore, be suggested as c. 1910 if the canvas was supplied and used as early as 1900, then allowed to dry and age.

The size of this painting is also quite unusual, in its format of 81 x 46 cm, is a non-standard Parisian canvas size (for a height of 81 cm, the smallest known width in standard canvas sizes was 54 cm; a *marine* format of 81 x 54 cm is known)[19]. Therefore, this work, along with the other painting in the Museum Ludwig collection (ML 1486), *Still Life with Coffee Pot*, likewise executed on a canvas that is a reused academic figure study, likewise stamped with the mark of an early 20th century supplier (here, Perrod, who was trading until 1904, a similar time frame)[20] remain for now singular examples of this type of use of support in Larionov's oeuvre.

Additional physical similarities shown between these paintings include: the use of similar colour palettes; the use of fluid, glossy paint; the use of the inscription format 'M. LARIONOW', in a rectangle, on the verso of the painting and the initials 'M.L.' on the recto. Another two *Still Life* paintings of similar appearance and approximate dimensions, in the collection of the State Tretyakov Gallery, Moscow, seem related[21]. These are dated to around 1928. An additional piece that is similar in composition and style, though not in dimensions or support – it is a work on cardboard – provides further consideration[22]. This *Still Life, Fruits and Nude Study (Nature morte, fruits et étude de nu)*, is smaller format but is very like these other three in terms of style, palette (white and brown tones) and concept, and is likewise inscribed 'M.L.'.

An important question concerns the authorship of the unfinished, underlying painting; is it possible that it might have been an early work, in the Moscow academy, from either Goncharova or Larionov? Or, given the stamp of the Chabod, could it have been a work acquired cheaply by Larionov in Paris and reused as a support, essentially, 'recycled'? While other examples of Larionov's reuse of canvases are known, these all seem to involve unfinished works by either himself or by Goncharova. Equally, the formation of the final, visible image can be shown to have integrated, to some extent, the underlying forms of the

[19] Labreuche (2011) *op. cit.* pp. 300-301.
[20] See the report for AAR0955.G, *Still Life with Coffee Pot*, Museum Ludwig 1486.
[21] See the Russian Edition of: State Tretyakov Gallery, *Catalogue of the Collection, Painting of the First Half of the 20th Century, Series Painting of the 18th to 20th Centuries*, Volume 6, Book Two, Letters K, L, State Tretyakov Gallery: Moscow (2017) p. 281, cats. 907, 909. These measure 48.2 x 81 cm and 81 x 45 cm respectively.
[22] Éditions du Centre Pompidou Paris, *Nathalie Gontcharova, Michel Larionov*, Imprimerie Le Govic: Saint-Herblain (1995) p. 149, Cat. 126.

first painting[23]. Here, the earlier work is simply used as a surface upon which to paint; if anything, the overlying painting obliterates it as thoroughly as possible, rather than working with the shapes of the form below. There is little of the underlying surface visible along the edges of the painting as the majority of the painting surface has been covered over. This attention to coverage of surface differs from other works by Larionov, where the underlying support is often left visible.

Other technical characteristics arising from a larger review of the works of Goncharova and Larionov may also contribute to a fuller understanding of the relative dating of this painting in the future. For the present, if we are to use the suggested dates of its first exhibition in 1928 – as suggested by A. Parton who gives the date of the work as 1927, and on the labels on the strainer of the painting - we are left with a window for the creation of the work from c. 1910-1927, though a later dating seems more plausible[24].

E. Conclusions

The study of the painting revealed a work that is materially consistent with a proposed date of creation for the *Still Life* in the second and third decades of the 20th century (and equally possible in later decades). It was worked over an abandoned, unfinished figure study, probably by an unknown artist working between 1900-c. 1906 (as the producer of the canvas ceased trading in 1904), rather than by Larionov or Goncharova. No visible measures were taken to efface the underlying work; simply, the paint was applied over it. The work shares many similarities with (ML 1486), *Still Life with Coffee Pot*; further thoughts regarding their dating should most likely be considered simultaneously, ideally, as well with more information concerning the clearly similar (size, subject, style) Larionov paintings in the Tretyakov Gallery.

[23] Other examples that may be cited include: *Boutique juive au marché de Tiraspol* (c. 1904), *Portrait de Tatline* (1913), both illustrated in Rioux, Aitken and Duval (1998) *op. cit*. pp. 23-31, and equally, *Rayonism, Red and Blue (Beach)*, Museum Ludwig 1333, in this current group of analysed works for the RARP project.

[24] Parton, A. *Mikhail Larionov and the Russian Avant-Garde.* Princeton: Princeton University Press (1993) p. xvi, refers to: 'Mikhail Larionov, *Still Life*, c. 1927. Oil on canvas, 46 x 81 cm. Reproduced in the catalogue of the Exhibition of Contemporary French Art, 1928. Collection Pierre Vorms, Belvés, France'. Cited in Franken (2017b) *op. cit*. p. 2 and p. 7, Table 2, which suggests that a label on the work implies that the picture was shown at Tretyakov Gallery in 1928.

Art Analysis & Research

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G. Appendices

Standard protocols used by AA&R in the preparation of this report for sampling, materials analysis and imaging are listed in each subsection below and detailed in the appendices to the global summary report.

App.1 Sampling and sample preparation

Protocols:

[P.1.1] Sampling
[P.1.2] Cross-sectional analysis

App.1.i Sampling

Table App.1.i Samples taken for analysis

#	*Colour*	*Description*	*Location*[25]	*Analysis*
1		White	482/119	PLM, SEM-EDX, Raman, FTIR, GCMS
2		Brown	441/204	PLM, SEM-EDX, Raman, FTIR, GCMS
3		Yellow	171/83	PLM, SEM-EDX, Raman, FTIR, GCMS
4		Bright Yellow	151/350	PLM, SEM-EDX, Raman
5		White (underlying painting)	666/3	PLM, SEM-EDX, Raman, FTIR
6		Grey (underlying painting)	123/64	PLM, SEM-EDX, Raman
7		Pink (underlying painting)	187/203	PLM, SEM-EDX, Raman
8		Yellow Over Grey	0/227	CSA
9		White	190/460	CSA
10		Fibre	0/0	PLM, FTIR, C14

[25] The coordinates in this column are given in millimetres, the measurements taken from the left edge of the picture, and from the lower edge of the picture.

App.1.ii Cross-sectional analysis

Results are shown in **App.5, Plates 17-19.**

App.2 Materials analysis summary results

Protocols:

[P.2.1] Polarised light microscopy (PLM)
[P.2.2] Scanning electron microscopy-energy dispersive X-ray spectrometry (SEM-EDX)
[P.2.3] Raman microscopy
[P.2.4.1] Fourier Transform Infrared Spectroscopy-Attenuated Total Reflectance (FTIR-ATR)
[P.2.5] Gas Chromatography-Mass Spectrometry (GCMS)
[P.2.7] Fibre Identification
[P.2.8] Radiocarbon dating

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App.2.i SEM-EDX, Raman microscopy and PLM analysis

Table App.2.i Analytical results SEM-EDX, Raman Microscopy and PLM

#	Colour	SEM-EDX (elements)			Raman Microscopy (peaks, cm^{-1})	Identification
		Major	Minor	Trace		
1	White	**Zn**	S, Ba	*Al, Si, Pb*	**1049 (vw), 988 (w), 616 (vw), 461 (vw), 453 (vw), 437 (vw)**	**Zinc oxide (main)** **Barium sulfate (minor)** **Lead carbonate type white (trace)**
2	Brown	**Zn**	Si, S, Fe	*Al, P, Cl, K, Ca, Mn, Ba, Pb*	-	Iron containing earth pigments Zinc oxide
3	Yellow	**Si**	Al, Fe, Zn	*P, S, K, Ca, Ba, Pb*	-	Iron containing earth pigments Aluminosilicate clay minerals Zinc oxide
4	Bright yellow	**S, Zn**	Cd	*Al, Si, Ca, Ba, Pb*	**986 (vw), 310 (vw), 217 (vw)**	**Cadmium sulfide** **Barium sulfate (trace)** Zinc oxide
5	White (underlying painting)	**Pb**	-	*Al*	**1049 (w), 410 (vw, br), 327 (vw), 110 (m)**	**Lead carbonate hydroxide [P0864]**
6	Grey (underlying painting)	**Pb**	Al, Cr	*Na, Si, P, S, Ca, Fe*	**545 (vw)**	**Ultramarine** Lead carbonate type white (main) Chromium oxide hydrate (minor) Earth pigments (trace) Aluminosilicate clay minerals (trace)
7	Pink (underlying painting)	**Pb**	-	*Al, Si, P, K, Ca, Fe*	**1049 (w), 405 (vw, br), 316 (vw), 110 (m)**	**Lead carbonate hydroxide [P0864] (main)** Iron containing earth pigments (trace) Aluminosilicate clay minerals (trace)

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App.2.ii Fourier Transform Infrared Spectroscopy-Attenuated Total Reflectance (FTIR-ATR)

Table App.2.ii Summary results from FTIR

#	Colour	FTIR (peaks, cm^{-1})	Identification
1	White	**3387 (w, br), 2918 (m), 2850 (w), 1738 (m), 1717 (vw), 1576 (m), 1569 (vw), 1557 (vw), 1541 (m), 1456 (m),** 1435 (vw, sh), **1409 (vw), 1399 (m), 1319 (vw), 1175 (s), 1111 (m), 1066 (vs), 982 (w), 746 (vw), 722 (vw), 681 (vw),** 670 (vw), **637 (m), 607 (s)**	**Barium sulfate** **Lead carbonate type white** **Oil**[26] **Metal soap formation, zinc-based**[27] **Metal soap formation**
2	Brown	**3402 (vw, br), 2955 (vw, sh), 2916 (vs), 2849 (s), 1736 (w), 1716 (w),** 1627 (vw, sh), **1593 (vw), 1547 (vs), 1527 (vs), 1454 (s),** 1408 (vw, sh), **1398 (m), 1178 (w), 1113 (w), 1071 (w), 984 (vw), 951 (vw), 744 (w), 720 (w), 637 (vw), 608 (vw)**	**Barium sulfate** **Oil**[28] **Metal soap formation, zinc-based**[29] **Metal soap formation**
3	Yellow	**3695 (vw), 3618 (vw), 3370 (vw, br), 2924 (m), 2853 (w), 1734 (m), 1715 (vw), 1575 (w), 1557 (m), 1541 (vw, sh), 1455 (m), 1416 (vw), 1385 (vw, sh), 1319 (vw), 1164 (w), 1111 (vw, sh), 1066 (m), 1027 (w), 1003 (m), 934 (vw, sh), 910 (m), 794 (w), 778 (vw), 753 (vw), 727 (vw, sh), 690 (w), 681 (vw), 635 (vw), 608 (vw)**	**Aluminium silicate clay mineral, kaolinite type** **Goethite** **Barium sulfate** **Lead carbonate type white** **Oil** **Metal soap formation, zinc-based**[30] **Metal soap formation**
5	White (underlying painting)	**3538 (vw), 3322 (m, br), 2929 (vw), 2853 (vw), 1729 (m), 1568 (m), 1330 (m),** 1078 (m), 1059 (s), **859 (vw), 670 (w)**	**Lead carbonate hydroxide** **Oil**[31] **Metal soap formation, presumably lead-based** Unidentified component

[26] The characteristic peak of oils occurring at around 1160 cm^{-1} was not observed in the spectrum due to the presence of barium sulfate whose peaks were masking this characteristic peak of oil however it is assumed that oil is present due to the formation of metal soaps.
[27] The peaks present in the sample spectrum matched the reference spectrum of zinc stearate, reference number AAR308. Zinc was identified in the SEM-EDX analysis.
[28] As note 28, above.
[29] As note 29, above.
[30] As note 29, above.
[31] The characteristic peak of oils occurring at around 1160 cm^{-1} was not observed in the spectrum however it is assumed that oil is present due to the formation of metal soaps

App.2.iii Gas Chromatography Mass Spectrometry (GCMS) Analysis

Table App.2.iii Summary results from GCMS

Sample #	Hexadecanoic acid, methyl ester ($C_{17}H_{34}O_2$)		Octadecanoic acid, methyl ester ($C_{19}H_{38}O_2$)		Ratio
	Retention time, mins	**Peak area**	**Retention time, mins**	**Peak area**	
2	25.662	1.743×10^9	29.605	8.364×10^8	P/S = 2.08
3	25.670	1.531×10^9	29.597	9.807×10^8	P/S = 1.56
11	25.643	1.039×10^9	29.586	7.337×10^8	P/S = 1.42

The P/S value of **Sample [2]**, brown paint, was 2.08, consistent with **linseed oil**.

The P/S value of **Sample [3]**, yellow paint, was 1.56, consistent with **linseed oil**.

The P/S value of **Sample [11]**, white paint, was 1.42, consistent with **linseed oil**.

App.2.iv Fibre Identification of the Canvas

Table App.2.iv Canvas fibre identification, Sample [10]

Sample	*Observations under PLM*	*Interpretation*
Horizontal	Nodes across fibres, parallel extinction, s-twist.	Bast fibre, probably linen (*Linum usitatissimum* L.)
Vertical	Nodes across fibres, parallel extinction, s-twist A few fibres with slightly lower birefringence, nodes across, undulose extinction.	Bast fibre, probably linen (*Linum usitatissimum* L.)

App.2.v Radiocarbon measurement

Radiocarbon dating is a method for determining age estimates of formerly living organic materials[32]. Carbon has three naturally occurring isotopes, ^{12}C, ^{13}C and ^{14}C. Both ^{12}C and ^{13}C are stable, but ^{14}C decays by very weak beta decay to nitrogen (^{14}N) with a half-life of approximately 5,730 years. While alive, organic materials continue to exchange carbon with the environment, such that they are in equilibrium. On death, the ^{14}C component begins to decay, such that over time the relative amount decreases. Measuring the level of ^{14}C remaining in the material then allows for a date to be estimated. This must be additionally calibrated against natural historical variation in relative ^{14}C levels in the environment, for which there are accepted standard curves expressing the changes over time[33].

[32] Based on from the websites of the NDT Resource Center, http://www.ndt-ed.org/EducationResources/CommunityCollege/Radiography/Physics/carbondating.htm and the website of the Oxford Radiocarbon webinfo site: http://c14.arch.ox.ac.uk/embed.php?File=webinfo.html, both consulted on 3 February 2013.
[33] For example, that used here is one known as IntCal13.

Prior to radiocarbon measurement, fibre identification was undertaken and the canvas sample was pre-tested using FTIR to ascertain the presence of any contaminating material that could influence the outcome. As noted elsewhere, the fibre was identified as a bast type, probably linen (*Linum usitatissimum* L.). FTIR indicated the presence of calcium carbonate (calcite type), calcium sulfate (gypsum type), a proteinaceous material, and possibly an oil, in addition to the cellulose of the fibre[34].

The canvas sample was then submitted to the Laboratory of Ion Beam Physics, ETHZ at the Swiss Federal Institute of Technology (*Eidgenössische Technische Hochschule Zürich*) for radiocarbon dating (see **Protocol 2.7**).

Table App.2.v.i Radiocarbon measurement

Sample-	Sample	Material	C14 age	±1σ	F14C	±1σ	δC13	±1σ	mg C	C/N
Nr.	Code		BP				‰			
ETH-77073	AAR0955.H 10	Textile fibre	82	23	0.9898	0.0028	-22.7	1	1	240.26

The radiocarbon date was determined as 82 years b.p. ±23 years. After calibration, this yielded a date distribution for which the most relevant period for the origin of the canvas lies 1812-1920 at the 95.4% probability level, pre-dating the so-called 'bomb-pulse' period that begins in the mid-1950s.

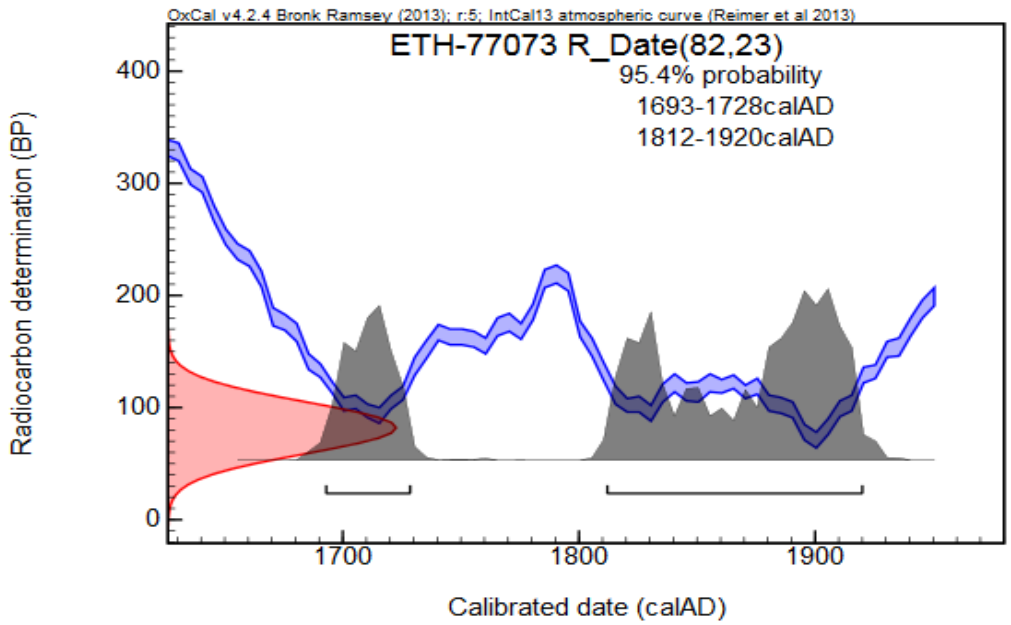


Figure App.2.v.ii Radiocarbon determination.

[34] Non-cellulosic materials are aimed to be removed by the sample pre-treatment process prior to the radiocarbon measurement.

App.3 Imaging methods

Protocols:

[P.3.1] Photography with visible light
[P.3.2] Photography with ultraviolet illumination
[P.3.4] SWIR infrared imaging (IR)
[P.3.6] X-radiography (X-ray)
[P.3.7] Thread counting and weave analysis

App.4 Plates

Plate 1. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Recto, visible light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d050878_08, www.kulturelles-erbe-koeln.de/documents/obj/05021029

Below, detail of inscription:

1.a

Plate 2. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Recto, UV light**.

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d050878_06, www.kulturelles-erbe-koeln.de/documents/obj/05021029

Plate 3. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Recto, oblique illumination**.

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d050878_04, www.kulturelles-erbe-koeln.de/documents/obj/05021029

Plate 4. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Verso, visible light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d050878_02, www.kulturelles-erbe-koeln.de/documents/obj/05021029

Plate 4.a Detail of the inscription.

a.

Plate 5. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Verso, UV light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d050878_07, www.kulturelles-erbe-koeln.de/documents/obj/05021029

Plate 5.a Detail of the canvas stamp, UV illumination.

Plate 6. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **Recto, SWIR image**.

Plate 7. SWIR image, rotated 90 degrees counter clockwise.

The motif below the visible painting, a nude study, may be seen. The red arrow indicates a pencil line present in the lower composition.

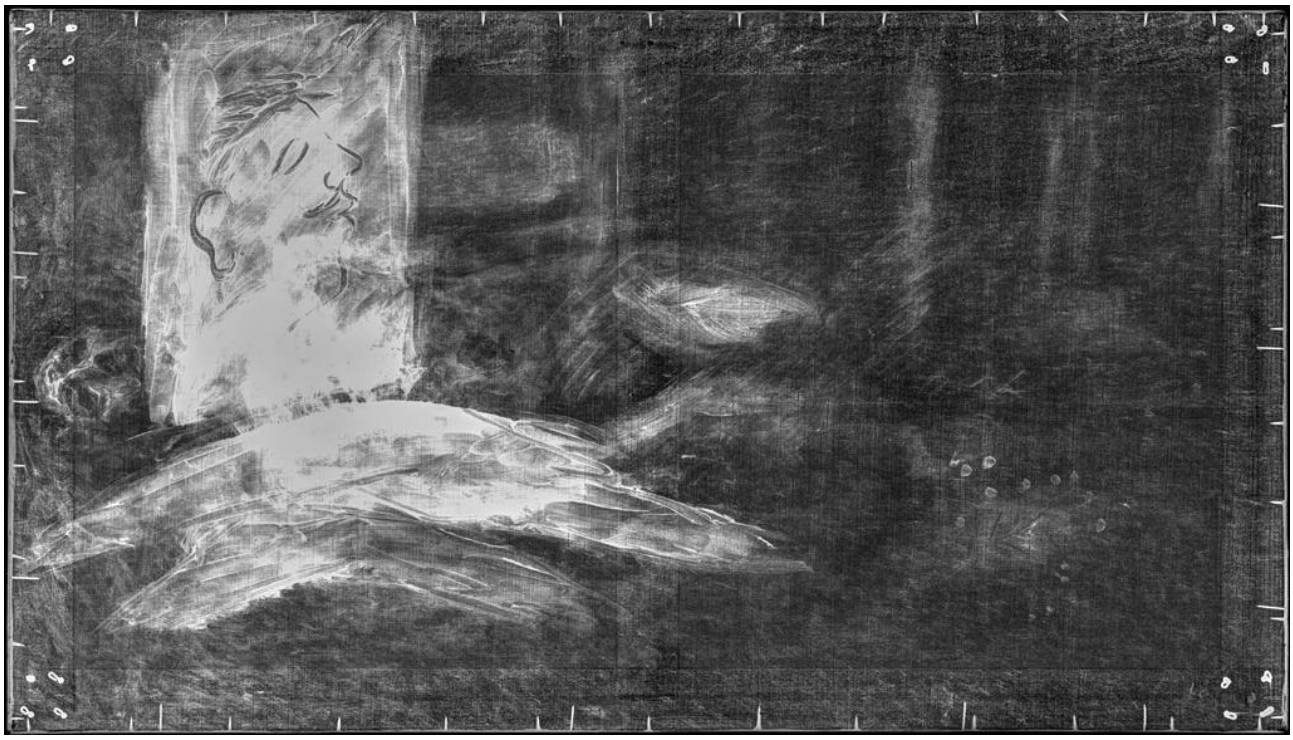


Plate 8. Mikhail Larionov: *Still Life*, c. 1907/1912, collection Museum Ludwig: Inv. Nr. ML 1487. **X-ray image**.

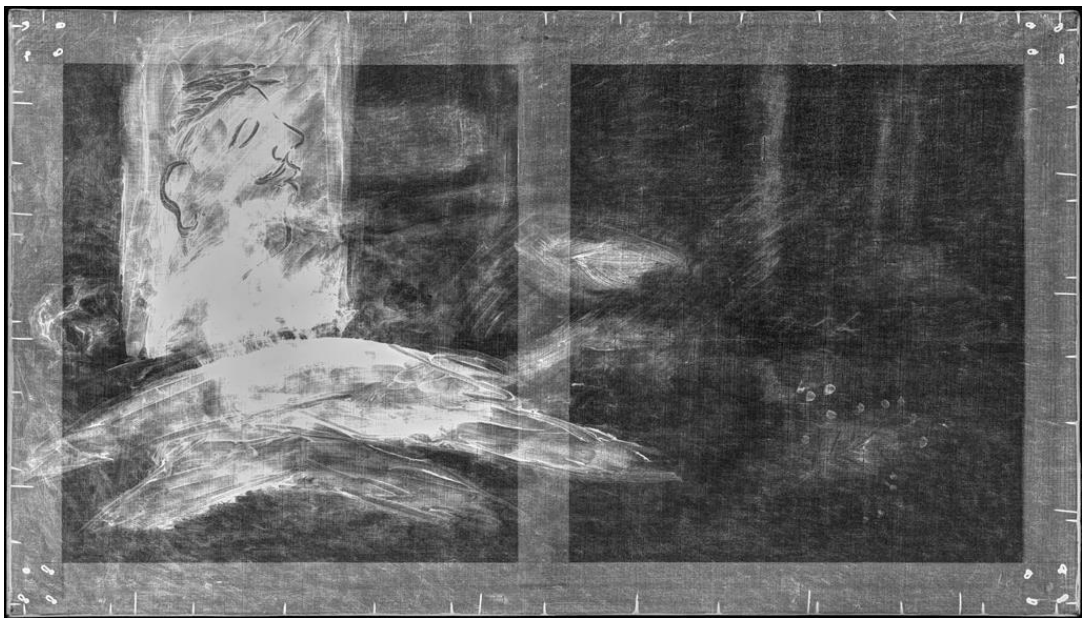


Plate 8.a The X-ray image before digital compensation for the stretcher bars.

Plate 9. X-ray image, rotated 90 degrees counter clockwise.

The motif below the visible painting, a nude study, may be seen.

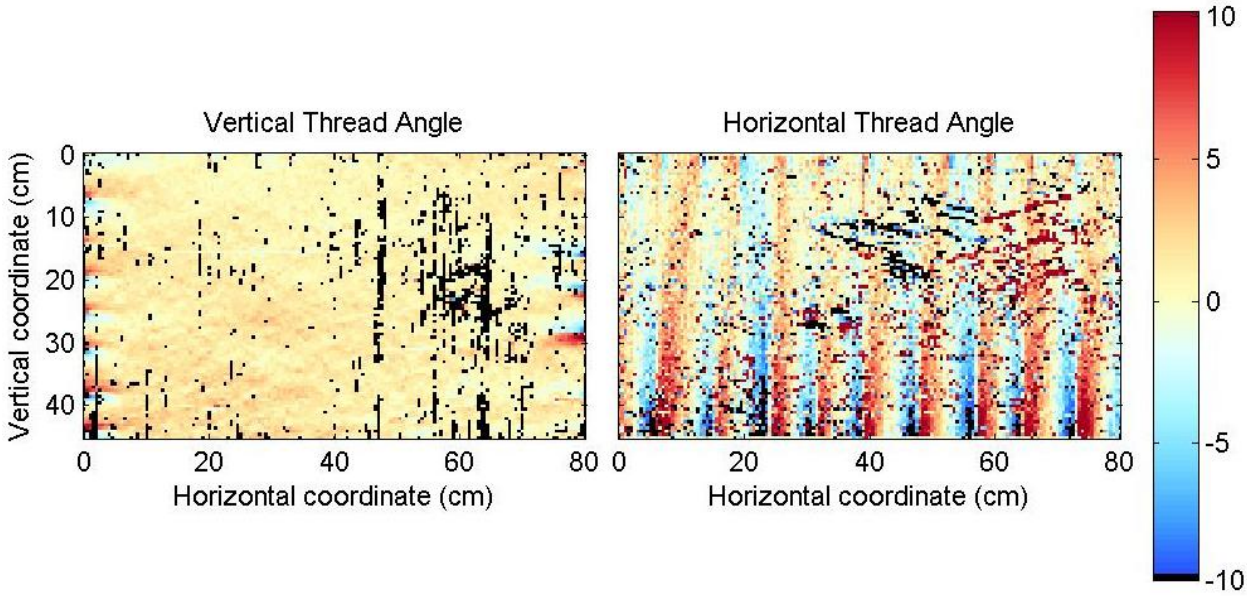


Plate 10.a Maps showing variation in canvas thread angle.

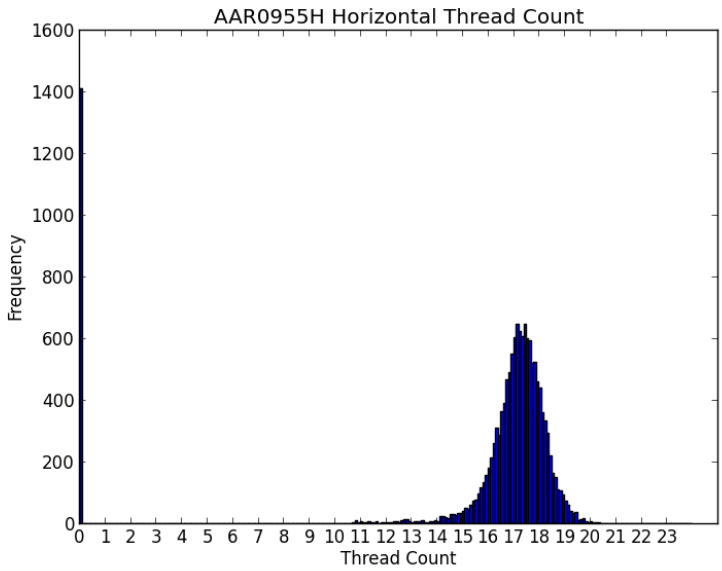


Plate 10.b Histogram of horizontal thread (in this case related to the warp) count readings.

Showing variation in thread count per centimetre.

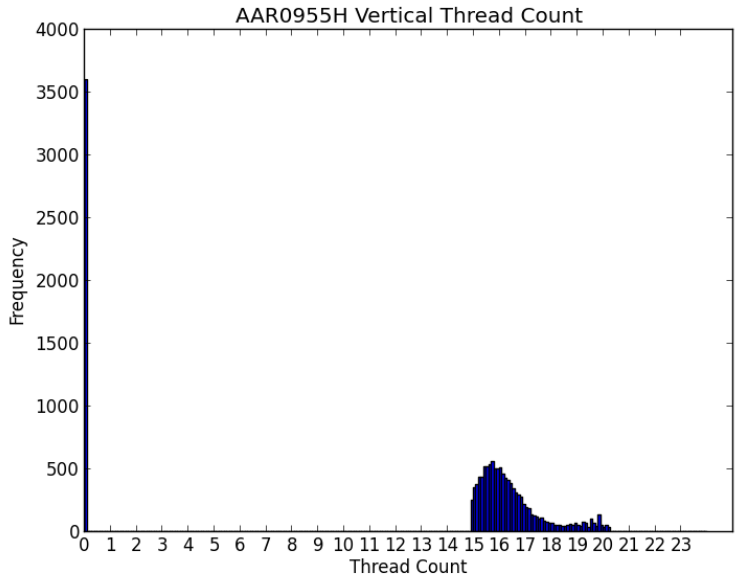


Plate 10.c Histogram of vertical thread count readings (in this case related to the weft).

Showing variation in thread count per centimetre.

Plate 10.d Table of thread count data (threads per centimetre)

	Mean	Estimated thread count (mode)
Horizontal	17.4	17.2
Vertical	16.4	15.7

Plate 11.a Detail of canvas, verso.

The canvas is a thin, plain weave comprised of a bast type fibre, probably flax. The yellow-white priming may be seen in the interstices between the threads.

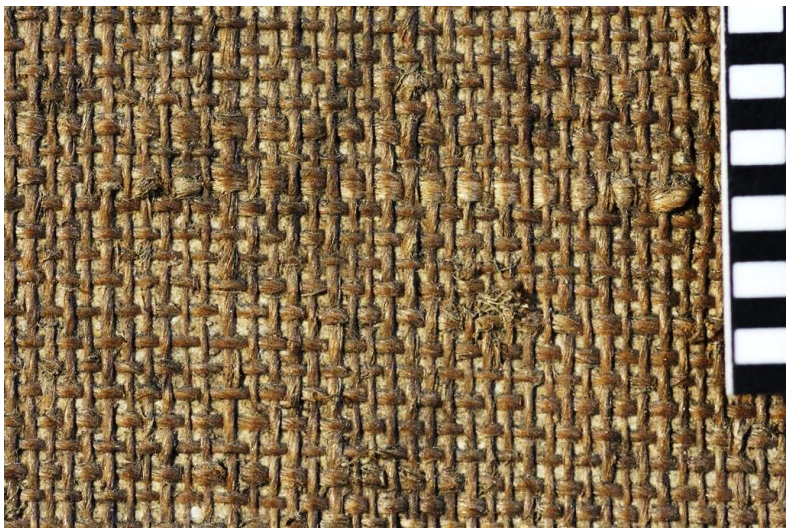


Plate 11.b Detail of canvas, verso.

A number of slubby, irregular threads may be seen.

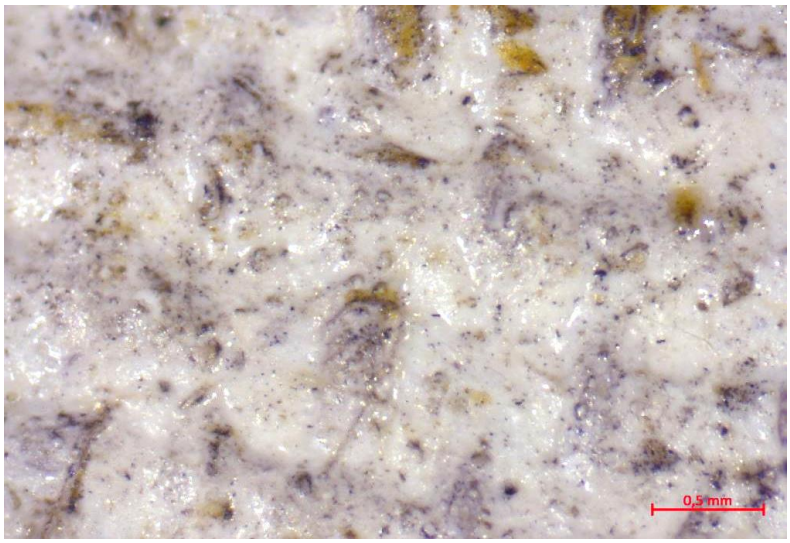


Plate 11.c Detail of the white ground, recto.

The ground fully covers the canvas, though the texture is still visible.

Plate 12.a Detail of canvas, bottom tacking margin.

The thin, white, factory prepared ground extends to the cut edge.

Plate 12.b Detail of canvas, bottom tacking margin.

Plate 12.c Detail of canvas, right tacking margin.

Plate 12.d Detail of canvas, top edge tacking margin.

Showing the mark left by the tack, now lost, at an original tacking point.

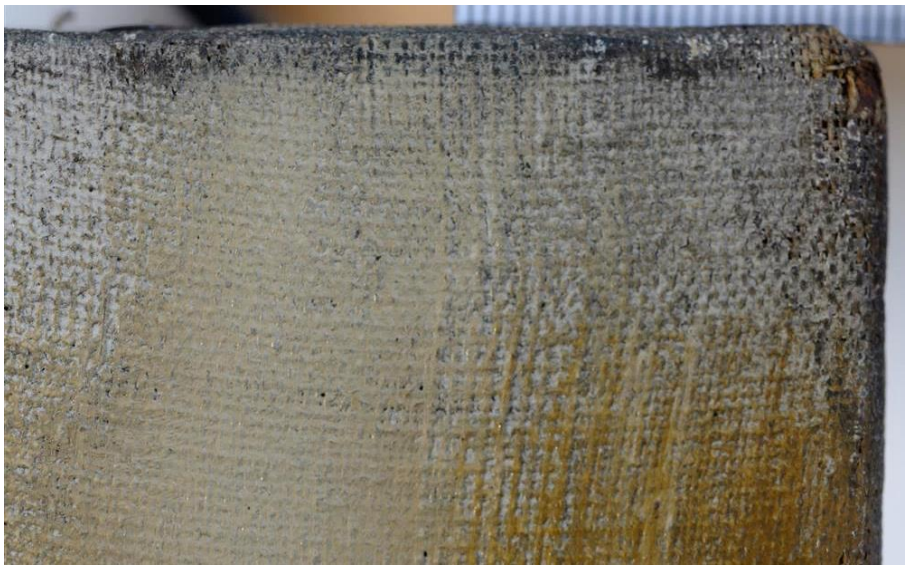


Plate 13.a Detail of canvas, upper right corner.

Curved patterns of cusping in the canvas may be seen.

Plate 13.b Detail of the tacking margin, left.

The painter has applied black paint over the painting surface and tacking margins.

Plate 13.c Detail of the tacking margin, left.

The painter has applied black paint over the painting surface and tacking margins.

Plate 14.a Detail of painting, showing a build-up of yellowed binding medium.

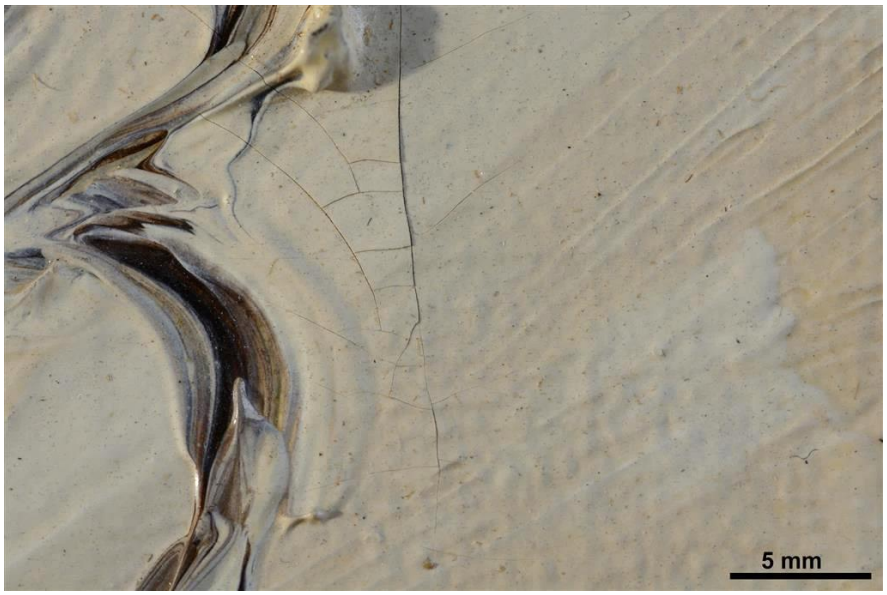


Plate 14.b Detail of the paint surface, recto.

An example of occasional brittle cracking of the thick, pale orange brown layer.

Plate 14.c Detail of painting, showing the light-coloured paint of the visible work, over the brown yellow of the underlying painting.

The underlying painting was clearly cracked, before the present work was executed, as the lighter paint passes over cracks in the lower layers.

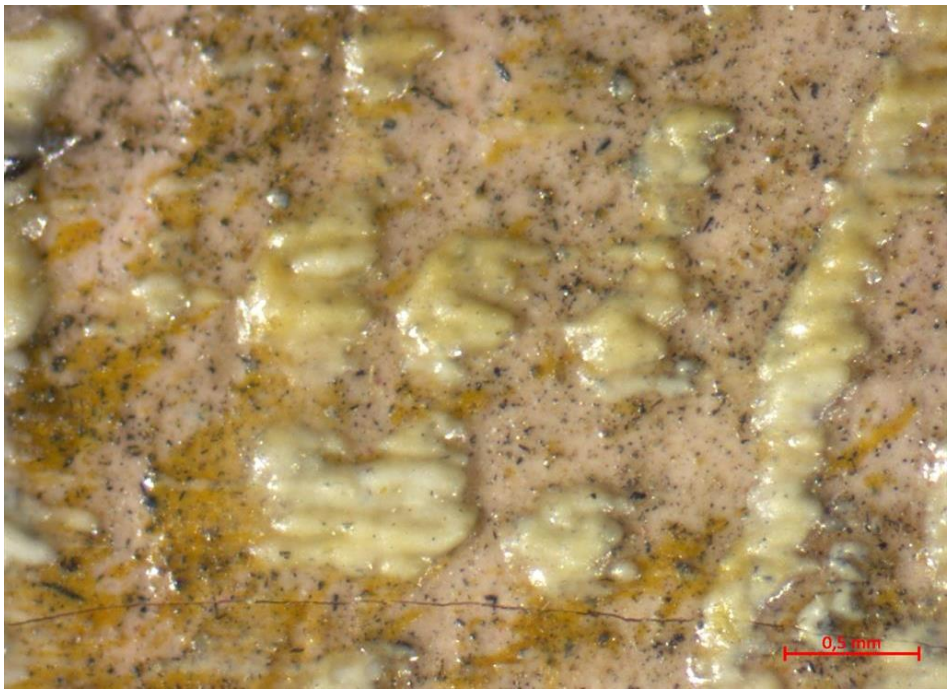


Plate 15.a Detail of underlying painting, with paint (yellowish) of the visible image uppermost.

A crack in the pink tone of the underlying layer does not penetrate the uppermost additions of paint.

Plate 15.b Detail of head of the figure of the underlying painting (left edge of picture).

Due to the tendency of oil paint to increase in transparency with age, it is now visible.

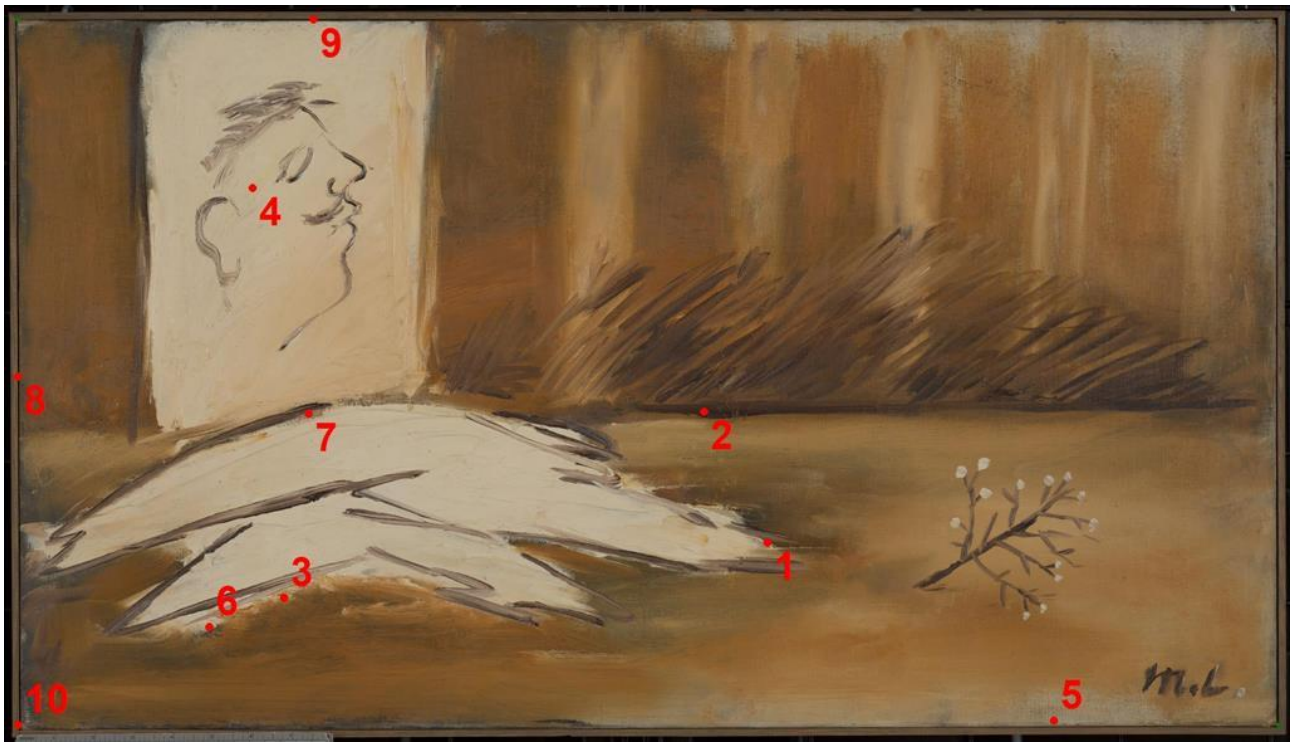


Plate 16. Image showing approximate location of samples taken for materials analysis.

App.5 Cross-sections[35]

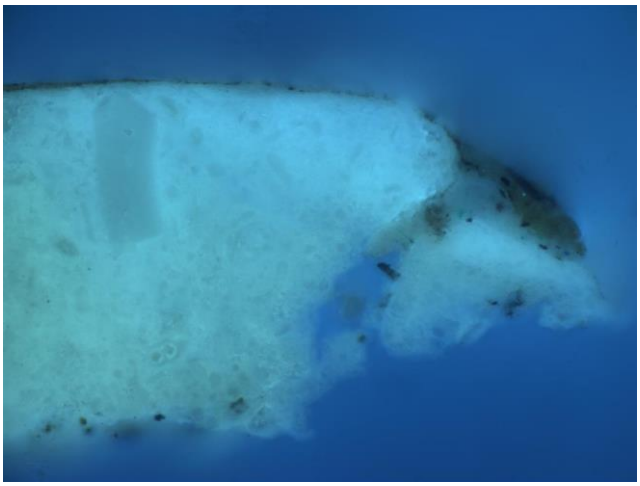
a.

b.

Plate 17. Cross-section, Sample [8].

Image ~1mm high. Yellow over grey from left edge. The sample has a thick off-white ground layer composed of calcite, followed by a thinner white layer (lead white) and fragmentary grey and yellow paint layers, visible only at the right-hand side of the sample.

a.

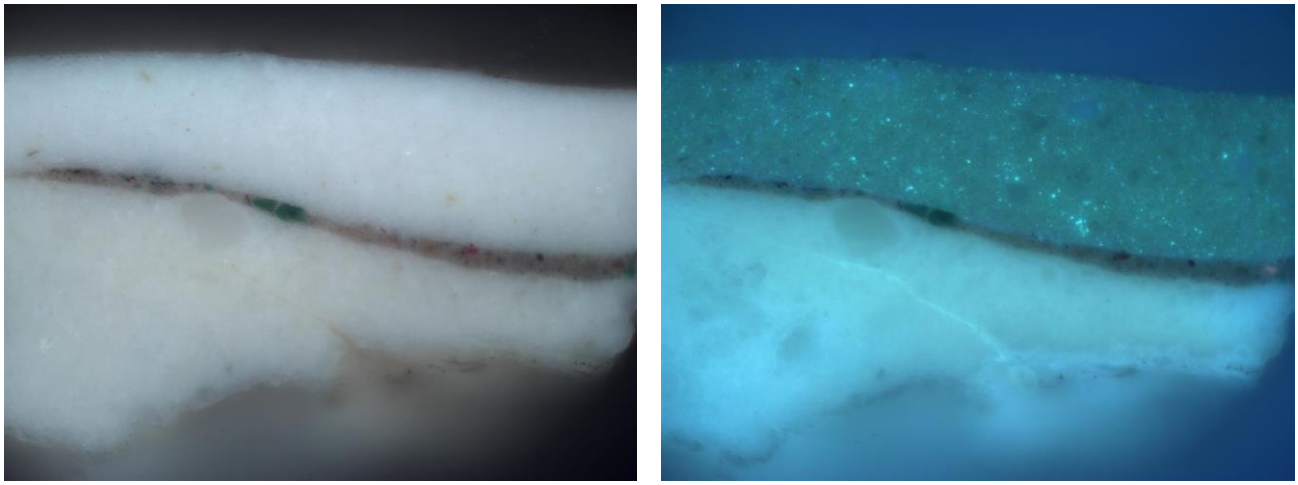


b.

Plate 18. Cross-section, Sample [8].

Image ~260µm high. Yellow over grey from left edge, sample pictured at higher magnification, showing the yellow and grey paint layers. The grey is composed mainly of white particles, with a few inclusions of black, green and red particles.

[35] Photographed under visible light, left (**a.**), and with ultraviolet illumination, right (**b.**).



a. **b.**

Plate 19. Cross-section, Sample [9].

Image ~260µm high. White paint. The sample has a thick white lowermost layer (containing barium sulfate and lead carbonate, possibly other materials not detectable to Raman microscopy; the preparation layer is not preserved in this sample), followed by a thin grey-brown layer containing black, red and some large green particles (as Sample [8]). The uppermost white paint layer contains many particles that display the green UV luminescence characteristic of zinc oxide and contains lead carbonate (measured directly from the sample by Raman microscopy).