Art Analysis & Research

ANALYTICAL REPORT

[Ref.: AAR0955.N / 8 May 2018]

Rayonistic Composition, dated 1916
Mikhail Larionov
Collection Museum Ludwig, Cologne, Inv. ML/Z 2011/134

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Summary

A work in paint and pastel on black paper by Mikhail Larionov, *Rayonistic Composition*, inscribed with the artist's name and the date 1916, belonging to the Museum Ludwig (reference: ML/Z 2011/134), 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 a 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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Tables, Figures and Plates

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A. Introduction

The work in paint and pastel on an irregularly sized sheet of black paper, *Rayonistic Composition* (**Plate 1**), by the artist Mikhail Larionov (1881-1964), measuring a maximum of 457 mm high by 546 mm wide, is now part of the collection of the Museum Ludwig, Cologne (Inv. ML/Z 2011/134). It is inscribed with the artist's name and the date '1916' (**Plates 4, 5**). The artwork has been examined as part of a larger technical study of fourteen paintings by Natalia 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 identification 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.N ML/Z 2011/134 Conservation*, Franken, V. 'Report on the examination of the artwork *Rayonistic Composition* (1916) by Mikhail Larionov' (2017a) and *AAR0955.N ML/Z 2011/134 Archives*, Franken, V. 'Report on the content of the Museum Ludwig archives, concerning the painting *Rayonistic Composition* (1916) 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. These are presented as follows:

- High-resolution visible colour (**Plate 1**)
- UV luminescence (**Plate 2**)
- Oblique illumination (**Plate 3**)

Some of the imaging techniques applied elsewhere in the RARP study group were not employed in the study of this painting, as they were not likely to produce useable results due to the nature of this object (3D laser surface scanning, Short-wave infrared imaging and X-radiography). Some exemplar images recorded as part of the surface microscopy and macrophotography are also reproduced here (**Plates 6, 7**).

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 artwork is executed in various media - gouache and pastel - on a thick, black paper support which is affixed to a backboard. It is inscribed in what appears to be pencil, or a similar material, bottom left ‘M. Larionoff’ and, bottom right, ‘1916’ (**Plates 5.a, 5.b**) and ‘M.L. Larionov. 1916 Paris’ on the verso (**Plate 4**). The artwork is in good condition, with only very minor, localised loss; no retouching was noted.

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[5] 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 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 here, differences between the colour of the luminescence of the different paints and any added retouching paints can also indicate later stages of intervention; however, in this case nothing notable may be seen (as here; **Protocol 3.2** and **Plate 2**).

In the UV image of this work, only the white areas, centre, and the red pigment present in small areas throughout the composition show a significant degree of luminescence.

C. Sampling and analysis

C.1 Introduction

Samples were taken for analysis by different means in order to determine the identity of a select range of pigments used in the painting. Given the existence of a non-invasive investigation of the work by hand-held X-ray fluorescence[6], it was decided to test only two pigments samples.

To this end, a series of two selected locations over the painting were micro-sampled for identification of the pigments (**Table App.2.1**).

[5] 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.

[6] Unpublished analysis report by M. Kokkori, November (2013), and summary in Franken (2017a) *op. cit*. Five areas of paint (black, red, white, purple and blue) were examined. The pastels were not tested. This report identified the presence of calcium compounds, ultramarine blue, Prussian blue, iron containing pigments, chrome containing pigments (viridian and/or chrome yellow), zinc containing pigment (likely zinc white), barium compounds and strontium compounds (or impurity).

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-2.ii**).

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 support is based on a heavy black paper, not further characterised.

C.3 Radiocarbon dating

Although paper, as a cellulosic material, may in principle be subject to radiocarbon dating, it was not considered possible here because of the amount of material required and potential interference from the black pigmentation of the substrate[8].

C.4 Ground

No ground appears to be present.

[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].

[8] The black pigment is most probably a carbon-based black. Since one source for this could be a flame carbon derived from fossil fuels, any material not removed during sample preparation could affect the result since it is ancient carbon.

C.5 Underdrawing

No underdrawing was found by examination under the microscope. Infrared imaging was not attempted on this piece due to the difficulty in resolving dark underdrawing from a dark support.

C.6 Paint layers: Pigments

The following pigments (**Tables App.2.1, App.2.2**) were found in the painting:

- CI Pigment Red 57 or 57:1 (most likely PR57:1)
- Titanium dioxide, rutile type
- Iron hexacyanoferrate(II) ('Prussian blue')
- A carbon-based black
- Aluminosilicate clay minerals
- Barium sulfate

In addition to these findings, the earlier analysis by Kokkori suggested the presence of synthetic ultramarine, iron containing-pigments, chrome containing pigments (possibly chrome yellow), calcium containing pigments and possibly strontium containing pigments or impurities[9]. Kokkori's investigation did not, however, pick up titanium compounds, or (as elemental analysis is not able to detect the presence of organic pigments) CI Pigment Red 57. Given the limited nature of the two investigations, it is possible that other materials, not identified, are also present in the work.

C.7 Paint layers: Binding media

No binding media analysis was conducted due to limitations on sampling.

C.8 Stratigraphy

No significant stratigraphy was observed in the painting and cross-sections were not taken.

D. Discussion of the findings

D.1 Support and preparatory work

This mixed media work has been executed on a thick sheet of black paper (**Plates 5, 6.a, 6.b**), with irregular edges. It is unclear whether the irregularity represents the original format or later alteration. The paint and pastel layers continue right up to the edges of the artwork. No evidence for the use of underdrawing was observed.

[9] Kokkori (2013) *op. cit.*

D.2 Paint and pigments

D.2.i General observations

The condition of the artwork is generally very good, although there is minor loss and flaking (**Plates 7.a**) and some limited creasing in the paper (**Plate 3**). Given the matt appearance of the paint surface as well as the obvious use of thin washes of colour as well as thicker more bodied strokes, the use of a gouache type paint was surmised but not further identified analytically.

D.2.ii Paint: pigment and binding medium

The painting was built up with both thin washy applications and thicker layers of gouache paint, interspersed with pastel drawing. There is some cracking visible in the more thickly applied areas (**Plate 7.a**). In terms of sequence of application, it appears that the areas rendered in pastel lie over the painted areas. Both are overlapped by the inscriptions lower right and lower left.

D.2.iii Materials analysis and implications for dating

The painting is inscribed 1916 both front and back; this inscription passes over areas of both gouache and pastel. Thus, it is essential to examine the plausibility of this date in regard to the material findings.

As sampling of the paper support for radiocarbon dating was not feasible, no dating evidence of this type is available. Instead, one must turn to a consideration of the materials comprising the image.

Of the materials present, that of greatest interest in connection with the dating is a rutile-type titanium dioxide white, which was not available in 1916. This was found in both samples taken from the artwork (from Samples [1] and [2]; **Plates 6.b, 6.c**).

There are three crystalline forms of titanium dioxide – anatase, rutile and brookite. Of these, only the first two are of commercial interest as pigments. The history of their development for pigment use is marked by changes in formulation and manufacture designed to improve their properties, changes that can also be employed to establish the chronology of their use. Although titanium oxides were produced in the laboratory in the period after the discovery of the element in the late eighteenth century, it was not until the twentieth century that their potential for employment as pigments for painting was realised. To date, there appears to be no evidence of the use of the synthetic product in paintings until the time of the commercial development that subsequently took place in the 1910s.

Early titanium pigment production was only of the so-called anatase form (although small percentages of rutile could occur in early anatase pigments, as by-product of production). Once larger quantities of anatase type titanium oxide were manufactured after World War I, it was incorporated into ready-made paints; in Europe, the first paint formulation using titanium

dioxide, intended for house painting, was registered in 1919 in Norway. The paint industry remained sceptical into the 1920s of the claims made for these pigments and the general public seem to have been unaware of them. It is not surprising therefore that artists' colour makers were slow to incorporate titanium dioxide whites in their formulations, especially as artists were often reluctant to adopt new, untested products. Equally, anatase type titanium dioxide is prone to 'chalk' (form a white powdery film on the paint surface), a problem which had to be overcome before it was widely used for paint manufacture, especially as the major colour component[10]. Thus, early use of anatase form titanium dioxide pigment is largely in the context of mixtures with other white pigments, rather than as the primary constituent. By the late 1920s and into the 1930s, titanium white begins to find regular mention in literature written for practicing artists and conservators as awareness of this material and its properties grew[11]. Of key importance is a strong upswing in use in the 1940s to 1950s shown across various data sources; this in practice indicates the earliest one normally finds instances of titanium dioxide whites, in anatase form, in paintings.

The 'chalking' problems associated with anatase form titanium dioxide were alleviated with the introduction of manufacture of rutile type titanium dioxide, which could also be reduced by the use of pigments coated with water-repellent substances[12]. The production of high opacity rutile titanium dioxide (then made by what is known as the sulfate process) was first announced by an American company, Titanium Pigment Corporation (Niagara Falls, NY, USA) in 1939[13], and two years later on January 10, 1941 came into production, which was announced at a conference in New York on May 26[14]. At the conference, it was noted that the previous year had been spent investigating and testing the properties of the material. Another source we have examined claims that rutile titanium was not available in Europe until 1945, after the war. The earliest known evidence for the use of rutile-type pigment in paintings occurs from 1948 onwards in America; the earliest cited instance is a work of 1948 by Willem de Kooning, then followed by instances in paintings by European artists from 1955 onwards[15]. The delay between production and identification in a painting is typical, as time was needed for new products to enter the supply chain, passed from manufacturer to paint producer to artist.

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[10] Standeven, H.A.L., *House Paints, 1900-1960. History and Use*, The Getty Conservation Institute, Los Angeles (2011) p. 74.

[11] Laurie, A.P. *The painter's methods & materials*. J.B. Lippincott Company: Philadelphia (1926) p. 83. Fischer, M. *The permanent palette*. National Publishing Society: New York (1930) pp. 29, 64. Gordon, J. *A Step-Ladder to Painting*. Greenberg Publisher: New York (1939) pp. 105, 106. Hesketh Hubbard, E. *Materia pictoria: an encyclopaedia of methods and materials in painting and the graphic arts*, Volume 1. Pitman Publishing Corporation: New York & Chicago (1939) p. 63 (mention as a material suitable for use in painting grounds).

[12] Standeven (2011) *op. cit.* p. 74. These problems were surmounted by the addition of rutile titanium dioxide which is first seen as a minor by-product of anatase titanium dioxide production in house paint formulations in America and Britain in the 1930s.

[13] Kronos website, consulted 19 June 2015; http://www.nl-ind.com/khome.nsf/nViewHomePages/Kronos+About

[14] Matiello, J.J. (Ed.), *Protective and Decorative Coatings. Volume III: Manufacture and uses. Colloids, Oleoresinous Vehicles and Paints, Water and Emulsion Paints, Lacquers, Printing Inks, Luminescent Paints, and Stains. Third Printing*. John Wiley & Sons Inc./Chapman & Hall, Limited: New York/London (1947) p. 275. First published 1943.

[15] Laver, M. 'Titanium Dioxide Whites', In: *Artists' Pigments. A Handbook of their History and Characteristics* **3** FitzHugh, Elisabeth West (ed.) National Gallery of Art, Washington and Oxford University Press, Oxford (1997) pp. 295-355, esp. 341.

Along with rutile form titanium white, another pigment found to be present that bears implication for dating is CI Pigment Red 57:1 (PR57) (from sample 1; **Plate 6.b**). PR57 is a Rubine (a member of the azo group, specifically an 'acid salt azo'), meaning blue shade of red (also Lithol Rubine). The name is most likely derived from the Latin *rubia*, for the madder plant, from which similar shades were historically made. It is made almost entirely as the calcium salt.[16] It was discovered by R. Gley and O. Siebert in 1903, and is said to have been a popular pigment since its discovery.[17] However, it has not been identified in actual paintings before c. 1958-63[18]. It is this pigment that seems to exhibit the red fluorescence seen in the UV imaging (**Plate 2**).

The findings generally are consistent with the data collected in the study of 45 paintings by Goncharova and Larionov in the collection of the Musée national d'art moderne, Paris; here too, titanium white pigments are not found in the works studied (whereas the organic red would not likely have been detected given the primary use of elemental analysis), especially as no works by Larionov from the Paris period – 1915 onwards – were included in the study[19]. Given the presence of these two materials, it is clear that the dating to 1916 cannot be correct; rather, a date of production post c. 1955 would be most plausible.

E. Conclusions

The examination of the painting revealed the presence of two materials that are not commonly documented in use as artists' materials until the mid-1950s onwards. Given that Larionov died in 1964, a date of production within his lifetime remains possible in the context of these findings only if one disregards the implications of the inscribed dates of 1916 or considers these inscriptions as later additions. The inscription and date of 1916 (on the recto) pass over the gouache and pastel of the composition, the latter of which contains pigments introduced only decades later[20]. Ideally, further study of the paint materials by similar means as used in this investigation on the two pastel samples might bring greater clarity regarding the material nature of the object.

[16] Patton, T.C. (ed.), *Pigment Handbook, Vol. 1: Properties and Economics*, Wiley-Interscience: New York (1973) p. 506.
[17] *Ibid*. p. 508.
[18] Lutzenberger, K. *Künstlerfarben im Wandel – Synthetische organische Pigmente des 20. Jahrhunderts und Möglichkeiten ihrer zerstörungsarmen, analytischen Identifizierung*, Unpublished PhD thesis, Humboldt-Universität zu Berlin (2009), p.177.
[19] This because upon moving to Paris, Larionov largely turned away from painting to other forms of expression. Rioux, Aitken and Duval (1998) *op. cit*.
[20] In the few cases noted in the literature, when titanium white has been found in the works of Larionov, it has been classified as restoration – as in Rioux, Aitken and Duval (1998) *op. cit.* - or evidence of forgery. Gallone (1997) *op. cit*. p. 140, opts for the hypothesis of forgery in evaluating the status of a Rayonistic work attributed to Larionov, and dated to 1912-13, in which she found titanium white, given its strident colouration as both artists abandoned strident colours in their later production, post-1930.

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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

App.1.1 Sampling

Table App.1.1 Samples taken for analysis

#	*Colour*	*Description*	*Location*[21]	*Analysis*
1		Pink	285/7	PLM, SEM-EDX, Raman
2		Blue	318/425	PLM, SEM-EDX, Raman

App.2 Materials analysis summary results

Protocols:

[P.2.1] Polarised light microscopy (PLM)
[P.2.2] Scanning electron microscopy and energy dispersive X-ray spectrometry (SEM-EDX)
[P.2.3] Raman microscopy

[21] 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.

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App.2.1 SEM-EDX, Raman microscopy and PLM analysis

Table App.2.1 Analytical results SEM-EDX, Raman Microscopy and PLM

#	Colour	SEM-EDX (elements)			Raman Microscopy (peaks, cm^{-1})	Identification
		Major	Minor	Trace		
1	Pink	**Si**	Al, Ti	*Mg, P, S, K, Ca, Cr, Fe, Zn, Ba*	**1602 (w), 1550 (vw), 1490 (w), 1405 (vw), 1364 (w), 1323 (vw), 1266 (vw), 1225 (vw), 1181 (vw), 1130 (vw), 1114 (vw), 1039 (vw), 1020 (vw), 964 (vw), 746 (vw), 714 (vw), 700 (vw), 608 (vw, br), 599 (vw), 560 (vw), 520 (vw), 498 (vw), 436 (vw, br), 359 (vw), 335 (vw), 146 (vw)**	**CI Pigment Red 57 or 57:1 (most likely PR57:1)[22]** **Titanium dioxide, rutile type**
2	Blue	**-**	Al, Si, S, Ti, Fe	*Na, Mg, P, K, Ca, Cr, Cu, Zn, Sr, Ba*	**2150 (w), 2089 (vw), 1599 (w, br), 1291 (w, br), 946 (vw), 530 (w), 275 (w), 147 (vw)**	**Prussian blue** **Carbon-based black** Titanium dioxide white Aluminosilicate clay minerals Barium sulfate (trace)

[22] The spectrum was a good match to the following spectra's in the pigment reference collection: PR57 [P1563], PR57:1 [P1564], and PR57:2 [P1565]. Of these the Raman spectrum of PR57:2 was slightly different to the spectra's of the other two reference samples based on the intensities of the peaks as well as to the spectrum obtained from sample 1 and therefore it is likely that the pigment present is either PR57 or PR57:1. The reference spectra's of PR57 and PR57:1 was almost identical and therefore it was not possible to determine the exact pigment present in sample 1 based on the Raman spectrum. SEM-EDX data was useful in determining the type present. PR57 is a sodium salt and PR57:1 is a calcium salt. Sodium was not identified in the SEM-EDX analysis whereas calcium was identified and therefore it can be assumed that the pigment present in sample 1 is PR57:1.

App.3 Imaging methods

Protocols:

[P.3.1] Photography with visible light
[P.3.2] Photography with ultraviolet illumination

App.4 Plates

Plate 1. Mikhail Larionov, Rayonistic Composition, inscribed 1916, collection Museum Ludwig: Inv. Nr. ML/Z 2011/134. **Recto, visible light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d045147_05, www.kulturelles-erbe-koeln.de/documents/obj/05020023

Plate 2. Mikhail Larionov, Rayonistic Composition, inscribed 1916, collection Museum Ludwig: Inv. Nr. ML/Z 2011/134. **Recto, UV light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d045147_04, www.kulturelles-erbe-koeln.de/documents/obj/05020023

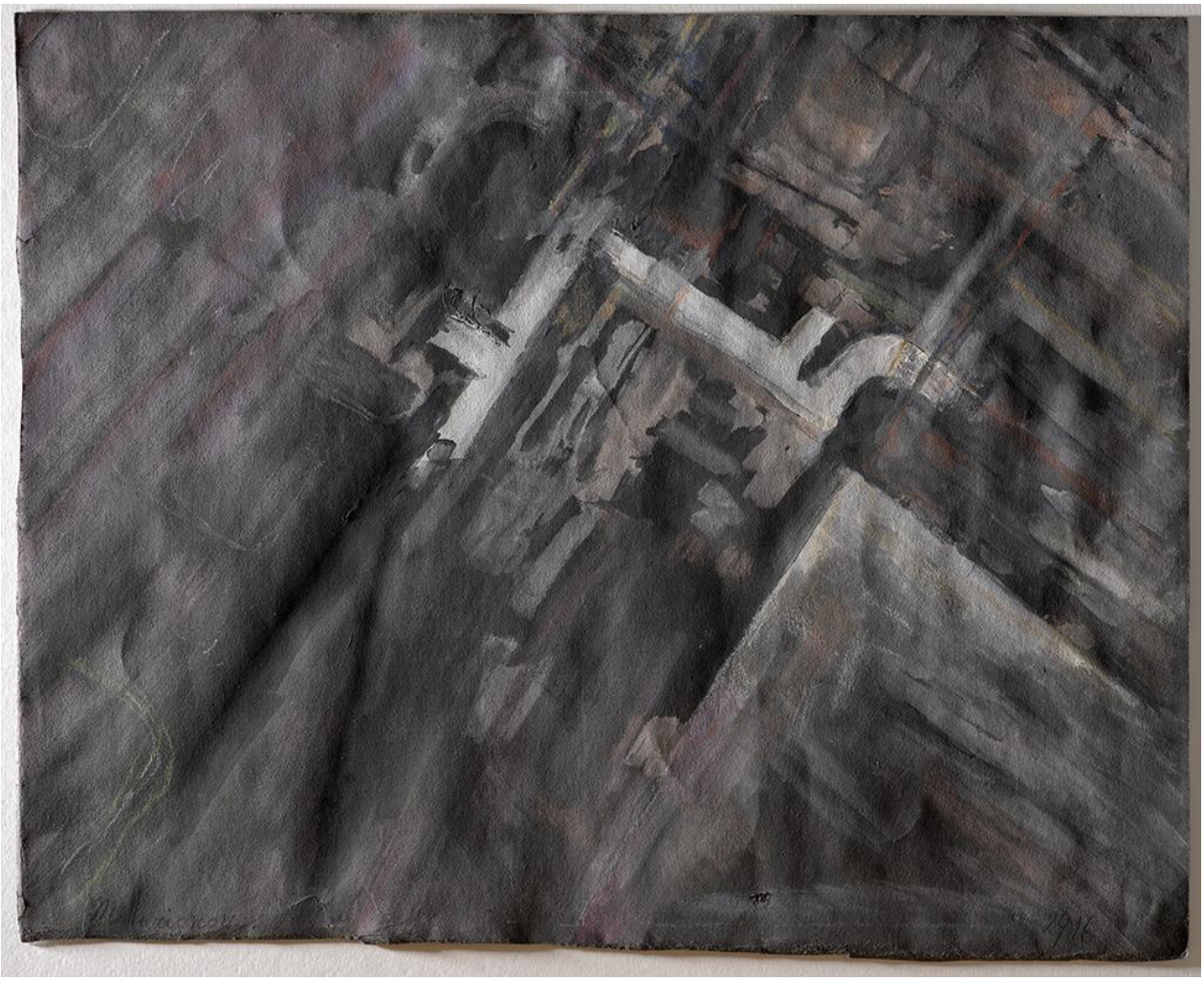


Plate 3. Mikhail Larionov, *Rayonistic Composition*, inscribed 1916, collection Museum Ludwig: Inv. Nr. ML/Z 2011/134. **Recto, raking light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d045147_03, www.kulturelles-erbe-koeln.de/documents/obj/05020023

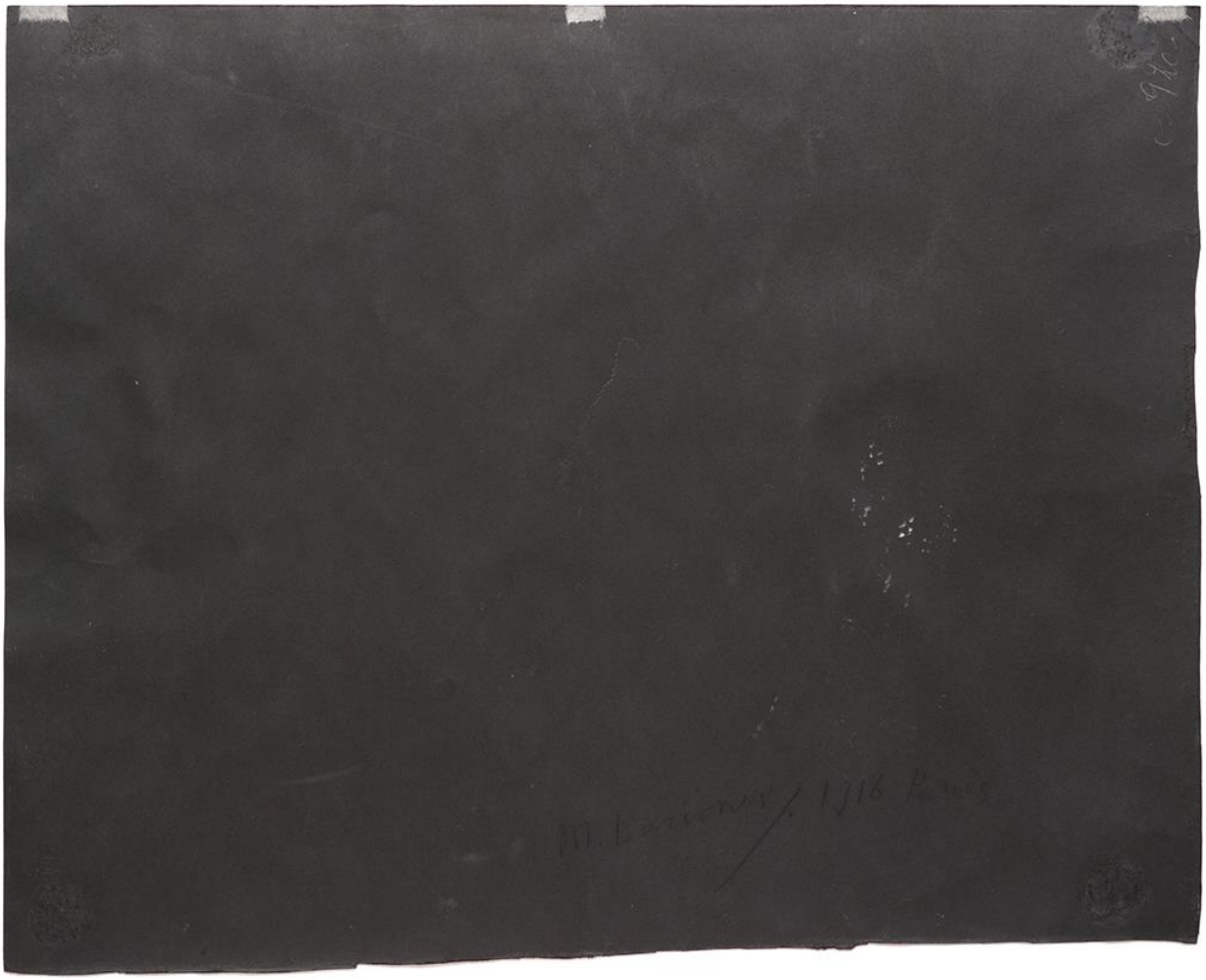
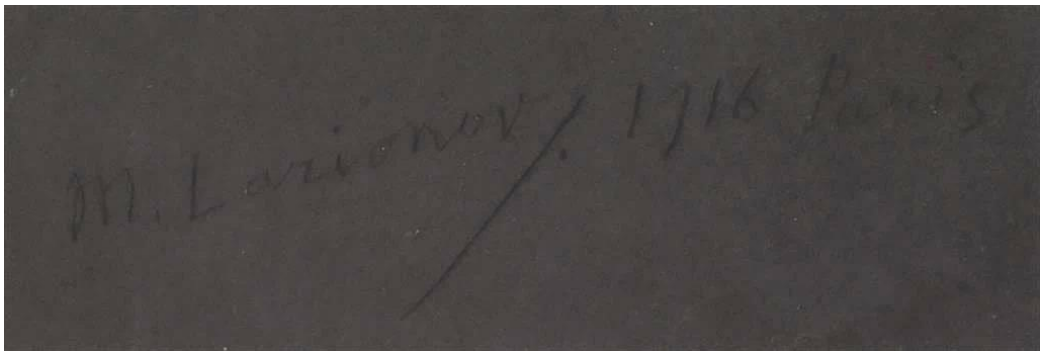


Plate 4. Mikhail Larionov, *Rayonistic Composition*, inscribed 1916, collection Museum Ludwig: Inv. Nr. ML/Z 2011/134. **Verso, visible light.**

Rheinisches Bildarchiv Köln, Patrick Schwarz, rba_d045147_02, http://www.kulturelles-erbe-koeln.de/documents/obj/05020023

Below, **4.b**, a detail of the inscription, verso: ‘M. Larionov. 1916 Paris’.



4.b

Plate 5.a Detail of inscription, recto, lower left.

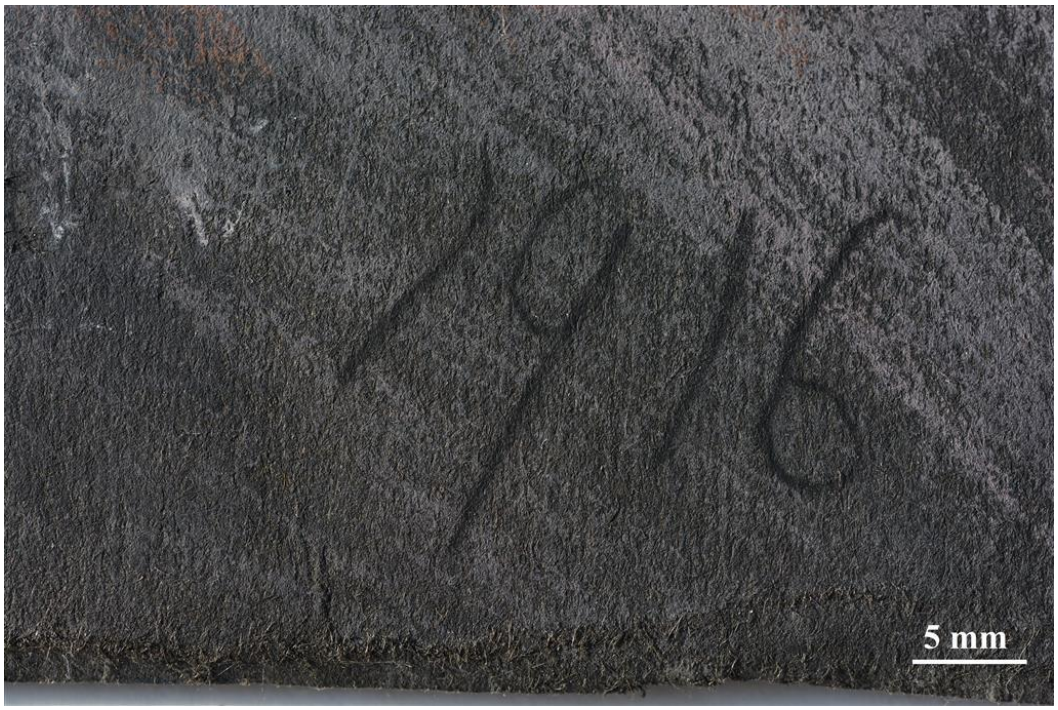


Plate 5.b Detail of inscription, date, recto, lower right corner**.**

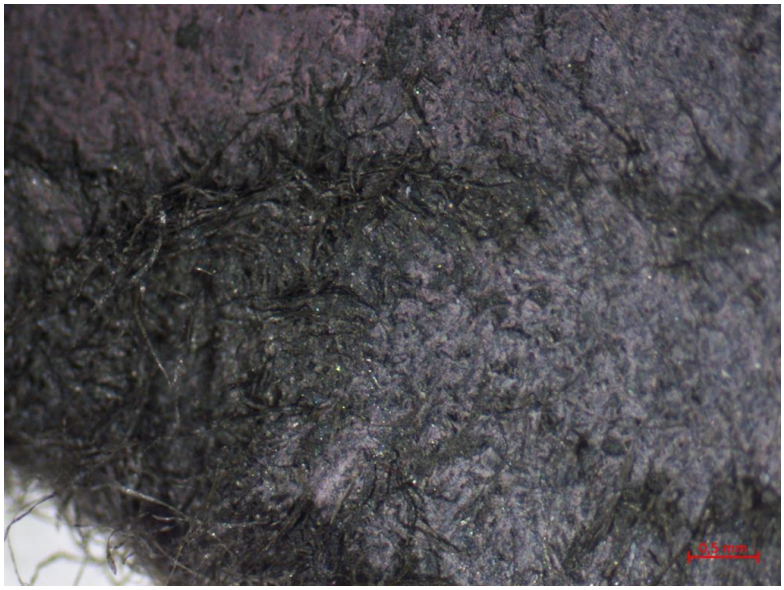


Plate 6.a Macro detail of the dark paper support.

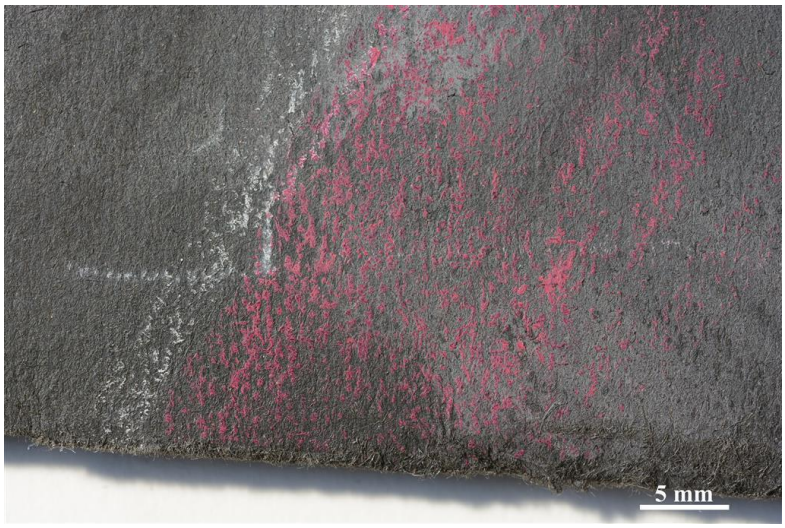


Plate 6.b Pink pastel, as sample [1].

Location as Plate 8, below. The material from which the sample came shows a reddish luminescence under UV illumination, as Plate 2.

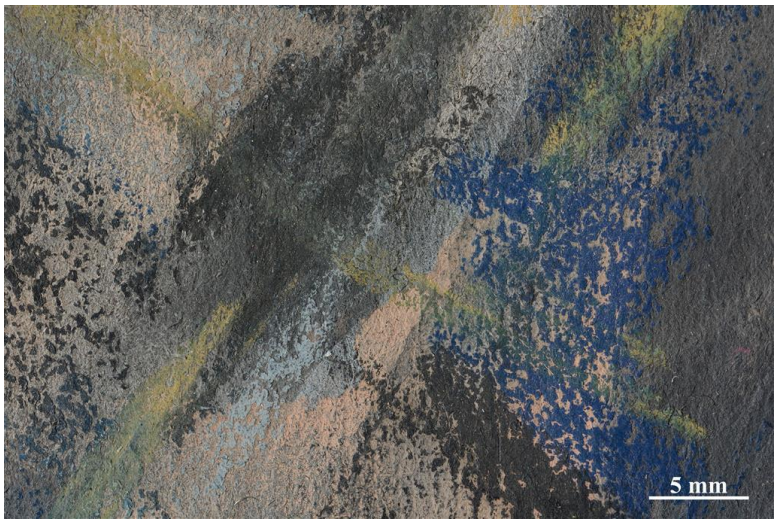


Plate 6.c Blue pastel, as sample [2].

As Plate 8, below.

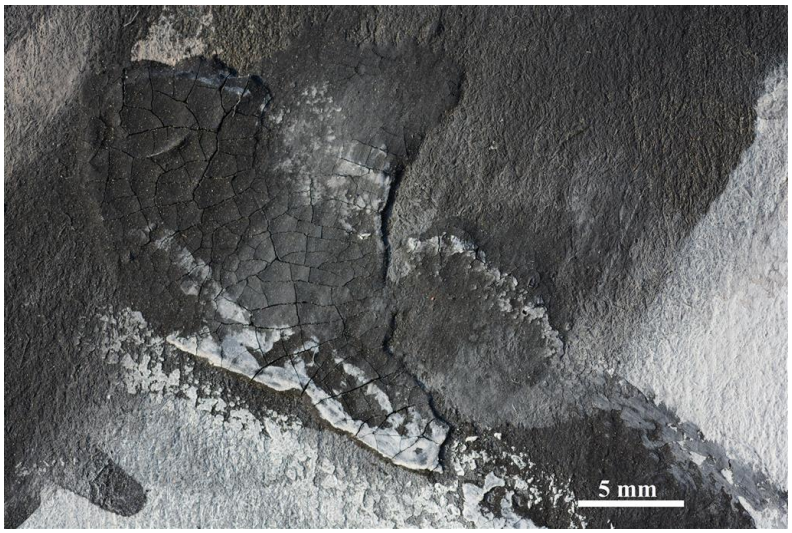


Plate 7.a Macro detail of thickly applied paint, showing brittle cracking.

Plate 7.b Detail of pastel and paint.

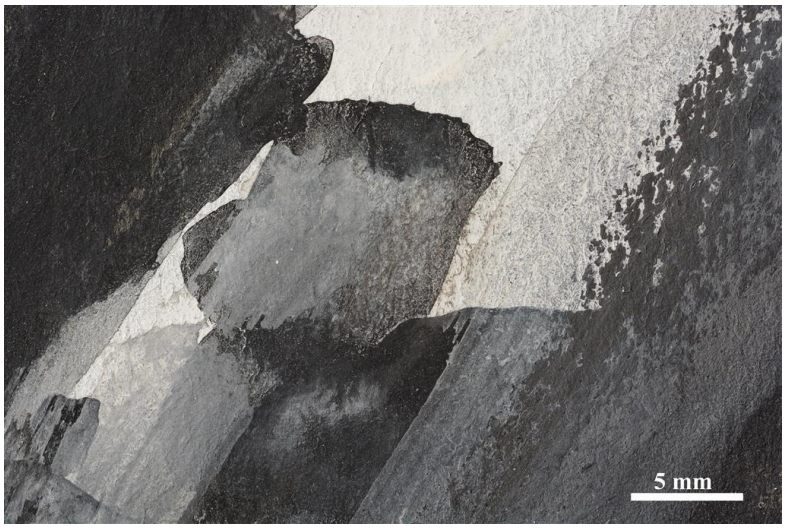


Plate 7.c Detail of thinly, and more thickly applied strokes of paint.

Plate 8. Image showing approximate location of samples taken for materials analysis.