

RESEARCH

Open Access



Rethinking Jacques-Louis David's *Marat assassiné* through material evidences

Catherine Defeyt^{1,2*}, Dominique Marechal², Francisca Vandepitte² and David Strivay¹

Abstract

Marat assassiné (Murdered Marat), one of the most famous masterpieces painted by Jacques-Louis David in 1793 has been investigated in situ by means of non-invasive and complementary analytical and imaging techniques. The overall material and technical information collected on this occasion led to important discoveries on the iconic picture of the French revolution. Following the identification of the palette used by David, we have shown the relationship between *Marat assassiné* and another David's painting. Features of David's artistic practice have been explained. Drastic changes in the final composition have been shown and explained based on scientific analysis and historical information. Finally we have formulated a hypothesis about how *Marat assassiné* could have been concealed.

Keywords JL David, Marat, MA-XRF, Imaging, Non-invasive

Introduction

In the framework of the research project *Face to Face* [1] initiated in 2019, the Royal Museums of Fine Arts of Belgium (RMFAB)'s masterpiece *Marat assassiné* (Murdered Marat) painted by Jacques-Louis David (1748–1825) in 1793 has been investigated in situ by means of non-invasive and complementary analytical and imaging techniques (Fig. 1). The overall material and technical information collected on this occasion led to important discoveries on the iconic picture of the French revolution. *Marat assassiné* joined the RMFAB collections in 1893, just one hundred years after the murder of the journalist Jean-Paul Marat (1743–1793), nicknamed the *Friend of the people*, by Charlotte Corday on 13 July 1793. This was made possible thanks to the legacy of the painting by David's grandson, in memory of the Belgium hospitality offered to the artist from 1816 until his death. Currently, the masterpiece is displayed in the

museum gallery dedicated to neoclassicism, in front of the last large format canvas by David, *Mars désarmé par Venus* (Mars unarmed by Venus) dated 1824, and beside works by his Belgian pupil François Joseph Navez. The painting shows Marat as a solitary figure, stabbed in his bathtub after his assassination by Charlotte Corday. The iconographic sources reported in literature for the *Marat assassiné* imagery are multiple and varied, among which are *il Letto di Policleteo* relief in the Roman Palazzo Mattei [2], the *Death of Germanicus* by Poussin [3], the *Deposition of Christ* by Caravaggio, a *Pieta* dated 1790 by Girodet [4, 5].

While extensively studied by historians and art historians, to date *Marat assassiné* has not further been properly investigated through the prism of technical art history, since the pioneering work conducted by Libby Sheldon in 2000 [6]. The present paper aims to remedy the situation by studying the canvas through a panel of complementary non-destructive analytical and imaging methods.

The applied methods comprise infrared reflectography (IRR), X-ray radiography (XRR), high-resolution photogrammetry, Raman spectroscopy (RS), digital microscopy, and

*Correspondence:

Catherine Defeyt
Catherine.Defeyt@uliege.be

¹ Centre Européen d'Archéométrie, U.R. Art, Archéologie, Patrimoine, University of Liège, Liège, Belgium

² Royal Museums of Fine Arts of Belgium, Brussels, Belgium



Fig. 1 Jacques-Louis David, *Marat Assassiné*, 1793, oil on canvas, 128 cm x 165 cm, Inv. 3260, RMFAB, Brussels

scanning X-ray fluorescence (MA-XRF). This paper presents an overview of the collected material and technical information, which led to new insights on the making process of the neoclassic masterpiece.

Experimental

A high-resolution photographic documentation has been performed. The full-size images in visible light and under ultraviolet light have been acquired by using the scanning system developed at the CEA [7] and a D7500 Nikon camera with an AF-S Micro Nikkor 105mm Nikon objective. Each close-up is recording a 4 cm x 3 cm area of the painting (8 μm pixel size) and common area of 15 % between adjacent close-ups. The images are then stitched as a panoramic image with PTGui software with a minimum of 20 control points between images.

X-ray radiography was performed using a mobile X-ray radiography system with an X-ray source at 40kV (X-ray side window Oxford-Instrument Series 5000) and X-Ris CCD detector. Infrared reflectography was acquired using an Osiris camera (Opus Instruments) sensitive in the 0.9–1.7 μm and halogen lamps. Additionally, the painting surface has been examined with a digital microscope (Dino-Lite). The multispectral images are reported in Fig. 2.

In order to get a better understanding of the pigments distribution through elemental maps, XRF (X-ray fluorescence) spectroscopy was used in macro scanning mode (MA-XRF). The XRF scans of selected zones of the painting have been completed by using the CEA translation stage and XRF system [8, 9], made of a Moxtek Magnum X-ray tube (50 kV) (with an Ag anode), a detector X-123SDD Amptek (25 mm²), with a resolution of 130 eV at 5.9 keV. Scanning step was set to 1mm with a dwell time of 300 μs . X-ray tube was set to a voltage of 40 kV and a current of 120 μA . Spectra were treated in batch mode using PyMCA [10], allowing separation of the signals from the different chemical elements.



Fig. 2 Jacques-Louis David, *Marat Assassiné*: **a** Infrared reflectogram; **b** UV photograph; **c** X-ray radiograph

The analyses by Raman spectroscopy (RS) were performed with the Enwave Optonics setup (portable Raman analyzer I-Dual-G), using a laser at 785 nm [11]. Three Raman spectra were acquired for each of the twelve investigated sites, with the lowest laser power necessary to obtain valuable results (ca. 30 mW). The recorded spectra were treated using GRAMS. Unfortunately, because of the thick varnish layer present on the painting only a few of the Raman spectra were useful.

Data and images were all acquired on the museum site thanks to our mobile laboratory.

The palette

The MA-XRF (Figs. 3 and 4 and Additional file 1: Fig. S1 and Additional file 2: Fig. S2) and RS methods made it possible to visualize the distribution of the inorganic pigments David used to portray Marat. The palette used by David is typical of the end of the 18th century and comparable to the one determined by Centeno, Mahon et al. [12]. Indeed, the different pigments identified through analytical methods have in common that they were used by most painters of the time.

The green color of the blanket (Fig. 4) results primarily from the mixture of a yellow pigment, in this case probably Naples yellow (Sb signal), and a blue pigment whose iron content is compatible with Prussian blue. Although the blue particles are not visible in the photomicrograph due to insufficient magnification, the yellow pigment grains contained in the layer of green paint appear distinctly in the photomicrographs (Fig. 5a).

Basically, the flesh tones in Marat's face were achieved by mixing lead white, iron oxide(s)/hydroxide(s) and Naples yellow. However, the microscope examination performed in the face pointed out the presence of black pigment particles (Fig. 5b), identified as carbon black thanks to Raman measurements, and unidentified isolated pinkish red grains, possibly a red lacquer such as Kermes or alizarin. Vermilion, present in relatively lower amounts for flesh colors, is the primary pigment used to mimic the color of blood. By looking at the MA-XRF map of Pb, Hg, Fe and Sb elements (Fig. 3) one can see the inorganic pigments identified for carnation are more or less abundant depending on the location. It can be observed from the distribution map of PbM that the right part of the face is significantly richer in lead white. The highlights consisting of whitish brushstrokes, placed on the forehead, the bridge of the nose and the sitter's right cheekbone, are primarily made of lead white. In contrast, the iron-based pigment(s) appear specifically more concentrated in the sitter's left part of the face, in shadow. Nevertheless, the areas corresponding to the upper lip, the eyelashes, the top lid, the nostrils, the philtrum (the shallow vertical groove running from the nasal septum to the center of the upper lip) and the mentolabial sulcus (indistinct line

separating lower lip from chin) appear as the richest in iron-based pigment(s). Concerning the Sb-based pigment identified as Naples yellow, its presence is less extensive, but it is more evenly distributed throughout the face. This means Naples yellow is involved in most of the pigments combinations used for rendering carnation. Note at some places, the color shade primary results from Naples yellow admixed with carbon black.

The background of the painting is realised with *frottis* as often with David. The *frottis* technique consists of the juxtaposition of brushstrokes split up and oriented differently depending on the location. The *frottis* applied to the background are mainly made of iron (hydro)oxides and carbon black (Fig. 5c), and are particularly evident in the IRR image.

All the pigments identified by the analytical methods perfectly reflect David's palette as described by Jean-Pierre Thénot in 1847 [13].

The role of a twin painting in the creative process

Regarding the various iconographic sources proposed for the *Marat assassiné* imagery, the role of *Le Peletier sur son lit de mort* (Le Peletier on his deathbed) that Jacques Louis David had completed just three months before the murder of Jean-Paul Marat, cannot be denied. The genesis of the iconic picture of the French revolution created by David must indeed be assessed against the portrait of Michel Le Peletier, for multiple reasons.

Both paintings

- commemorate a deputy to the National Convention (political institution that was governing France from 21 September 1792 to 26 October 1795 during the French Revolution) murdered for a political motive;
- celebrate the victim as a martyr figure with emphasis on the fatal injury;
- have been offered to the Convention by the artist;
- were presented together in the Louvre courtyard before being hung together in the Convention's meeting room.

Offered to the Convention on 29 March 1793 and untraceable since 1826, the appearance of David's *Le Peletier* painting is known today from Devosge's drawing (Fig. 6), dated 1793 and used as model for Pierre-Alexandre Tardieu's engraving,¹ which is partly destroyed, and from a sketch by Étienne-Jean Delécluze.² Further

¹ P-A Tardieu after David's *Le Peletier de Saint-Fargeau sur son lit de mort* (Le Peletier de Saint Fargeau on his deathbed), fragment of engraving, Paris, Bibliothèque nationale de France, Département des estampes et de la photographie.

² E-J Delécluze after David's *Le Peletier de Saint-Fargeau sur son lit de mort*, New York, Wildenstein Gallery.

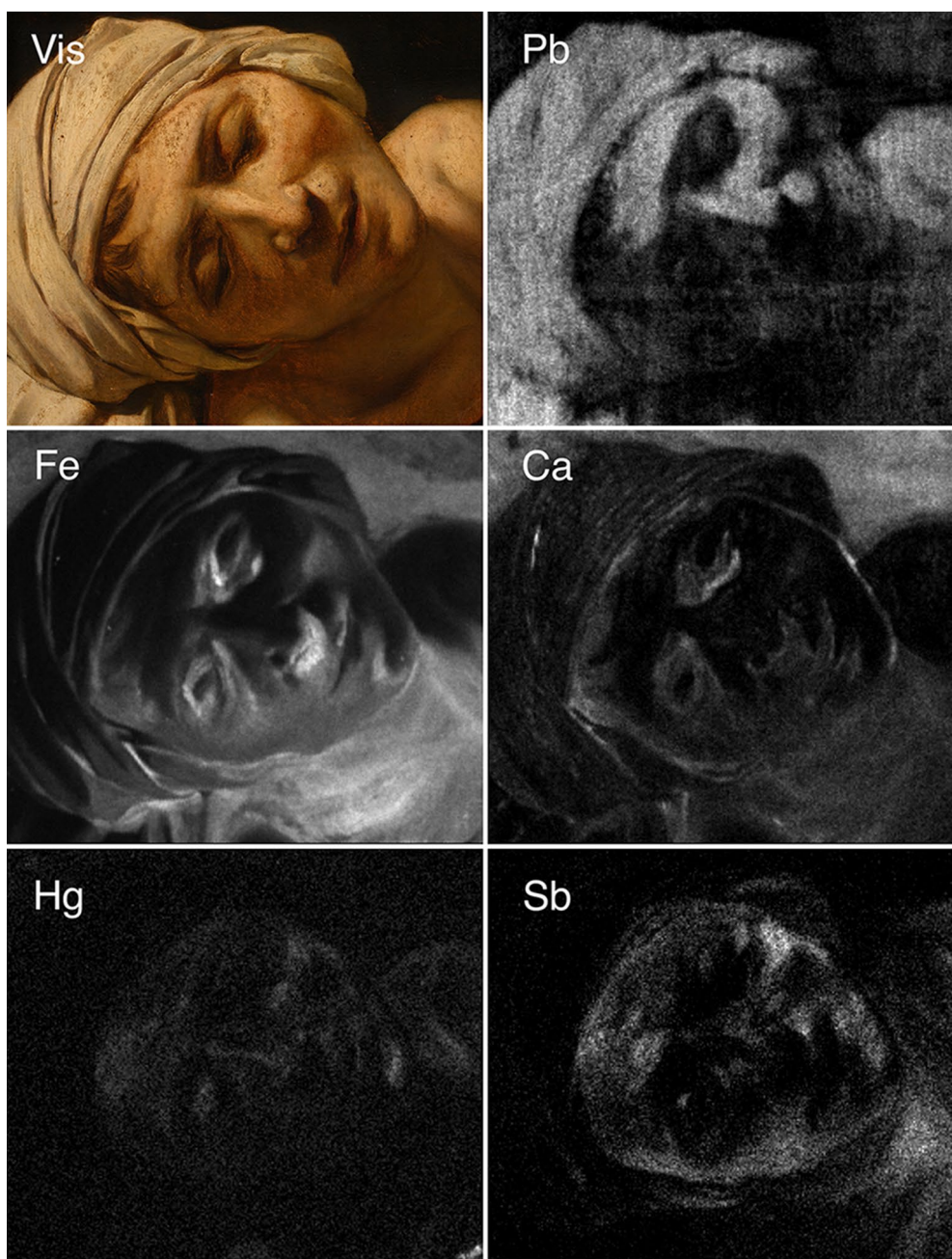


Fig. 3 MA-XRF maps of Marat's head (24 cm x 27 cm), scanned with a dwell time of 0.33 s/pixel and a step size of 1.0 mm. All distribution images are corresponding to the number of counts in the corresponding X-ray lines of the elements: Photograph of the scanned zone; Pb M lines; Fe K lines; Ca K lines; Hg L lines; Sb K lines

contemporary authors, [14–17] who described Le Peletier and Marat portraits delivered additional relevant information: the two martyrs portraits were originally arranged opposite each other [15] and the canvases had identical size [16]. Together, the written testimonies and the images related to the lost picture invite to think the portraits of Le Peletier and Marat as a diptych, in the

strict meaning of the term. This involves the need of discussing Le Peletier and its sources in first 1.

About the painting Chaussard wrote in 1806 [14] :

The half-length figure of Le Peletier is well done and studied and almost copied from that of Hector in the painting by the same artist.

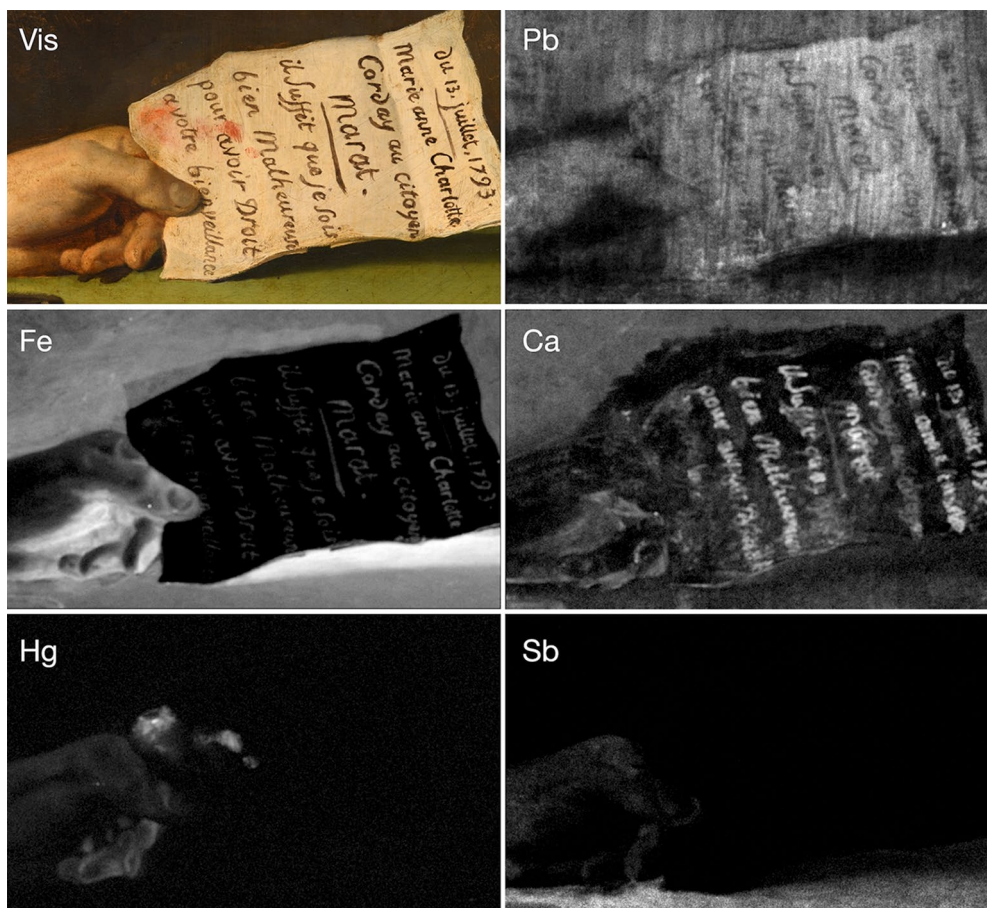


Fig. 4 MA-XRF maps of Marat's left hand (28 cm x 17 cm), scanned with a dwell time of 0.25 s/pixel and a step size of 0.5 mm. All distribution images are corresponding to the number of counts in the corresponding X-ray lines of the elements: Photograph of the scanned zone; Pb M lines; Fe K lines; Ca K lines; Hg L lines; Sb K lines

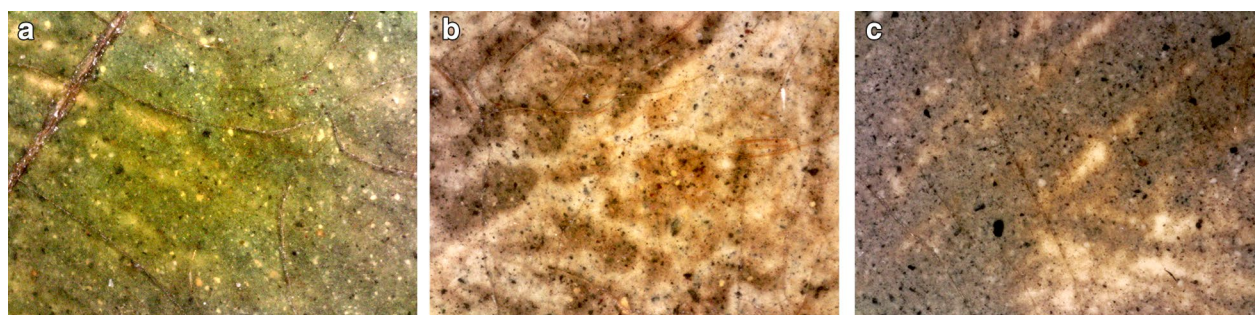


Fig. 5 Photomicrograph (x200) revealing the pigment grains of the green cloth (a), the face (b) and the *frottis* background (c)

The author referred to Hector's body lying on a triumphal bed (Additional file 3: Fig. S3) in *La douleur et les regrets d'Andromaque sur le corps d'Hector* (Andromaque's pain and regrets on Hector's corpse) dated 1783. The confrontation of Le Peletier and Hector figures leaves little doubt on the main source of the

portrait David made to pay tribute to the murdered politician.

The descriptions and the images of Le Peletier's funeral that David personally organized with the help of Chénier, allow assuming the idea of immortalizing the assassinated deputy through the Trojan warrior

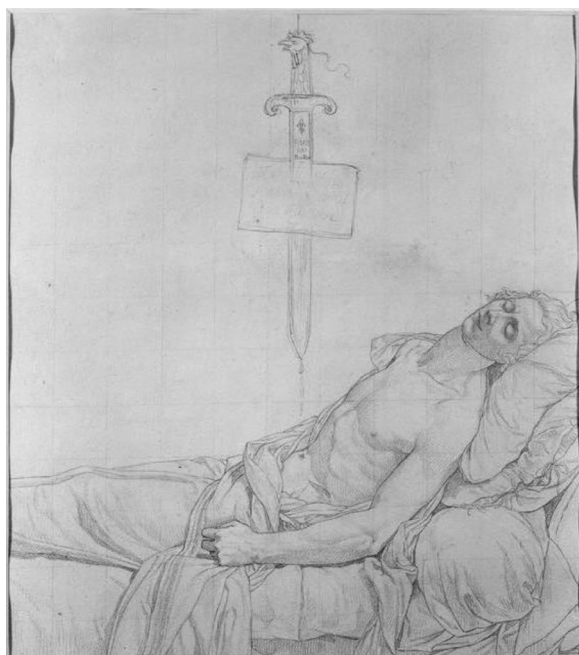


Fig. 6 Anatole Devosge after David's *Le Peletier de Saint-Fargeau sur son lit de mort*, 35 cm x 38 cm, Dijon, Musée des Beaux-Arts

quickly imposed itself. In the frame of the present study, the authors have discovered the Hector and Marat are equally linked. Indeed, by comparing the right hand of Marat and the right hand of Hector one can observe their high similarity (Fig. 7). This finding will be discussed in the section *The billet and the feather*.

Two David's drawings related to Le Peletier painting are known. The first one represents the head of Le Peletier on his deathbed viewed in profile, known from the engraving by Denon (Additional file 4: Fig. S4). The second one, discovered in 1989 on the verso of a study for *Les Sabines*

arrêtant le combat entre les Romains et les Sabins (The Intervention of the Sabine Women) shows a figure identified as Le Peletier viewed in 3/4, (Additional file 5: Fig. S5) [18, 19].

These drawings commonly display Le Peletier's body in the same direction than Hector, from left to right. David, however, finally depicted the murdered deputy from right to left. By inverting the direction of Le Peletier figure, did David try to make less obvious the borrowing from *La douleur Andromaque*, displayed at the Academy since 1783? Le Peletier could have been seen as a simple replicate. Or, did he seek to enhance the visibility of the lethal stab curving, which is on the left side, as exhibited in Le Peletier's funeral David did organize? The reason of the operated reversal remains unknown.

Much more evident is the role of Le Peletier picture played in David's choice to show Marat's body from left to right, just like Hector. The two paintings were indeed intended to be hung on either side of the chairman's platform in the Convention's meeting room (Salle des machines, Tuileries from 9 May 1793) [17] (Additional file 6: Fig. S6). What has been the case from November 1793 until February 1795 [20]. If we assume that the paintings were mirror of each of other, Marat had to be depicted from left to right. This display is nevertheless the opposite of reliable images showing Marat just after being murdered in his bathtub, such as the painting by Jean-Jacques Hauer (Additional file 7: Fig. S7), which is considered as the image most faithful to reality [21].

One can also assume the portrait of Le Peletier completed beforehand, did also condition the format and the size of *Marat assassiné*. As a reminder, the identical dimensions of both canvases are reported in several historical documents [16, 22]. In the same way, the palette and the light source in Le Peletier probably have also

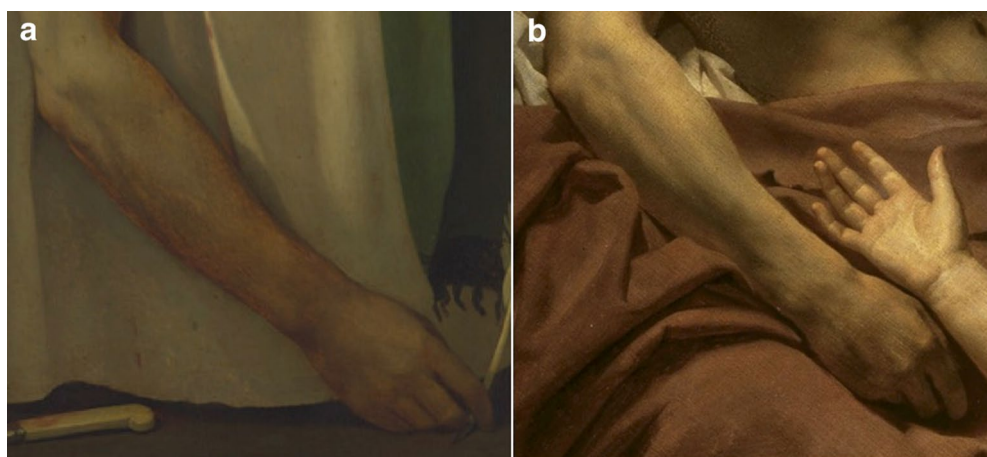


Fig. 7 Detail of Marat's right forearm (a) with detail of Hector's right forearm from *La douleur et les regrets d'Andromaque sur le corps d'Hector* after a rotation of ca. 40° toward the right (b)

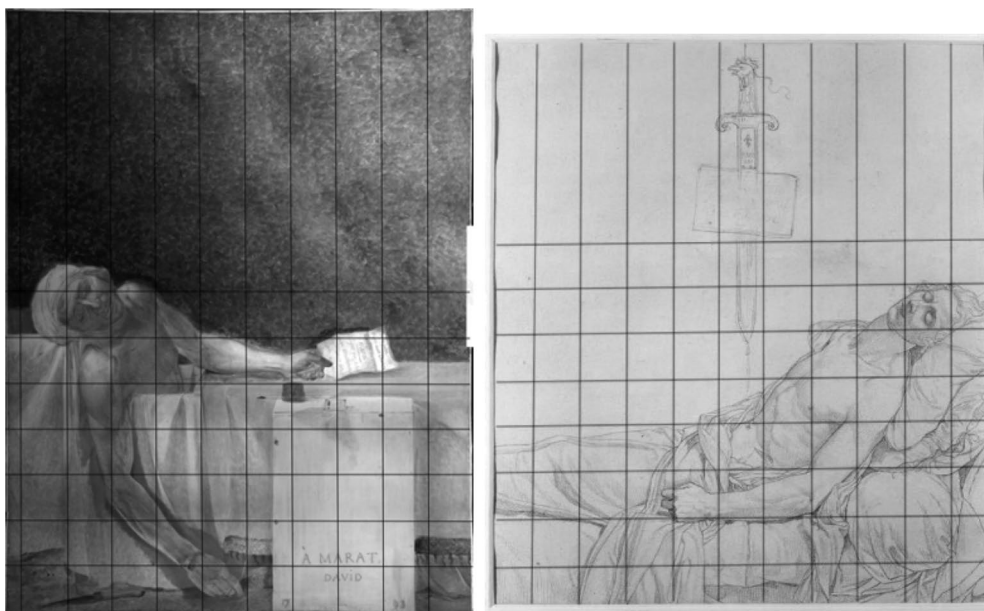


Fig. 8 IRR image of David's Marat and Devosge's drawing with grids of line highlighted in black

impacted the colors and the orientation of light in Marat. The green color of the cloth in Marat's portrait could have responded to the color of the blanket in Le Peletier, possibly reddish like in Hector. If so, the complementarity of the red/green colors would have produced an interesting simultaneous contrast.

The use of the squaring up method for the Marat painting was first established by Sheldon in 2000 through photographs of low resolution infrared reflectograms of a few details. Nevertheless, the identity of a *modello* used in this process remains unknown.

In this regard, it is interesting to point out that the drawing of Le Peletier by Devosge made after David's painting, would have provided helpful benchmarks for making Marat's portrait.

Executed between 29 March and 10 August 1793 [23–25], this drawing could have been used for portraying the Friend of the people in the same proportions as Le Peletier figure. A grid has indeed been drawn as in the square up method (laying down a grid and keeping to the original plotting of the composition). It should be noted that David painted Marat between 14 July and 14 October 1793. When arranged side-by-side Devosge's drawing and Marat painting, one can see the axial symmetry of both compositions. The comparison of the whole grid of lines visible through the IRR image newly acquired from the Brussels painting, and the squared up drawing of Le Peletier provided valuable insight in that respect (Fig. 8). Marat's head and the white sheet lying beneath are, for instance, in the

same ranges as Le Peletier's head and the pillow. Note also the bathtub and the deathbed have similar height and width, respectively six squares and eleven squares in the report grids.

Did Devosge's drawing serve as a template/practical guidelines to create a harmonious balance between the two compositions? The question needs to be raised. This hypothesis does not exclude the possible recourse to a live model for the orientation of the head and the body position and/or to a conceptual sketch such as the drawing N°355 reported in the catalogue raisonné by Rosenberg and Prat [18].

Concerning the report grid of the Marat, it must be noted the first column of squares on the left side has been truncated as regards width (ca. 9 cm). This indicates cutting the left edge could have shrunk the painting. The sacrificed canvas strip could look like the David's workshop copy made in 1794 and kept at the Château de Versailles.

Marat's face

At first glance, the painted head of Marat, for which the rapid touch reminds the self-portrait with a palette executed in 1794, seems to have little to do with the detailed pen- and -ink study *Tête de Jean-Paul Marat mort* (*Head of dead Jean-Paul Marat*) (Fig. 9) made from life [26] and/or from a death mask taken by Madame Tussaud [27] (Additional file 8: Fig. S8), between 14 and 16 July. First of all because as he did for Le Peletier painting, David painted Marat's head in the opposite direction to

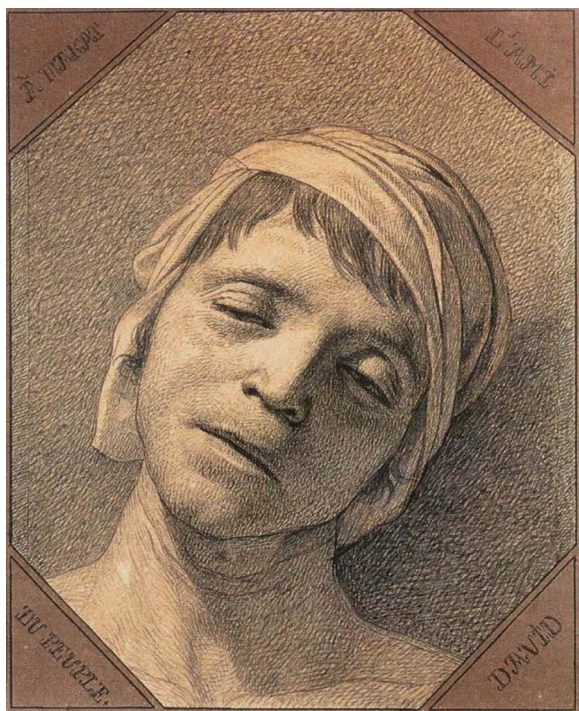


Fig. 9 Jacques-Louis David, *Study from nature of the head of murdered Jean-Paul Marat*, 1793, plume, brown and black inks on black stone, 21 cm x 27 cm, Inv. R.F. 1921/M.V.5288, Musée national du château de Versailles

his drawing. In the same way, the half-closed eyes and the hanging mouth of the drawing are clearly distinguished from the painting. One can observe an inversion in the position of the highlights as well as the shadows. Haute-coeur was the first to underline the close link existing between the painted head, and that study of Marat's head [28]. Actually, the superimposition of the images of the two heads made it possible to determine that the orientation of the head in the painting is aligned with the drawing after a rotation of ca. 100° to the left (Fig. 10). This simple operation highlighted the almost perfect correspondence at the level of the facial oval. In fact, the shape of the painted face seems to be borrowed from the drawing. There are other intriguing correspondences between the two figures, such as the positioning of the eyes, mouth, nose and part of the turban. In the painting, the left part of the fabric that is wrapped around the head of the deceased has been significantly thickened. By this increase in volume, the orientation of the head is made realistic. Regarding the turban from the drawing, it should be noted that its presence could be explained by the intervention of the forensic scientist Louis Deschamps. Indeed, for performing the autopsy of the corpse the coroner had to open the skull of Marat to extract the cerebrum [29, 30].

The high-resolution IRR image newly acquired unveiled the *pentimenti* in the eyes, the mouth and the lower jaw region (Additional file 10: Fig 10). Indeed, the eyes appear as they had been first depicted more open than they are in the visible picture. They would have been therefore more similar to the drawing. Actually, the face visible from the IRR resembles Marat's face in the engraving Morel made of Marat assassiné after a drawing executed by Wicar on David's request (Additional file 9: Fig. S9). In the light of this, it appears possible the correction of the eyes was not already done when Wicar drew David's painting. In addition, the IRR examination supports the use of Marat's death mask for modeling the lights and shadows (Fig. 10). On the one hand, the dysmorphism of the left part of the face visible in the preparatory drawing, which is compliant with the death mask, the portrait painted by Boze and the physical description of Marat from his contemporaries [31], is not represented in *Tête de Jean-Paul Marat mort*.

Moreover, the shadow strongly marked below the nose in the preparatory drawing seems consistent with the use of a 3D model as the plaster death mask by Mme Tussaud [27]. In the light of these findings the authors assume David could have used both, his detailed drawing and the death mask for immortalizing Marat's face.

The billet and the feather

In addition to the *pentimenti* completed in Marat's face, the new IRR image made visible two highly relevant features in the hands region. Indeed, one can observe a whitish painted shape identified as a crumpled sheet of paper in the right hand (Fig. 2a) and a curved line traced with pencil or charcoal lying underneath the billet hold in the left hand (Fig. 11). Concerning the right hand the authors pointed out its similarity with Hector's right hand. This is particularly evident when the late is inclined ca. 40° to the right (Fig. 7). The underlying item discovered in the left hand, which could be a feather because of its curve and its length (Fig. 11) was at least partly painted by considering the thin line, supposedly the feather tip, unrelated to the fingers and extending the curved line discovered beneath Charlotte Corday's billet (Additional file 10: Fig. S10).

Regarding the left hand itself one can observe from the under drawing some changes in the shape and the fingers position (Additional file 10: Fig. S10). Although the presence of a feather in Marat's left hand in an earlier version of the painting remains uncertain, the crumpled sheet of paper hold in the right hand lying on the subsurface supports this hypothesis. Indeed, there is little chance that David did paint a sheet of paper in both hands. On the basis of these material evidences, the authors assume

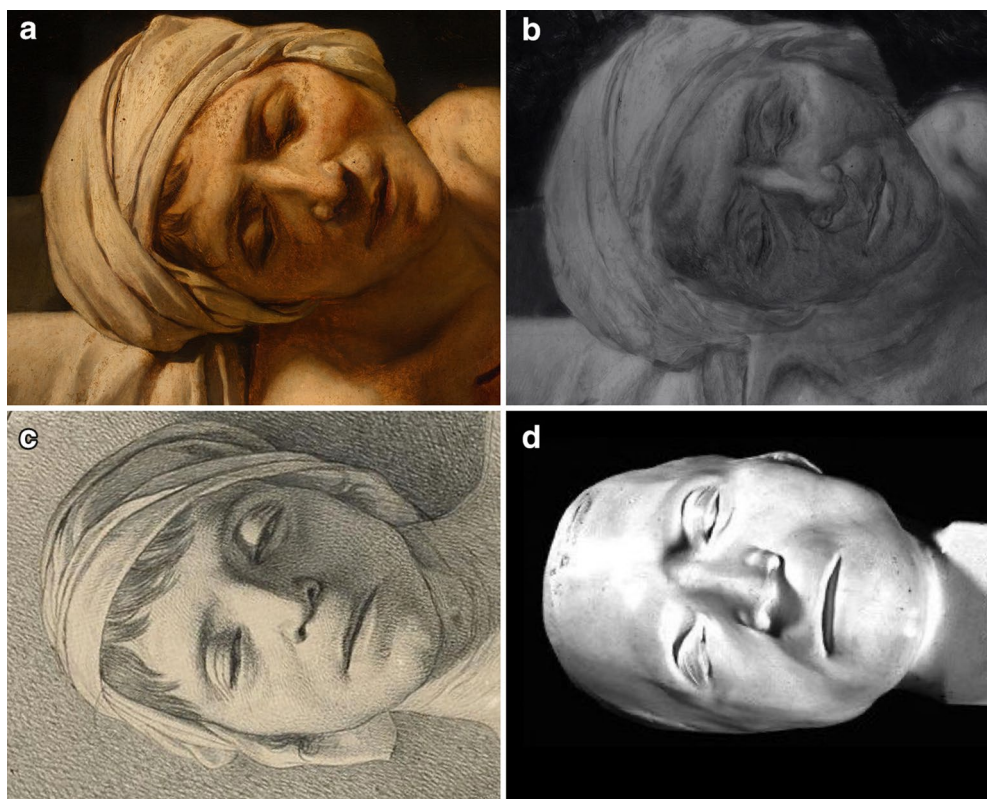


Fig. 10 Comparison of the visible image (a), infrared reflectogram (b), the pen drawing of *Study from nature of the head of murdered Jean-Paul Marat* rotated 100° and the death mask rotated 90°

David's first intent was to show Marat like he found him a day before the journalist's assassination on 12 July. Regarding his last image of Marat alive, the painter declared [32]:

The day before Marat's death, the Société des Jacobins sent Maure and I to inform us of his news. I found him in an attitude that struck me. He had beside him a block of wood on which were placed ink and paper, and his hand, coming out of the tub, was writing his last thoughts for the salvation of the people. Yesterday, the surgeon who embalmed his body sent me to ask how we would expose him to the eyes of the people in the Cordeliers church. We cannot find some parts of his body because you know he had leprosy and his blood was burnt. But I thought it would be interesting to offer it in the altitude where I found it, writing for the happiness of the people.

In conclusion David's first idea for the composition of the Marat was most probably to depict the inverse of what he finally did for the props in the hands. In the light of this the following question arises: why did David change his mind? The possible reasons are multiple: did he realize that the journalist would have been left-handed? (mistake

he already made in his self-portrait dated 1794), did he read the contents of Corday's billet later in the making process of the picture? did he finally decide to immortalize the political character of Marat's death rather than his activity as writer? did he choose to show Corday's writing to echo the paper with inscriptions painted in Le Peletier?

The ceruse affair

In October 1795, the Marat painting, formerly hung in the convention room, has been returned to his author, the assembly having decreed that the honors of the Pantheon, of the exhibition at the Convention and in public places would no longer be reserved for any citizen ten years after his death. The picture will not reappear before the inventory of the artist's estate in March 1826 undertaken at Antoine-Jean Gros' place, a former pupil and lifelong friend of David. The portrait of Le Peletier, that of Marat as well as two copies of the latter were entrusted to the care of Gros, at the time of the David's exile to Belgium in 1816. According to Jules David, the artist's grandson, these four canvases would have been hidden underneath ceruse layers (lead white based paint) in order to avoid their destruction. In 1880, he wrote [32]



Fig. 11 Detail of Marat's left hand in visible light (top) and in IRR (bottom). One can observe from the IRR image the drawn curved line beneath the billet and a thin line painted over the fingers. The curve and the length of the item discovered in the left hand region (highlighted in red) are fully compliant with the visible feather posed on the billet (highlighted in red)

the portraits as well as the copies of Le Peletier and Marat are hidden by a layer of ceruse.

The author does not cite his sources and perhaps takes this information from oral history. The use of ceruse is supported by the mention collected from a letter dated April 1820, from Gros to David [32]:

Today also he hung the other paintings, which are thus more surely placed. My dear master, I am in a sanctuary! The four canvases, still covered with their plaster, are not there: discretion presides over all this.

In the same way a letter dated 9 March 1826, from Beauvoir to David's pupil François-Joseph Navez [33] tend to support the Marat had effectively been overpainted at some time:

I added that I thought I had heard that during the Restoration something was painted on this canvas; but that the Duke of Orleans, having wanted to see him, had since been cleaned.

Different scholars have relayed this assertion afterwards [20, 26], without ever questioning it. The digital microscopy devices used for investigating the Marat gave the opportunity to verify the hypothetical application of ceruse over the painting, in order to hide it and therefore to prevent its destruction.

Though, the examination under microscope of the painting surface has demonstrated the absence of white paint residues within the brushstrokes. The overpainting of the picture by means of ceruse or any other paint can be therefore excluded. In contrast, one can observe under microscope the presence of fabric fibers enclosed in the varnish layer all over the surface of the painting (Fig. 12). The varnish layer enclosing the fabric fibers should be dated 1826 [27]. The observed fibers, which do not seem originating from the cleaning, suggest that Marat has been possibly concealed beneath another canvas. Unfortunately, the identification of the fibers type would require sampling, which has not been done in the framework of this study.

While the IRR image revealed a part of the first raw to the extreme left was missing (ca. 9 cm), the XRR image makes visible nails holes alongside the four edges. These ones result from a previous attachment system. Strangely there are no traces of crease lines next to the nails holes. This absence of crease lines on the painting edges suggests that the canvas has been previously fixed on the *plats* of a stretcher, as illustrated in Fig. 13.

On the basis of these material evidences, the authors made a hypothesis concerning how the painting could have been masked by ceruse and why fabric fibers have been found.

The Marat would have been covered by a white primed canvas fixed over it on the stretcher edges as illustrated in Fig. 13. By proceeding in this way, only the white ground layer applied on the canvas laid over the Marat was visible. The painting could thus be displayed for all to see in a corner of the studio without arousing curiosity.

Conclusions

Whoever is interested in the creative process of the Marat image must necessarily take into consideration the painting of Le Peletier. Indeed, the solitary figure, the display of the body from left to right, the dimensions, the palette, the light of the Marat have been most probably determined by Le Peletier. In the same way, the squared up drawing of Le Peletier by Devosge could have provide benchmarks for depicting Marat in his bathtub.

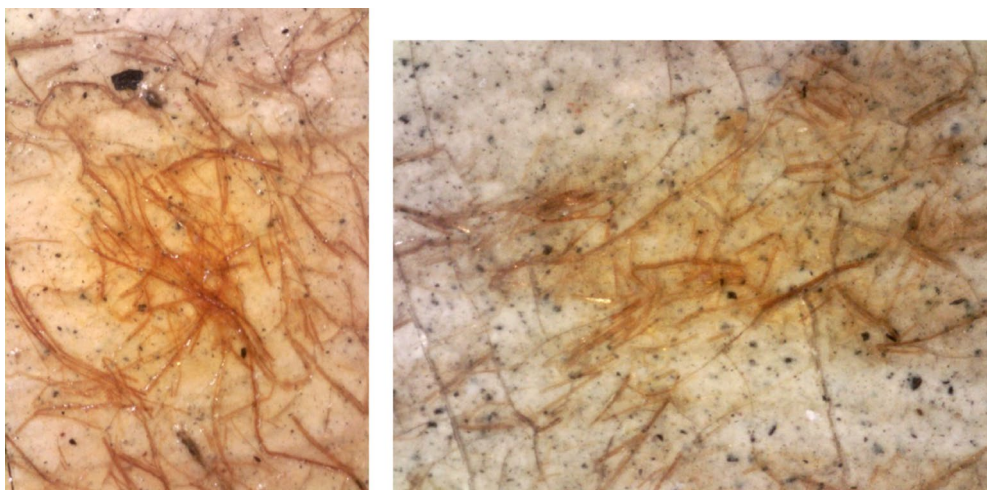


Fig. 12 Examples of fabric fibers found on the overall painted surface, magnification x230



Fig. 13 Schema of the system presumably employed to dissimulate the Marat painting. In this manner nails are placed on the flat parts of the stretcher and not on its edges. A white primed canvas can be therefore placed over the painting and stretched on the edges of the stretcher

Regarding Marat’s face, the use of *Tête de Jean-Paul Marat mort* as a model appeared quite evident because of the identical facial oval found in the painting and in the drawing. On the other hand the IRR image of the painted head unveiled features in the preparatory drawing that indicate the use of Marat’s death mask as well. The IRR image equally evidenced the presence of pentimenti in the eyes, which were initially painted more open. Other significant composition changes have been identified in the hands region. While a painted crumpled sheet of paper has been found in the right hand, the presence beneath Corday’s billet, of a curve that reminds a feather, has been detected in the left hand. These findings

tend to evidence David’s first intent was to depict the inverse of what he finally did for the props hold in the hands. In addition, it has been found that Marat’s right hand is borrowed from the Hector figure in *La douleur d’Andromaque*. Finally, the present study permitted to formulate a hypothesis about how *Marat assassiné* could have been concealed beneath a layer of ceruse.

In conclusion, the achieved outcomes highlight the pragmatism of the painter, who made his masterpiece in a short time, by using all the resources at his disposal and, who probably had recourse to an ingenious system to hide his painting.

Abbreviations

XRF	X-ray fluorescence
RS	Raman spectroscopy
IRR	Infra-red reflectography
XRR	X-ray radiography
RMFAB	Royal Museums of Fine Arts of Belgium
UV	Ultraviolet

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40494-023-00861-3>.

Additional file 1: Fig. S1. Pb L lines MA-XRF map of Marat's head (24 cm x 27 cm), scanned with a dwell time of 0.33 s/pixel and a step size of 1.0 mm. Distribution image is corresponding to the number of counts in the corresponding X-ray lines of the element.

Additional file 2: Fig. S2. Pb L MA-XRF map of Marat's left hand (28 cm x 17 cm), scanned with a dwell time of 0.25 s/pixel and a step size of 0.5 mm. Distribution image is corresponding to the number of counts in the corresponding X-ray lines of the element.

Additional file 3: Fig. S3. *La douleur et les regrets d'Andromaque sur le corps d'Hector* by David. Detail of *La douleur et les regrets d'Andromaque sur le corps d'Hector* (Andromaque's pain and regrets on Hector's corpse) by Jacques-Louis David, 203x275 cm², Le Louvre, Paris (Inv. DL 1969 1 ; MR 1433).

Additional file 4: Fig. S4. Denon's engraving. Dominique Vivant Denon after David's *Tête de Michel Le Peletier de Saint-Fargeau mort, renversée en arrière de profil à droite* (Head of dead Michel Le Peletier de Saint-Fargeau, thrown back in profile to the right), 1793, engraving, Paris, Bibliothèque Nationale de France.

Additional file 5: Fig. S5. Fragment of Le Peletier drawing by David. Jacques-Louis David, *Fragment d'une étude de tête masculine vue de trois quarts, tournée vers la droite, les yeux clos* (Fragment of a study of a male head, three-quarter view, facing right, eyes closed), 1793, Paris, Le Louvre museum, Département of Graphic Arts, RF 5200 (verso).

Additional file 6: Fig. S6. Convention Hall. New Convention Hall at the Tuileries, formerly Machines Hall, on May 20 1795. Illustration for *Paris à travers les Ages* (Firmin-Didot, 1875), engraving.

Additional file 7: Fig. S7. Hauer's painting. Jean-Jacques Hauer, *La Mort de Marat*, 1794, oil on canvas, Lambinet Museum (Versailles).

Additional file 8: Fig. S8. Marat's death mask. Marat's death mask, 1793, plaster, 15.5 cm x 29.5 cm, Bibliothèque municipale de Paris.

Additional file 9: Fig. S9. Morel's engraving. *Marat Assassiné d'après David*, after 1793, Antoine Alexandre Morel (1765-1829) engraved in 1794 from Wicar's drawing (at the request of David between November 14 1793 and January 1794), Petit Palais, Musée des Beaux-Arts de la Ville de Paris.

Additional file 10: Fig. S10. Marat left hand fingers. Detail of the left hand from the IRR image. The blue arrows show the drawn features that are not consistent with the hand currently visible. The thin line painted over the fingers and identified as the feather tip is highlighted in red.

Acknowledgements

The authors sincerely thank Michel Dragnet, General Director of the RMFAB for his commitment that greatly assisted this research. The authors would like also to express their gratitude to Ludovic Godfrin, Modern painting collection keeper at the RMFAB, for his technical assistance. The authors are grateful for the support of the University of Liège and of the RMFAB.

Author contributions

CD did the conception and design of the work. CD and DS have performed the in situ measurements (imaging, XRF and Raman). CD, DM, DS and FV have interpreted the results of the analysis. CD wrote the manuscript with the help of DS. All authors read and approved the final manuscript.

Funding

The authors acknowledge support from the Belgian Science Policy Office (BELSPO, Brussels) through the FED-tWIN project Face to Face (FED-tWIN2019-prf060).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests.

Received: 20 October 2022 Accepted: 9 January 2023

Published online: 31 January 2023

References

1. Face-to-Face project. <https://fine-arts-museum.be/en/research/research-projects/face-to-face>. Accessed 30 Sep 2022.
2. Kruff H-W. An antique model for David's Death of Marat. *Burlington Mag.* 1983;125(967):604–97.
3. Greenhalgh M. David's Marat Assassiné and its sources. *Yearb Engl Stud.* 1989;19:162–80. <https://doi.org/10.2307/3508048>.
4. Crow T. *Emulation. Making artists for revolutionary France.* London and New Haven: Yale University Press; 1995.
5. Guicheteau S. David, La fabrique du génie [David, the factory of genius]. Paris: Ellipses; 2018.
6. Sheldon L. Methods and materials of David's Marat. In: Vaughan W, Weston H, editors. *Jacques-Louis David's Marat.* New York: Cambridge University Press; 2000.
7. Strivay D, Clar M, Rakkaa S, Hocquet F-P, Defeyt C. Development of a translation stage for in situ non invasive analysis and high-resolution imaging. *Appl Phys A.* 2016;122(11):950. <https://doi.org/10.1007/s00339-016-0476-y>.
8. Hocquet F-P, Garnir H-P, Marchal A, Clar M, Oger C, Strivay D. A remote controlled XRF system for field analysis of cultural heritage objects. *X-Ray Spectrom.* 2008;37(4):304–8. <https://doi.org/10.1002/xrs.1076>.
9. Hocquet F-P, Calvo del Castillo H, Cervera Xicotencatl A, Bourgeois C, Oger C, Marchal A, Clar M, Rakkaa S, Micha E, Strivay D. Elemental 2D imaging of paintings with a mobile EDXRF system. *Anal Bioanal Chem.* 2011;399(9):3109–16. <https://doi.org/10.1007/s00216-010-4281-8>.
10. Solé VA, Papiillon E, Cotte M, Walter P, Susini J. A multiplatform code for the analysis of energy-dispersive X-ray fluorescence spectra. *Spectrochim Acta, Part B.* 2007;62(1):63–8. <https://doi.org/10.1016/j.sab.2006.12.002>.
11. Lauwers D, Hutado A, Tanevska V, Moens L, Bersani D, Vandenberghe P. Characterisation of a portable Raman spectrometer for in situ analysis of art objects. *Spectrochim Acta Part A Mol Biomol Spectrosc.* 2014;118:294–301. <https://doi.org/10.1016/j.saa.2013.08.088>.
12. Centeno S, Mahon D, Carò F, Pullins D. Discovering the evolution of Jacques-Louis David's portrait of Antoine-Laurent and Marie-Anne Pierrette Paulze Lavoisier. *Herit Sci.* 2021. <https://doi.org/10.1186/s40494-021-00551-y>.
13. Thénot J-P. *Les Règles de la Peinture à l'huile: Dédiées à Son Ami et élève M. Raffort [Rules of oil painting: dedicated to his friend and pupil M. Raffort].* Danlos, Paris 1847.
14. Chaussard P-J-B. *Le Pausanias Français. Etat des Arts du Dessin en France, à l'ouverture du XIXe Siècle: Salon de 1806 [The French Pausanias. State of the drawing arts in France, at the beginning of the 19th century: Salon of 1806].* F. Buisson, Paris 1806.
15. Coupin P-A. *Essai sur J.L. David, Peintre d'histoire, Ancien Membre de l'Institut, Officier de la Légion-d'honneur [Essay on J.L. David, History Painter, Former Member of the Institute, Officer of the Legion of Honor].* Jules Renouard, Paris 1827.
16. Lenoir A. *David, Souvenirs Historiques [David, Historical Memories].* Paris: P. Baudouin; 1836.

17. David J-L. Décret qui accorde les honneurs du Pantheon à Marat du 24 brumaire an 2. 14 9bre (Novembre) 1793 [Decree granting the honors of the Pantheon to Marat of 24 brumaire year 2. 14 9ber (November) 1793] (1793). <https://catalogue.bnf.fr/ark:/12148/cb44369369r>
18. Rosenberg P, Prat L-A. Jacques-Louis David 1748–1825: Catalogue Raisonné des Dessins [Jacques-Louis David 1748–1825: Catalog Raisonné of Drawings]. Milan: Leonardo Arte; 2002.
19. Prat L-A. Le Dessin Français Au XVIIIe Siècle [French drawing in the 18th century]. Paris: Louvre éditions; 2017.
20. Schnapper A, Sérullaz A. Jacques-Louis David: 1748-1825. Catalogue de L'exposition Au Musée National du Château de Versailles, 26 Octobre 1989–12 Février 1990 [Jacques-Louis David: 1748-1825. Catalog of the Exhibition at the National Museum of the Palace of Versailles, October 26, 1989–February 12, 1990]. Réunion des musées nationaux, Paris (1989)
21. Mazeau G. Le Bain de L'histoire. Charlotte Corday et L'attentat Contre Marat (1793–2009) [The Bath of History. Charlotte Corday and the Attack on Marat (1793–2009)]. Champ Vallon, Ceyzérieu 2009.
22. Pérignon A-N. Catalogue des Tableaux de Galerie et de Chevalet, Dessins, études, Livres de Croquis, de M. Louis David [Catalog of Gallery and Easel Paintings, Drawings, Studies, Sketchbooks, by M. Louis David]. Réunion des musées nationaux, Paris 1826. <http://catalogue.bnf.fr/ark:/12148/cb409931017>
23. Schnapper A. David, la Politique et la Révolution [David, politics and the revolution]. Paris: Gallimard; 2013.
24. Thomé A. Vie de David: Premier Peintre de Napoléon [Life of David: Napoleon's First Painter]. Maison Baudoin frères, Bruxelles: Tarlier et Grignon; 1826.
25. Explication par ordre des numéros, et Jugement motivé Des ouvrages de Peinture, Sculpture, Architecture et Gravure, exposés au Palais National des Arts [Explanation in order of numbers, and reasoned judgment of the works of painting, sculpture, architecture and engraving, exhibited at the national palace of arts]. HJ Jansen et comp, Paris 1793.
26. Wildenstein G. David. Les Beaux-Arts, Paris 1793.
27. Delécluze E. Louis David, Son école et son temps, souvenirs [Louis David, His school and his time, souvenirs]. Paris: Didier; 1855.
28. Hautecoeur L. Louis David. Paris: La Table Ronde; 1954.
29. Cabanès A. Marat Inconnu. L'Homme Privé. Le Médecin. Le Savant. D'après des Documents Nouveaux et Inédits [Marat Unknown. The Private Man. Doctor. The Scientist. From New and Unpublished Documents]. A. Michel, Paris 1924. <https://gallica.bnf.fr/ark:/12148/bpt6k86305723/f430.item>
30. Carol A. L'embaumement, Une Passion Romantique [Embalming, a romantic passion]. Ceyzérieu: Champ Vallon; 2015.
31. Fabre d'Églantine P-F-N. Portrait de Marat [Marat's portrait]. Maradan, Paris 1793. <http://catalogue.bnf.fr/ark:/12148/cb30414199d>
32. David J. Le Peintre Louis David : Souvenirs et Documents Inédits [The Painter Louis David: memories and unpublished documents]. Paris: Victor Havard; 1880.
33. Alvin M, Navez Fr J. Sa Vie, Ses Oeuvres et Sa Correspondance [Fr. J. Navez: His life, his works and his correspondence]. Bruylant-Christophe et Cie, Brussels 1870.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- Convenient online submission
- Rigorous peer review
- Open access: articles freely available online
- High visibility within the field
- Retaining the copyright to your article

Submit your next manuscript at ► [springeropen.com](https://www.springeropen.com)
