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► **To cite this version:**

Charlotte Guichard, Anne-solenn Le Hô, Hannah Williams. Prussian Blue: Chemistry, Commerce and Color in Eighteenth Century Paris. *Art History*, 2023, 46 (1), pp.154-186. 10.1111/1467-8365.12695 . hal-03773473

**HAL Id: hal-03773473**

**<https://hal.science/hal-03773473>**

Submitted on 23 Nov 2023

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# Prussian Blue: Chemistry, Commerce, and Colour in Eighteenth-Century Paris

Charlotte Guichard, Anne-Solenn Le Hô, Hannah Williams

Jacques-Louis David's portrait of Jacobus Blauw (plate 1) is striking for its liberal use of blue. Standing out against the soft grey background, the extensive blue passages of the sitter's jacket cover at least a quarter of the canvas and emerge again in tonal echoes throughout the scene: in the turquoise-blue tablecloth, the enamel of the snuffbox, the glass of the inkwell, and the luminous irises of Blauw's eyes. For David, blue must have seemed an apt chromatic choice for a sitter whose name – Blauw – meant 'blue' in his native Dutch. More than a mere witty trope, however, David's use of blue also created an evocative fashioning of self for this Dutch citizen, sent to Paris in 1795 as *Ministre Plénipotentiaire* to negotiate the Treaty of the Hague by which France recognized the young Batavian Republic. David's blue provided the perfect foil to frame Blauw's illuminated face, its cool tonality lending a calm gravitas to this moment of civic endeavour. It may also have been a discrete symbolic reference to the deep blue of the new Batavian flag.<sup>1</sup> Whatever the precise artistic reasoning behind these colour choices, David's decision to use such a large amount of blue paint in this portrait was, by 1795, one that could be made with relative ease, largely unhindered by the financial or practical concerns of cost, quality, or longevity that had encumbered European artists in preceding centuries. Such increased freedom around the use of blue in late eighteenth-century France was due to a range of technical advances in artists' materials, but foremost among them was the invention, nearly a hundred years earlier, of the synthetic pigment known as Prussian blue, which David used so liberally in this portrait.<sup>2</sup>

**Detail from Nicolas Lancret,  
*Pleasures of Bathing*, c. 1725  
(plate 10).**

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DOI:  
10.1111/1467-8365.12695  
Art History | ISSN 0141-6790  
46 | 1 | February 2023 | pages  
154-187

The story of Prussian blue – from its accidental discovery in Berlin at the beginning of the eighteenth century, to its revolutionary impact on artists' canvases across Europe – is a compelling and oft-told episode in histories of colour. According to most accounts, it began in the workshop of an alchemist called Johann Konrad Dippel, where, in around 1704 or 1706, a pigment maker called Johann Jacob Diesbach was attempting to prepare red lake using cochineal insects.<sup>3</sup> Unwittingly he added some recycled potash that had earlier been contaminated with animal blood, when Dippel had used it to make a medicinal oil for treating hysteria, among other things. When Diesbach added this potash to his solution, instead of obtaining the red powdery material of cochineal lake, the unexpected result was a deep blue precipitate, quickly recognized as an intriguing new pigment in its own right. Between 1708 and 1716, Diesbach began working with a new partner, Johann Leonhard Frisch – a member of the recently formed *Königlich-Preußische Akademie des Wissenschaften* (Royal Prussian Academy of Sciences) – to sell this new blue pigment to painters.

1 Jacques-Louis David,  
*Portrait of Jacobus Blauw*,  
1795. Oil on canvas, 92 × 73 cm.  
London: National Gallery.  
Photo: © National Gallery.



Keeping the recipe secret for nearly twenty years, they began exporting Prussian blue across Europe, including to Italy, England, Switzerland, Russia, and France.<sup>4</sup> Probably reaching Paris between 1710 and 1714, Prussian blue was supposedly an immediate hit with French painters. By 1716, it had become so popular, according to Frisch's correspondence, that the imports of his Prussian blue had been a factor in the closure of two of Paris's ultramarine manufactories, formerly the unmatched blue of choice for oil painters.<sup>5</sup> Eventually, in the 1720s, the secrets of Prussian blue's recipe were revealed. Initially published and circulated through Europe's scientific academies and learned societies, the recipe – a complex and much debated set of ingredients and procedures (as we shall see) – passed subsequently through networks of manufacturers, who set up local factories and put an end to the Prussian monopoly. This increase in supply supposedly led to a growth in demand, for as soon as Prussian blue appeared on the market, so the story goes, Europe's painters snapped up this brand-new and much-needed alternative blue pigment, keen to make use of it on their canvases.

From its legendary accidental origins to its rapid spread across Europe, the story of Prussian blue has become a narrative of successful commercialization (in the economic sphere of art materials) and of transformative innovation (in the aesthetic context of art production). It is summed up succinctly by the French historian of colour, Michel Pastoureau, who states that, in the history of blues, ‘everything changed in the first half of the eighteenth century’ with the invention of this pigment, which ‘permitted feats that had been impossible for centuries’ and ‘transformed the palettes of painters for almost two hundred years.’<sup>6</sup> Prussian blue’s origin story is without doubt a captivating tale, not least because much of it is true, if exaggerated in parts. But, as Sarah Lowengard has argued, sensationalizing stories like this in the history of colours often leave the most important questions unasked.<sup>7</sup> They concentrate on innovation and dramatic ruptures, but leave little space to explore the actual patterns of usage by artists or to examine the messier aspects of a pigment’s development. Far more fascinating, we contend here, are the details that are glossed over in those mythic retellings and the crucial insights that these gaps and complexities offer, not only for histories of art, but also for histories of chemistry and commerce. Indeed, it is the intersections between these worlds of art, chemistry, and commerce – their spaces, networks, materials, and actors – that emerge so vividly in this article, where a ‘thick description’ of Prussian blue offers a more granular retelling of its history at a specific time and place.<sup>8</sup>

This microhistorical investigation of Prussian blue in eighteenth-century Paris was inspired in part by the anthropologist Tim Ingold’s call to ‘follow the materials’.<sup>9</sup> Taking one material – Prussian blue – this study traces the pigment back, decontextualizing it from the painted surfaces of canvases in order to recontextualize it in a much larger and more complex social world of Enlightenment science, industry, and commerce. Following Prussian blue in this way has required a variety of sources and a combination of methods: artworks (analysed through both physico-chemical techniques and art-historical interpretation); technical literature to retrieve the historical substance (including chemical treatises and practical manuals); and archival documents to trace it through the city (via commercial contracts and inventories of factories, shops, and artists’ studios). The artworks examined in this article emerged from a large-scale survey of technical analysis, which developed a corpus of over one hundred eighteenth-century French artworks in which Prussian blue had been detected through the technologies of conservation science, including infrared and Raman spectroscopy, X-ray fluorescence (XRF), false-colour infrared photography, fibre optics reflectance spectroscopy (FORS), and analysis of paint samples under scanning electron microscopes (SEM).<sup>10</sup> From these physico-chemical traces, we then followed the material back, through written sources and documentary evidence, to reconstruct Prussian blue’s passage through the sequence of stages that led to its presence in the paint layer: invention, theorization, experimentation, manufacture, sale, preparation, and use. Conceived as a *chaîne opératoire*, André Leroi-Gourhan’s term denoting the social acts and processes in the lifecycle of an artefact, this framing sheds light on both Prussian blue’s transformations as a substance (from its raw ingredients in the factory, to barrels of pigment waiting for distribution; from ground pigment for sale in shops, to mixed oil paint on the palette) and the social worlds it traversed (via a network of chemists, apothecaries, manufacturers, entrepreneurs, colour merchants, and artists).<sup>11</sup>

Following Prussian blue through eighteenth-century Paris has involved an intrinsically interdisciplinary journey. Tracing the pigment’s movement through and between the city’s intersecting worlds of chemistry, commerce, and art has required a collaborative traversing of the disciplinary boundaries that often compartmentalize those terrains into conservation science, socioeconomic history, and art history.

Drawing those fields together via the eighteenth-century threads that already connected them, this article reconfigures the story of this 'revolutionary' colour through a multifaceted transdisciplinary lens. What emerges in the process, however, is the somewhat inconvenient revelation that Prussian blue may not have been quite so revolutionary after all, or at least, not in the ways that are conventionally presented. From our investigation, it appears that Prussian blue's apocryphal narrative of rapid popularity and transformative effects on eighteenth-century art has been somewhat exaggerated, at least in its Parisian chapter. As we shall see in the three sections of this article, Prussian blue's development by French chemists reveals a material with enduring instabilities and inconsistencies, its local commercialization by Parisian manufacturers and colour merchants was far from swift, and while its use by Parisian painters increased steadily, the uptake began cautiously and the pigment never overtook the market entirely.

Yet if Prussian blue's triumph over the blues has been oversimplified, then our investigation suggests that its role in the larger history of artists' materials has been underestimated. Distinguished as the world's first modern synthetic pigment – derived not from a natural, animal, vegetable, or mineral source, but from an artificial chemical compound – Prussian blue marks a crucial turning point in the development of artists' materials.<sup>12</sup> Chronologically and materially, it initiated the vital intersection of chemistry, commerce, and art that would drive production of paint from the nineteenth century onwards. Following the Revolution, in a France rebuilding itself on industrial and commercial success, the innovation of Prussian blue became a model emulated in efforts to invent synthetic versions of existing pigments, like Thenard's cobalt blue (1802) and Guimet's ultramarine (1826), or to deploy newly discovered chemicals to create entirely new pigments, like the use of chromium (discovered in 1797) to make chrome yellow.<sup>13</sup> Prussian blue's legacy can as such be compellingly traced, not only in the evolution of blues, but in the increasing importance of physico-chemical innovation, technological invention, and market investment in art world economies. Such a historical narrative is arguably traceable all the way to the recent development of Vantablack – the blackest black – by Surrey NanoSystems and its controversial exclusive licensing as a pigment to the artist Anish Kapoor in 2016.<sup>14</sup> In that crucial evolution from premodern artisanal workshop practices to modern mass-production and scientifically engineered materials, Prussian blue's story sheds light on the tentative steps, complex developments, and experimental transitions that initiated the earliest moments of this shift.

In developing this interdisciplinary microhistory of Prussian blue in eighteenth-century Paris, our investigation into the pigment's intersecting worlds builds on rich bodies of scholarship from different fields, drawing their often disparate methodological threads together, while also contributing original empirical research and interpretative analysis. Historians of science have been concerned with piecing together the evolution of Prussian blue as a chemical product, from its discovery in Berlin and the initial secrecy surrounding its composition, to the publication of the recipe in the 1720s and further developments throughout the century by France's chemists.<sup>15</sup> Conservation scientists and chemists, meanwhile, have undertaken invaluable investigations into the chemical properties of Prussian blue, exploring its stability as a pigment, and drawing connections between the original recipes and procedures used in its production and its subsequent materiality and behaviour on the canvas.<sup>16</sup> For curators, conservators, and art historians, studies have explored Prussian blue's use as a pigment, especially for oil painting, with particular attention paid to artists active in the early decades of the eighteenth century, during the pigment's first period of adoption.<sup>17</sup>



Building on these important foundations, this article exploring Prussian blue in eighteenth-century Paris has been guided by three objectives, examined in its three sections. Our first aim was to retrieve Prussian blue as a historical material. In the eighteenth century, an era before stable chemical formulae, what exactly was this substance known as Prussian blue? What were the ingredients, recipes, and procedures used in its production? Was 'Prussian blue' consistent as a material, or did it evolve over time? And if so, what were the effects of those differences for its use as a pigment? Our second objective was to recover the actors and spaces involved in the circulation of Prussian blue in Paris, in order to investigate the social and commercial networks formed by this material. Following this material from chemist's laboratory to artist's studio, via the factories and shops of colour merchants, we asked: who were the people in this world of Prussian blue and where was it located? Last, but certainly not least, we sought to measure the use of Prussian blue by artists in Paris to gain a more nuanced understanding of its supposed rapid adoption and transformative impact. Did Prussian blue really come to dominate the eighteenth-century palette? How was it used by artists and did that change across the century?

### **Prussian Blue in Chemistry: Experimenting with Colour**

Although discovered in Berlin, the first procedure for Prussian blue's preparation was published in London in 1724 by Royal Society naturalist, John Woodward.<sup>18</sup> This was immediately followed in the Society's *Philosophical Transactions* by observations and experiments from his colleague, the chemist John Brown.<sup>19</sup> Almost as soon as the secret of Prussian blue had been revealed, French chemists began actively researching its methods of preparation. With his strong links to English scientists, the first, in 1725, was Etienne-François Geoffroy, doctor, chemist, and member of the Académie Royale des Sciences in Paris.<sup>20</sup> Having spent brief periods in England, Geoffroy was also a Fellow of the Royal Society and played a major role in the circulation of ideas between these two learned societies.<sup>21</sup> After his death, French experiments on Prussian blue continued with findings published by several chemists, among them his brother Claude-Joseph Geoffroy (1743), Pierre-Joseph Macquer (1749), Louis-Claude Cadet de Gassicourt, an apothecary-major at the Hotel Royal des Invalides (1755 and 1757), and Jean Hellot (1756).<sup>22</sup> Read together, these publications offer valuable insights into the evolution of scientific activity around Prussian blue. They account for the starting point in the *chaîne opératoire* of its production in Paris, in which extensive research and numerous experiments ultimately enabled scientists to understand and control the production processes in order to obtain and stabilize desired tones in predictable quantities. Perhaps more unexpectedly, these texts also reveal the role of chemistry in creating and maintaining connections between painters, colour makers, and others involved in the production process. These different fields of activity emerge not as distinct and separate, but as often intersecting and overlapping, with chemistry contributing actively to the improvement of art and craft practices, as well as seeking advances for industry, health, and the economy.<sup>23</sup>

What was new about Prussian blue? In their published observations, eighteenth-century chemists presented it as having many qualities desirable in a blue pigment. Etienne-François Geoffroy described a range of impressive characteristics, including its versatility and relative stability. He noted that it: 'combines perfectly with oil, water, or other binders'; could also be used 'in distemper'; 'grinds finely and softly enough for miniature painting'; and could withstand exposure to 'air', 'eau forte', 'other acids', and 'quicklime'.<sup>24</sup> Geoffroy also emphasized the new colour's advantages over other pigments. Oil painters, he claimed, had long lacked a good blue. There

were, he acknowledged, many blues available – the most beautiful being ultramarine, prepared from lapis lazuli – but they were not always durable, they faded or were sandy, they required extensive grinding, did not mix well with other colours, or lacked the qualities necessary for delicate work.<sup>25</sup> Moreover, unlike many of the materials used in painting at this time, Prussian blue was also noted as posing no significant health risks. By the mid-eighteenth century, chemistry's interest in the use of Prussian blue extended beyond painting to dyeing, in response to the demands of a textile industry also seeking the benefits of the new pigment.<sup>26</sup> In order to enhance Prussian blue's efficacy as a material for this variety of uses, France's chemists embarked on a programme of chemical analysis, observing a range of different preparations and testing ideas through experimentation.

Methods of preparing Prussian blue differed, but in general it was a lengthy process comprising around forty separate operations, conducted over two days, and requiring several ingredients, utensils, and large quantities of boiling water. The chemists' reports on Prussian blue reflect chemical theories of the period, in particular the development of the new chemistry of salts, which, as Bernard Joly argues, led to further advances in the field more generally.<sup>27</sup> Yet despite such developments towards what might be described as 'modern chemistry', eighteenth-century chemists had not yet detached their thinking from older alchemical traditions. This is evident, for instance, in regular references to phlogiston theory in relation to substances regarded as flammable, such as blood.<sup>28</sup> The French chemists' interest in the origins of the blue colour in Prussian blue also reflect an attachment to a German chemistry still very much linked to its alchemical past. Etienne-François Geoffroy, for example, thought that the pigment owed its blue colour to iron bitumen, an oily substance extracted from vitriol using animal oils and alkali salts (here calcined ox blood and a tartar-type alkali).<sup>29</sup>

All the descriptions of the manufacturing process published by French chemists of the Académie des Sciences followed the same overall principle, with variations and detours.<sup>30</sup> First, an alkali (a fixed alkali salt, also called nitre fixed by tartar) was made from tartar and/or saltpetre.<sup>31</sup> After a great fulmination or detonation, this base was mixed with dried animal blood, in most cases ox blood, ground and gradually heated red-hot for two to four hours in a crucible to produce a blood lye. These three steps are also found in Woodward's and Brown's descriptions, derived directly from German methods, first published in the Royal Society's *Transactions*.<sup>32</sup> The blood lye was then boiled in water and filtered, and the resulting pale-yellow solution was next mixed with a solution of iron salt (vitriol or copperas) and alum, and sometimes spirit of wine, producing a pale, slightly bluish-green precipitate.<sup>33</sup> This precipitate was then treated with hydrochloric acid (spirit of salt), washed, air-dried, and ground into a fine powder or preserved in the form of a dark blue block. Alternatively, it could simply be air-dried for several days and thoroughly washed, to give a paler, more blue-green Prussian blue. Modern reconstructions of eighteenth-century synthesized Prussian blue, undertaken in two invaluable collaborative studies, suggest that this paler colour was probably due to the presence of aluminium hydroxide, a white compound.<sup>34</sup> Meanwhile, the greenish tint in such versions was due to an absence of filtration, causing an excess of ferrous ion to form a yellowish hydrous iron oxide that discoloured the blue tone of the resulting precipitate.

Eighteenth-century chemists paid great attention to the tones and nuances of Prussian blue. Their experiments might even be described as developing a chemistry of colour and certainly suggest a conception of Prussian blue that privileged chromatic over material properties.<sup>35</sup> The term 'pigment' never appears in the chemical

literature; Prussian blue is always described as a colour and defined in terms of its visual function, rather than as a category or class of compound. In descriptions of the steps necessary to prepare Prussian blue, all the intermediate compounds are described by colour ('mountain green', 'emerald', or 'sea green') and instructions relating to temperature often refer to the colour of the flame or substance (Geoffroy describes heating something 'until nearly red' or until the flame becomes 'light blue'), despite the existence of thermometers in this period (Cadet de Gassicourt notes that the temperature should be 285° on a Fahrenheit thermometer).<sup>36</sup> Low, medium and high calcination temperatures would produce pale blue, darker blue, and dark purple tones, respectively. Chemists evaluated their operations according to the resulting blue, with descriptions such as 'bluish', 'brilliant', 'pure', 'royal', 'celestial', 'beautiful and bright' and so on. These observations appear to confirm that their experiments were guided by the ultimate aim of using the blue material as a coloured substance. Many variations of Prussian blue were found, with at least ten different shades, depending on the acidity of the vitriols and spirits of salt used.<sup>37</sup> Different shades of blue were also obtained by mixing darker Prussian blue with a paler variant. With varied objectives, some experiments mixed Prussian blue with other colours, for example with 'blanc de Rouen' or 'blanc de Paris' to lighten it,<sup>38</sup> cochineal red to give a more purplish tone, or saffron to enhance the colour.<sup>39</sup> These experiments were conducted with varying degrees of success, with the quality of colour always a key criterion of achievement.

Bernard Le Bovier de Fontenelle, the Académie's secretary, described the range and complexities in Prussian blue's preparation as a 'maze' of different operations.<sup>40</sup> This maze was in fact due more to the concerns of industry than science, as it had resulted from chemists' responses to the needs of manufacturers when it came to producing Prussian blue. These included issues of pollution, cost, efficiency, and stability. Such considerations led them to vary the nature and proportion of ingredients and the stages of preparation. To reduce urban pollution, chemists experimented with replacing some compounds with others. For example, ox blood was usually collected from what Claude-Joseph Geoffroy described as 'dirty places' (presumably abattoirs), which people of a more 'delicate' nature found disgusting.<sup>41</sup> As alternatives, Geoffroy tried replacing ox blood with other animal products, like deer antler and raw silk, which produced a very bright, light blue. To lower production costs, chemists attempted to reduce the number of operations required, making the process quicker and easier; they substituted expensive ingredients for cheaper ones (Geoffroy suggested replacing nitre with soda alkali); and they developed improvements to ensure quality and consistency.<sup>42</sup> In some cases, efficiency and quality were achieved simultaneously, as in the case of Cadet de Gassicourt's experiments with the water used in Prussian blue's preparation. There had been much discussion among the chemists about the chemical characteristics and provenance of the water used ('rain water', 'boiled water', 'Seine water') in order to avoid residual salts (which altered the colour of the blue) and any precipitation of iron contained in mineral water. Following the discovery of a new mineral water source in Passy (on the outskirts of Paris) at the home of Monsieur and Madame Calsabigi, Cadet published several memoirs on its properties including a detailed account of its effects in the production of Prussian blue.<sup>43</sup> This 'Passy water' was particularly rich in iron, which removed the need for vitriol acid and alum in order to heighten and fix the colour. He described obtaining a beautiful dark blue, 'superior to ordinary Prussian blue', in a process that produced far larger amounts of this 'perfect' colour than had ever been obtained by his predecessors.<sup>44</sup>

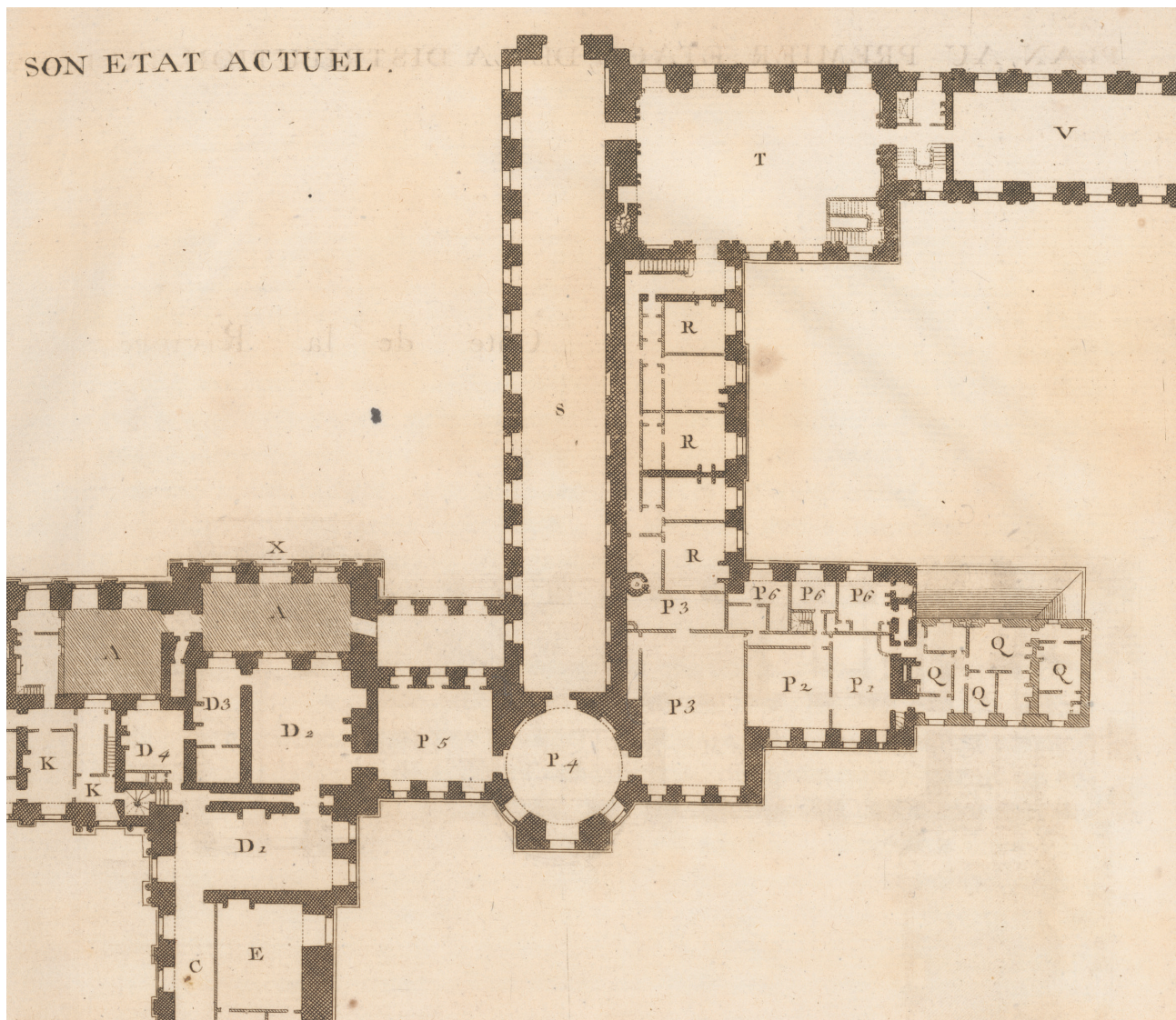
Along with the requirements of industry, chemists were also acutely attuned to the needs of artists, evident especially in their concern with the durability of Prussian blue



on the canvas. Despite its many benefits as a pigment, for instance, it was known to become yellowed over time. Investigating this undesirable interaction, Claude-Joseph Geoffroy determined that it was likely due to residues of acid (spirit of salt) left from poor washing of the precipitate. The acid was actually added to eliminate the yellowing caused by remnants of vitriol, but unless thoroughly removed it could itself trigger a yellow discolouration following exposure to air and humidity.<sup>45</sup> This was why, according to Geoffroy, one saw so many skies painted with Prussian blue quickly ruined by yellowing effects. To prevent this, he recommended avoiding the repeated use of acids in Prussian blue's production, but also advised painters to protect their Prussian blue with several layers of varnish.<sup>46</sup>

Chemists did not test the behaviour of Prussian blue in painting themselves, but their recommendations on its use by artists and reports on examples suggest a direct and fruitful interface between chemistry and painting. For chemists at the Académie des Sciences and artists at the Académie de Peinture et de Sculpture, these exchanges were facilitated by the proximity of the two institutions on the first floor of the Louvre (plate 2), where their neighbouring apartments were joined by a door between the scientists' library (D2 on the plan) and the artists' meeting room (P5). While there is no record of official institutional collaboration on Prussian blue experiments, the space of the Louvre would have provided ample opportunity for informal interaction, not least given the many artists' studios also located in the palace.<sup>47</sup> The chemists' work on Prussian blue was clearly informed by observation of its use in practice, whether in preparation (notes on its versatility in different binders, its amenability to fine grinding),<sup>48</sup> or in application (remarks on its frequency or manner of use).<sup>49</sup> In particular, they noted its regular use in the painting of skies and the sea, and to achieve effects of distance ('les parties fuyantes') in perspectival recession.<sup>50</sup> Hellot noted that he had seen it used as a glaze for 'blue skies and draperies', for which he considered it as effective as 'the most beautiful ultramarine', but with the added 'advantage of being resistant to the impression of air'.<sup>51</sup> Given the scarcity of artists' writings on the practicalities of art-making in this period, these chemists' observations offer valuable insights into studio process and artistic choices, which as we shall see, are borne out through analysis of the paintings themselves.

In terms of the larger context of Prussian blue in Paris, the Académie's chemists had from the outset steered their efforts towards a more localized production of the material, ensuring greater proximity between sites of manufacture and consumption. Already in the 1720s, Etienne-François Geoffroy's early experiments were oriented around comparisons with Prussian blues produced in other countries (notably Germany and England) with a view to achieving French superiority in method.<sup>52</sup> By the 1740s, his younger brother noted explicitly a desire to avoid 'using too much from abroad' in his continued efforts to improve French recipes, while, in the meantime, 'putting more people in a position to undertake the operations' by widely circulating in French the principal procedures followed in Berlin and England.<sup>53</sup> As their research progressed, French chemists were keen to maintain a monopoly of their new processes, believing Parisian Prussian blue to be of better quality than those varieties sold abroad.<sup>54</sup> As an apothecary, Cadet de Gassicourt adopted a slightly different position from the Académie's chemists, while taking care not to contradict them.<sup>55</sup> Taking a more practical approach emphasizing the colour's use, Cadet wanted to make the process of preparation quicker and easier, with the additional aim of enabling more people to do it.<sup>56</sup> This mid-century inclination to increase local production of Prussian blue coincided with efforts to extend its use from the painter's studio to the textile industry, to enhance the dyer's craft in the same way, as Macquer put it, that 'chemistry



**2** Detail of plan of the first floor of the Louvre, showing the location of the Académie des Sciences (rooms labelled 'D') next door to the Académie de Peinture et de Sculpture (rooms labelled 'P'). From Jacques-François Blondel, *Architecture Française*, Paris: Chez Jombert, 1756, vol. 4. Paris: Bibliothèque nationale de France. Photo: © BnF.

had enriched painting'.<sup>57</sup> Investigations by Macquer and Hellot into the advantages of Prussian blue over existing dyes (based on indigo and woad) found it to be a resilient, cheap colour that was fully absorbed by the fibres, but which remained soft and silky in texture.<sup>58</sup> Encouraging dialogue between laboratories and dyers' workshops, on the grounds that the chemists of the Académie were looking for practical solutions to practical problems, Macquer ended his *mémoire* with a call to action.<sup>59</sup> Referring to the dyers as 'les gens de l'art' (practitioners of the art) and noting magnanimously that some of them were 'very intelligent', Macquer expressed a desire that further experimentation with his published findings on Prussian blue would continue among these practitioners.<sup>60</sup>

While it is difficult to evaluate the real impact of academic science on workshop practices, it is evident from the chemists' publications on Prussian blue that they envisaged their theoretical interpretations and experiments in an embedded relationship with both manufacturing industries and artistic trades. Alongside the circulation of scientific ideas among members of learned societies (not least the initial publication of the secret recipe by the Royal Society), the development of Prussian blue was even more dependent on the less formalized connections that emerged



between chemists, colour makers, artists, and dyers, and the confluence of their shared objectives across disparate sectors. Exploring the chemistry of Prussian blue has drawn us into networks of production less frequently traversed by art historians, expanding the Beckerian art world and its 'cooperative activity' to these laboratories of chemists and apothecaries.<sup>61</sup> In the following section, we shift the perspective more directly to spaces of commerce and industry, encountering Prussian blue in the factories of manufacturers and the shops of colour merchants.

### **Prussian Blue in Commerce: Making and Selling Colours**

In the world of chemistry, Prussian blue emerged as a substance in process, a set of variable ingredients and experimental procedures. Moving into the world of commerce, this same material became a commodity: an item of sale, produced in large quantities, and designed to turn a profit. In some ways, commerce transformed Prussian blue into a more stable entity – a market product – and yet the commercial world of artists' materials in the eighteenth century was far less defined than that might suggest, a space of flux and ambiguity in terms of its actors, activities, and locations. Following Prussian blue through its commercial history in eighteenth-century Paris reveals an industry far slower to develop than the colour's apocryphal narrative implies, but also offers fascinating insights more broadly into the spatial expansion of urban sites of the colour trade, the changing social and juridical perimeters of industrial production, and the new professions and networks becoming embedded in the art world. Crucial to this narrative is the figure of the 'colour merchant', which would become a profession in its own right in the nineteenth century, but which emerged in this period as a role performed between a nexus of apothecaries, grocers, industrialists, entrepreneurs, and artists.<sup>62</sup> These connections are evident throughout the world of Prussian blue, not least in relationships between two major eighteenth-century painters and two apothecaries/merchants: François Boucher and Cadet de Gassicourt; and Louis-Léopold Boilly and Louis-Julien Gohin.

Given its nebulous form, reconstructing the commerce of Prussian blue in eighteenth-century Paris has involved extensive archival research and a range of primary sources. To retrieve its actors and spaces, we searched the Minutier Central of the Archives Nationales for an assortment of documents – inventories of factories and shops; commercial contracts between manufacturers and merchants; accounts; price lists; and personal papers – which together revealed a web of connections formed by Prussian blue and offered a sense of its economic value and urban geography. To flesh out the histories of industry and commerce emerging from these records, we also consulted a technical literature of treatises and handbooks, often written by colour merchants themselves, revealing the complex circuits of knowledge and skills required in the preparation of pigments in spaces of production between the chemist's laboratory and the artist's studio.

Notwithstanding the emphasis on local production of Prussian blue found in the chemists' reports, documentary evidence suggests that Paris's Prussian blue industry did not actually begin to develop until the mid-eighteenth century.<sup>63</sup> Coinciding with a period of intensive chemical research in the 1740s and 1750s, this was the moment that colour suppliers and manufacturers came to see Prussian blue as a potential industrial product in which to invest. One of the earliest traces is a legal document from March 1751, which records that three 'merchants and makers of colours' (Louis Grandjean, Michel Savoye and Adrienne Morieux) founded a company for the 'production of Prussian blue and other colours of all kinds'.<sup>64</sup> They jointly invested to buy the necessary equipment for making Prussian blue and to rent a house on the city's Left Bank in Rue Notre-Dame des Champs, where they intended to live and make the

colours. This document suggests that Prussian blue had become a new commercial opportunity for those already working as colour producers and merchants. The production space they created – somewhere between artisanal workshop/home/factory – reveals the relatively small scale of the business and investment involved. The short-lived company collapsed in July 1751, when one of the partners, Adrienne Morieux, married another colour producer, Jacques de Fairchild de Ville, and launched a different partnership.

At this time, the colour merchant was still a new professional category, usually found in combination with other trades.<sup>65</sup> Before 1789, when ‘colour merchants’ finally achieved the status of a separate group in the trade lists of the *Almanach de Paris*,<sup>66</sup> they could be found in different corporations, all of which claimed a monopoly on the activity.<sup>67</sup> In 1632, *maîtres épiciers* (master grocers) had gained the right to sell pigments, but not to grind them, so they sold raw pigments to artists, who would prepare the colours themselves. A century later, in 1738, after a long series of legal battles with the *épiciers*, the *maîtres peintres* (master painters) from the Paris guild obtained the right to ‘prepare, produce, sell and retail canvases, oil and tempera colours [...] for Painters and Sculptors to use’.<sup>68</sup> The apothecaries also joined the fray to protect their right specifically to prepare and sell chemical products, generating a need, crucial for Prussian blue, to define this notion of a ‘chemical product’ within the world of commerce and corporations. In legal terms, chemistry was defined in this context as the ‘art of decomposing’ and ‘separating substances’.<sup>69</sup> Over the course of the century, these competitions produced a shift in the balance of power, in which the rise of Prussian blue reveals the broader impact of invention and innovation on the commerce of artists’ materials. While at the beginning of the century, the *épiciers* were in the strongest position, the ruling of 1738 gave the apothecaries and painters the upper hand, until they too were challenged by the Prussian blue entrepreneurs.

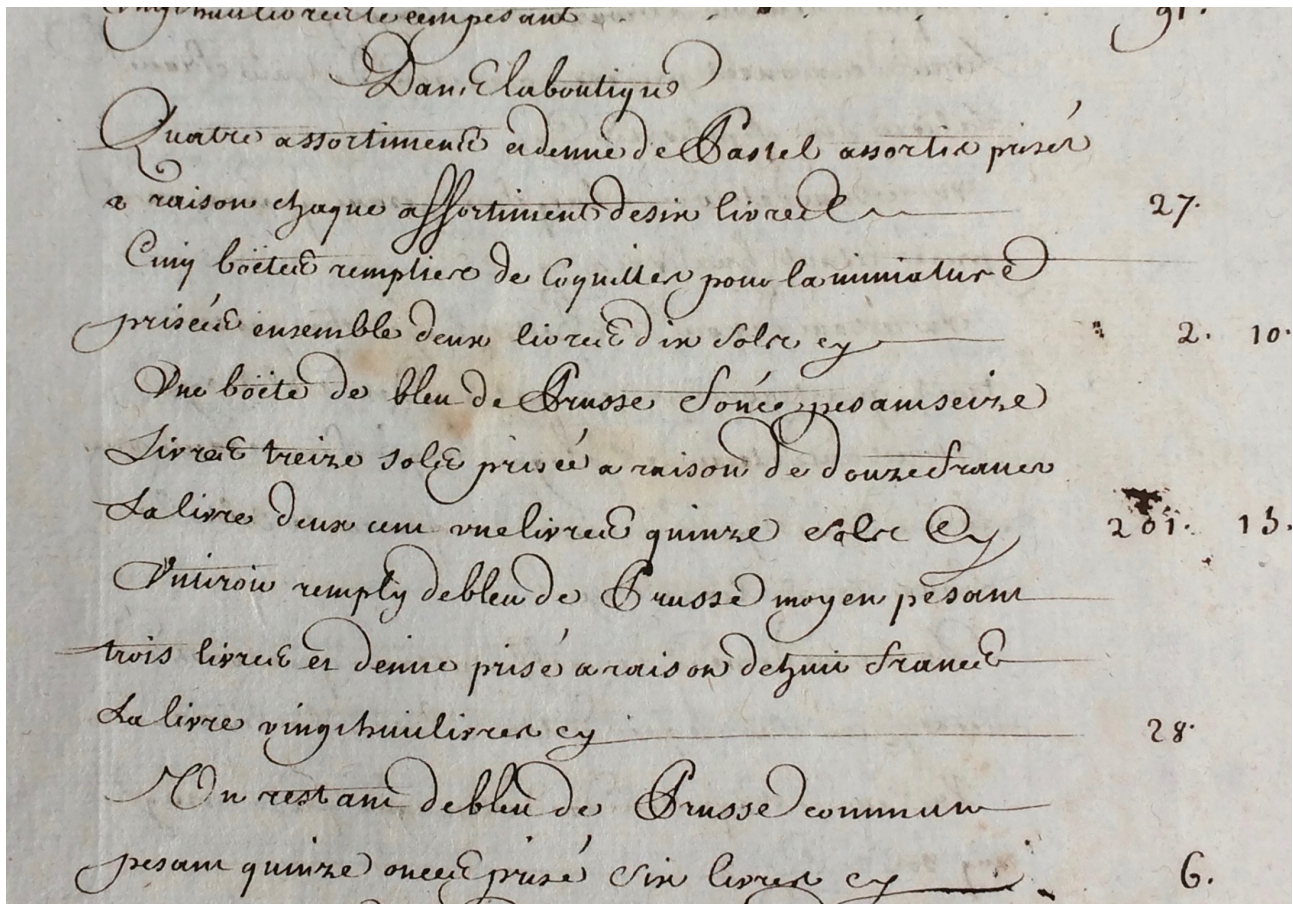
In 1764, the corporation of master painters seized the premises of two ‘makers of Prussian Blue’ and went to court to prevent them from trading in the new colour. Jean-Baptiste Gly and Antoine-Robert Dheur had established a Prussian blue manufactory in 1761 in the city’s industrial south, near the Gobelins tapestry factory and the centre of the dyeing trade, and had proved far more commercially successful than the earlier trio of 1751.<sup>70</sup> The court case of 1764 was particularly notable, as Sarah Lowengard has argued, due to the nature of the defence mounted by Gly and Dheur, who argued that their business was a ‘chemical factory’ not a ‘colour manufactory’.<sup>71</sup> At the trial, the court heard expert testimony from the chemist, Hellot, who declared Prussian blue indeed to be a product of ‘chemical operations’, arguing accordingly that Gly and Dheur should be authorized to continue their business.<sup>72</sup> Their premises and equipment were returned and Gly and Dheur became two of the city’s most successful Prussian blue manufacturers, with a dynasty that continued into the nineteenth century. The complex legal arguments, of which this offers only the briefest account, reveal both the economic importance of the colour trade in Paris and its imprecise status, corresponding to differing conceptions of products and materials.

The interest in Prussian blue shown by mid-century investors and entrepreneurs reflects its earlier rise to become a successful commercial product no longer confined to the status of scientific innovation. For while local production may have taken longer to establish, the commercial market for Prussian blue in Paris had already made inroads. Early traces of the trade include the mention of different variants of Prussian blue, sometimes distinguished by origin, but more usually by colour or quality. For example, in 1743, the shop inventory of the colour merchant, François-Charles Prévotel, on Place de l’Ecole, listed three types (plate 3):

A box of dark Prussian blue weighing 16 livres 13 sols ... 201 livres and 15 sols  
 A drawer full of medium Prussian blue weighing 3 livres and a half ... 28 livres  
 Remnants of common Prussian blue weighing 15 ounces ... 6 livres<sup>73</sup>

Along with offering insights into its materiality as a commercial product (stored in boxes and drawers), these documents also reveal something of its circulation among artists. The list of creditors attached to the inventory of Prévotel's estate includes the names of at least three painters: Nicolas Delobel (1693–1763), a painter at the Académie Royale de Peinture et de Sculpture; Jacques-André Portail (1695–1759), a keeper of the king's pictures known also as a draughtsman; and 'Veuve Godefroy', or Marie-Jacob Godefroy (1701–75), a picture restorer for the royal collection.<sup>74</sup> The varying types and prices of Prussian blue itemized in Prévotel's shop suggest that quality was already a determining factor in its sale. Dark Prussian blue was the most expensive at twelve livres per pound, medium Prussian blue sold for eight livres, and common Prussian blue for six livres four sols. These distinctions made in the retail trade between different qualities of Prussian blue were reinforced over the course of the century. In 1773, Jean-Félix Watin, a master painter and colour dealer, was selling four varieties of Prussian blue in his shop at Porte Saint-Martin, 'La Renommée des couleurs', the retail prices of which he published in his book *L'art du peintre, doreur, vernisseur* (plate 4). These included local Prussian blues of different shades as well as Prussian blue 'from Berlin' (which was notably more expensive). As methods of production proliferated and the industry grew, the range of shades and types of production proliferated and the industry grew, the range of shades and types available grew considerably. By 1807, Louis-Julien Gohin, a prominent entrepreneur

3 Page from inventory of Charles François Prévotel's shop, Paris, 29 July 1743. Paris: Archives nationales de France. Photo: © Charlotte Guichard and Hannah Williams.





4 Detail of blue pigments from a price list of products sold by colour-merchant Jean-Félix Watin. Published in Jean-Félix Watin, *L'art du peintre, doreur, vernisseur*, Paris: Grange & Durand, 1773, second edition. Paris: Bibliothèque nationale de France. Photo: © BnF.

<i>Bleu.</i>			
'Azut . . . . .		1	10
Email des quatre feux en poudre . . . . .		1	4
Cendre bleue en poudre . . . . .		9	
Indigo en pierre . . . . .		12	
Bleu de Prusse, de Berlin, en pierre . . . . .		40	
Différens bleus de Prusse de diverses nuances, à 8, 10, 12 18 liv. . . . .			
Outremer, l'once . . . . .		96	
Cendre d'Outremer . . . . .		48	

and producer of Prussian blue and other colours, was selling at least eight different varieties of Prussian blue, distinguished as products simply by number (e.g. 'Prussian blue no. 1', or 'Prussian blue no. 5').<sup>75</sup>

Where prices are concerned, the disparate nature of the archival records and changes in currency across the century make comparisons difficult. Watin's Prussian blue prices in 1773 (between eight and forty livres per pound) are certainly higher than in Prévotel's shop thirty years earlier, possibly because of a shift in the value of the product or due to general inflation in Paris. Comparisons of pigment prices more generally reveal Prussian blue's cost relative to other available blues: usually more expensive than indigo, but far cheaper than ultramarine, which Watin sold for ninety-six livres per ounce (or 1,536 livres per pound).<sup>76</sup> If ultramarine remained a luxury item in the context of the eighteenth-century market, Prussian blue might be considered a 'populuxe' pigment – not as precious and durable as the luxurious ultramarine, but offering solid colour and pleasant tonality at an affordable price. Prussian blue's affordability encouraged its use not only in painting, but also (as we shall see) in decorative objects, architecture, and increasingly textiles, particularly following Jean-Michel Raymond's (1766–1837) publication of the process for dyeing silk with Prussian blue instead of indigo in 1811 (plate 5).<sup>77</sup> This market for cheaper materials reflects a broader trend in the art market itself, which had started in the Quattrocento, when the core valuation of paintings according to their materials (gold, ultramarine) began to be superseded by valuation based on the painter's skill.<sup>78</sup>

Prussian blue's variety in type and price suggests both its success as a commercial product for the arts (at least by the 1740s) and the ongoing experiments throughout the century to keep improving it. From the chemists' reports as much as from the records of colour merchants, it is clear that the common term 'Prussian blue' was not a single thing, but rather encompassed various recipes and substances. This allowed space in the market to innovate and target improvements directly at the consumer. Cadet de Gassicourt's experiments with Passy water, discussed in the previous section, are a case in point. In his accounts, the apothecary emphasized the benefits for artists of his 'beautiful, very dark blue', noting, for instance, that painters could 'expect to see [their works] retain freshness for a long time', as well as finding his product easier to crush



**5** Samples of silk thread dyed in Prussian blue (left) and indigo (right) at the Manufacture Impériale des Gobelins, 1813. Paris: Archives nationales de France (F/12/2252). Photo: © Charlotte Guichard and Hannah Williams.

under the muller when preparing the pigment.<sup>79</sup> Even more interestingly, Cadet notes working closely with at least one artist in the development of his Prussian blue: the ‘renowned’ (as Cadet describes him) François Boucher, who reportedly tried the new pigment ‘with success’ and so provided an endorsement of the product.<sup>80</sup>

Cadet was an apothecary with a shop on Rue Saint-Honoré, very close to the Louvre, so presumably had a retail market in mind for his Prussian blue among the Académie’s artists. Naming Boucher, First Painter to the King, was undoubtedly intended to encourage this market, arousing curiosity among painters, generating publicity, and lending authority to his new colour. But this connection also reveals the non-commercial interactions and relationships that existed between artists and sellers. If Boucher did indeed use Cadet’s Prussian blue before it was available for sale – and there is no reason to doubt Cadet here – it means that Boucher must have known the chemist, visited his laboratory or received him in his studio, and discussed Cadet’s discoveries and Boucher’s trials.<sup>81</sup> In 1821, when Cadet’s son Charles-Louis died, he had two paintings by Boucher in his possession.<sup>82</sup> Since Boucher was no longer a fashionable painter by this point, it seems likely that Charles-Louis inherited the works from his father. Whether Louis-Claude purchased the paintings or received them as gifts from Boucher, these objects provide further material evidence of the connection between the two men. While recent studies have examined Boucher’s place in Paris’s networks of natural history (not least thanks to his important collection of shells), his links to chemistry remain less deeply explored.<sup>83</sup> Yet his interest in curiosities could certainly have intersected with an interest in the chemistry of colour: at the sale of Dubois Jourdain’s collection in 1766, for instance, he paid eighteen livres for several pieces of copper and silver ore, remarkable for their ‘beautiful blue’.<sup>84</sup>

For most of the eighteenth century, Prussian blue production in Paris remained a small and specialized industry, with manufacturers of the pigment far



outnumbered by the expanding trade of colour merchants retailing it to the public.<sup>85</sup> It was not until the last quarter of the century that the Prussian blue industry began to expand, with enough new factories opening to create three key centres, each corresponding with other artistic trades: the Faubourg Saint-Marcel to the south (home to the dyeing industry); the Faubourg Saint-Antoine to the east (known for its furniture trade); and the Faubourg Saint-Martin to the north (an important neighbourhood for colour merchants and guild painters). By 1800, the industry was firmly established and would continue to develop through a shifting impetus around colour production in this period. Following the loss of French colonies and the Revolutionary Wars, the local production of colours, notably indigo, had acquired national importance as a means of saving France from dependency on other nations. Victor-Noël Vernezobre, son of the artist and pastel-supplier Jean-Nicolas Vernezobre, wrote to the Minister of the Interior asking for public money to produce 'new colours, beautiful enough to replace those that come to us from the Indies and abroad at excessive prices'.<sup>86</sup> In his letter, he mentioned that Jacques-Louis David used colours produced by his father and could testify to their quality, thus offering further incentive for state support. For Prussian blue, this national interest was cemented in 1803 when, to promote industrial and commercial success, the Société d'Encouragement pour l'Industrie Nationale held a competition to certify officially the best French-produced Prussian blue. The competition was won by two Parisian colour makers, brothers Michel and Pierre Gohin, who were awarded a medal and 600 francs prize money.<sup>87</sup>

**6** Louis Léopold Boilly, *The Gohin Family*, 1787. Oil on canvas, 94 x 135 cm. Paris: Musée des Arts décoratifs. Photo: © Les Arts Décoratifs.





Increasing state interest and expanding markets also saw a shift in the scale of production, witnessed in the emergence of colour entrepreneurs, like Louis-Julien Gohin, nephew of the prize winners. Along with numerous other business interests (from indigo to chocolate), Gohin owned a large factory that produced Prussian blue in huge quantities. After the death of his second wife Marie-Suzanne Arthur in 1807, her estate inventory reveals the extraordinary scale of colour production at his factory, with output of Prussian blue totalling nearly five tonnes (4,959 kg) along with extensive raw materials for further production, including over seven tonnes of ox blood (7,600 kg).<sup>88</sup> Through Gohin we also find yet another close connection between merchant and artist. Louis-Léopold Boilly painted portraits of the Gohin family at least twice. In 1787, he painted *The Gohin Family* (plate 6) representing this entrepreneurial dynasty, with Louis-Julien at the centre flanked by his parents, wife, sister and brother-in-law, Henry-Jean-Baptiste Bouquillard, whose gesture towards a maritime scene underscores the colonial commerce behind their success. A few years later, Boilly painted a more intimate family scene of maternal interaction, depicting *Madame Louis-Julien Gohin, Her Son, and Her Stepdaughters* (c. 1804; Ramsbury Manor Foundation).<sup>89</sup> These portraits are evidence of a relationship between Gohin and Boilly spanning at least two decades, but tantalizingly they may also be material traces of the Prussian blue sold in Gohin's factory. As yet there has been no technical analysis on the pigments Boilly employed here, but his use of blue is notable in both paintings, in clothing, drapery, upholstery, the seascape, and the punctuating mark of blue on the central doorframe. It is certainly conceivable that Boilly's portrait of the entrepreneur was also an advertisement of Gohin's wares.

**7 Jean-Siméon Chardin, *Attributes of the Painter*, c. 1725–26. Oil on canvas, 50 × 86 cm. Princeton: Princeton University Art Museum. Photo: Princeton University Art Museum.**

### Prussian Blue in the Artist's Studio

Moving to the last stages of Prussian blue's preparation and use brings us to the artist's studio. Those developments in chemistry and commerce traced in the previous sections of this article had a direct impact on the practices, economics, and materiality of the eighteenth-century studio: the activities performed there, the costs of materials,





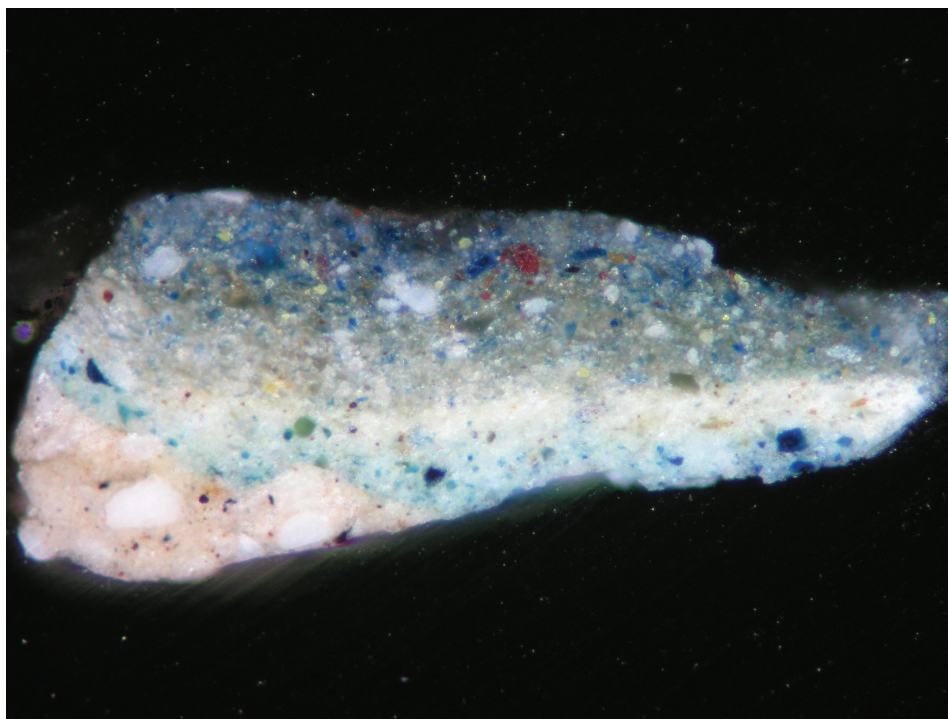


**8 François Lemoyne, *Hercules Clubbing Cacus*, 1718. Oil on canvas, 131 × 170 cm. Paris: Musée du Louvre (inv. 6714). Photo: © RMN-Grand Palais (musée du Louvre)/Adrien Didierjean.**

and the creative possibilities afforded by different colours. In terms of preparation, for instance, the studio had traditionally been the site for key tasks like grinding pigments and mixing them with binders, work often undertaken by assistants for whom this was an important part of their training. Outsourcing the preparation of pigments in various ready-to-use forms (most famously the metal paint tube of the 1840s) would transform the nature of labour in the studio, a process that was in transition through the eighteenth century. Already in the late seventeenth century, Roger de Piles noted the sale of pre-mixed oil paint in pigs' bladders, two of which were depicted as habitual studio items by Jean-Siméon Chardin in his *Attributes of the Painter* (plate 7) from the 1720s.<sup>90</sup> At the other end of the century, a painting like Boilly's celebrated *Meeting of Artists in Isabey's Studio* (1798; Musée du Louvre, Paris) presents the conceptual conclusion of this outsourcing – a studio where labour is banished, the space instead claimed for sociability and connoisseurship.<sup>91</sup> The reality, however, was less neat. Eighteenth-century artists may have taken advantage of colour merchants' pre-ground and pre-mixed pigments, but inventories of their studios reveal the continuation of manual practices in tools like mullers and grinding stones. In 1789, for example, Jean-Baptiste-Marie Pierre had twenty-eight bottles of colours ready-mixed in water and a granite grinding stone so large it needed its own wooden base.<sup>92</sup>

Following Prussian blue through the studios of eighteenth-century Paris builds a more detailed picture of these shifts, particularly with regard to those most elusive of questions around choice in the creative process. Why would an artist choose Prussian blue? It might be assumed that such decisions were driven largely by tonal criteria

**9** Paint sample (no. 10924) from the mountain in the background of Lemoyne's *Hercules Clubbing Cacus*. Photo: © C2RMF Myriam Eveno.



(finding the right blue to achieve the desired colour), but observing the choices around a single pigment actually suggests a more complex confluence of interests, concerns, and practicalities. For this part of our investigation, artworks themselves have been the primary sources of evidence, offering an archaeological record of artistic choices in the layers of paint on their surfaces. Working with a corpus of a hundred artworks in which Prussian blue has been detected through physico-chemical analysis or imaging techniques, we traced patterns over time to understand the evolution of its use across the century, while also focusing on specific objects as case studies of individual practice.<sup>93</sup> This material analysis permits a reassessment of Prussian blue's apocryphal story of rapid uptake, in which, almost from its arrival in Paris, it supposedly became the most widely used blue in oil painting. In an effort to gauge more accurately the impact of this new synthetic impact on eighteenth-century artistic production, our analysis also highlights the decisive intersections between these developments and the pigment's chemical optimization and commercial circulation.

Observing patterns of use chronologically confirms some aspects of Prussian blue's anecdotal history but challenges others, for while its use certainly increased substantially over the century, its start was slower and its dominance less complete than often assumed. Among artworks produced by Parisian painters in the first two decades of the eighteenth century – when Prussian blue's recipe remained secret and local production had not yet started in Paris – there were, as might be expected, very few instances of its use. It is possible that Antoine Coypel and Charles de La Fosse were using it at this time, but the earliest definite example identified in our research was in François Lemoyne's *Hercules Clubbing Cacus* (plate 8). Painted in 1718, Lemoyne's *Hercules* dates from before the publication of the recipe in French by Geoffroy and thus offers an example of a Parisian painter using Prussian blue imported from Berlin, almost certainly from the workshop of Frisch, who still had a monopoly over the pigment in the 1710s.<sup>94</sup> Interestingly, but perhaps not surprisingly, Lemoyne seems to have been fairly cautious in his use of the pigment. This can be seen in the



stratigraphy of paint layers in samples, such as the one taken from the mountains in the background (plate 9). Prussian blue is only evident in lower levels, while ultramarine appears in the upper levels, suggesting that Lemoyne used Prussian blue only to sketch the composition, before switching to ultramarine in the final paint layers.<sup>95</sup> This painting from an early moment in the pigment's history thus appears to be a tentative experiment with a new material: ventured during the preparatory stages of the work, but replaced with a more proven (if costlier) option in the finishing stages. Lemoyne's risk aversion might have been prompted by uncertainties over the chromatic behaviour or longevity of the new pigment, but was almost certainly intensified by the significance of this particular painting, which was his reception piece for admission to the Académie, and arguably the most important work he had produced in his career to date.

From the few instances traced before the 1720s, Prussian blue's use in this period appears to have been quite limited.<sup>96</sup> Its use increased, however, over the next two decades, following the publication of the recipe in 1724 and those early experiments by chemists in the Académie des Sciences. Among the best known of its early adopters are Jean-Antoine Watteau and his circle of *fête-galante* painters, including Nicolas Lancret, Jean-Baptiste Pater, and Jacques de Lajoue.<sup>97</sup> In Lancret's *Pleasures of Bathing* (c. 1725) (plate 10), for instance, Prussian blue was used to paint the sky and the blue dress of the seated woman, showing its tonal versatility when mixed with lead white.<sup>98</sup> Another artist from this period who appears to have engaged keenly with Prussian blue in the 1730s and 1740s is Jean-François de Troy.<sup>99</sup> In De Troy's work, the pigment takes on even greater prominence, often featuring strongly within the composition. In his *Coronation of Esther* (1738) (plate 11), for example, it takes centre-stage in the robe of the kneeling woman in the foreground. A sample taken from the figure's shoulder (plate 12)

**10 Nicolas Lancret, *Pleasures of Bathing*, c. 1725. Oil on canvas, 97 × 145 cm. Paris: Musée du Louvre. Photo: © RMN-Grand Palais (musée du Louvre)/Jean-Gilles Berizzi.**





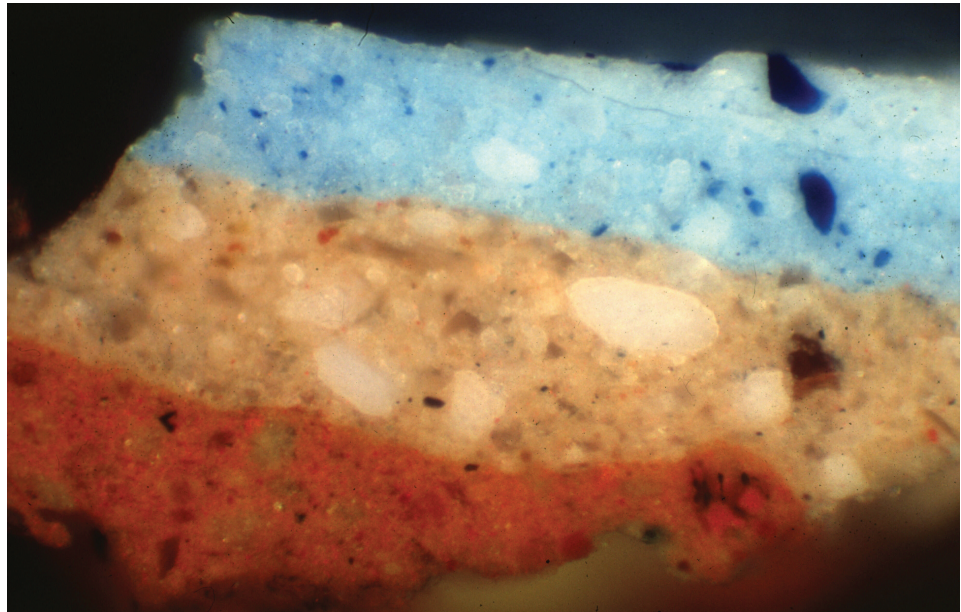
shows Prussian blue in the top two layers of paint, mixed with varying quantities of lead white to achieve the desired tonal effects of light and shade in the garment. In contrast to Lemoyne's earlier experimental use of Prussian blue in the hidden preparatory stages, in De Troy's works it became a pigment of choice, used regularly and confidently in a range of roles, and in a way that serves to emphasize the colour's chromatic qualities.

Notwithstanding this early use of the pigment, it was in the second half of the century that its use increased substantially. Most objects in our corpus bearing detectable traces of Prussian blue date from the period between the 1750s and 1790s. This coincides with archival findings regarding the development of local production of the pigment in Paris, emerging as a small industry at mid-century before expanding in the final decades. This necessarily had an impact on the availability, quality, and affordability of Prussian blue in Paris, where, in these later decades, it became an established material in the colour boxes of the city's painters. Our research found Prussian blue in paintings by numerous artists working across a range of genres, among them (in roughly chronological order): Chardin, Boucher, Joseph Vernet, Joseph-Marie Vien, Louis-Jean-François Lagrenée, Jean-Baptiste Greuze, François-Hubert Drouais, Jean-Honoré Fragonard, Anne Vallayer-Coster, and David. These artists used Prussian blue in their artworks in a variety of ways. In some cases, it was subtly mixed with other colours, like in the pale blue sky of Fragonard's *Blindman's Buff* (1755; Musée du Louvre, Paris) or in the vibrant green foliage of Vien's *Lover Crowning his Mistress* (1773; Musée du Louvre, Paris). In other cases, it was the true star of the work, flaunting its distinctively deep tonal qualities.<sup>100</sup> In Drouais's *Portrait of the Comte de Vaudreuil*

11 Jean-François de Troy, *Coronation of Esther*, 1738. Oil on canvas, 328 × 470 cm. Paris: Musée du Louvre. Photo: © RMN-Grand Palais (musée du Louvre)/Jean-Gilles Berizzi.



**12** Paint sample (no. 4414) from the shoulder of the kneeling woman in the foreground of De Troy's *Coronation of Esther*. Photo: © C2RMF Jean-Paul Rioux.



(1758; National Gallery, London), for instance, Prussian blue was used for Vaudreuil's blue velvet coat, conveying its shimmering texture, and, as we have already seen, it was used so generously in David's portrait of Blauw (see plate 1) that it became the dominant colour of the composition.<sup>101</sup>

By the second half of the eighteenth century, Prussian blue had become commonplace in the standard range of pigments used by painters in Paris. But as the contents of colour merchants' shops revealed, other blue pigments were still available throughout the eighteenth century. When faced with this selection of blues, why might an artist choose Prussian blue over the alternatives? And was it the preferred option? Among the criteria that drove artists' decisions regarding pigments, one of Prussian blue's most lauded advantages was that it was comparatively cheap. As we saw in Watin's price list (see plate 4), there was a dramatic difference between the staggering cost of ultramarine (1,536 livres per pound) and even the most expensive type of Prussian blue (forty livres per pound). With local Prussian blue available at the same shop for even less (eight to eighteen livres per pound), it could be acquired more cheaply than indigo (twelve livres per pound), but was still considerably more expensive than smalt (a mere one livre four sols per pound). Cost alone would seem to put ultramarine in a category all of its own, leaving the other blues to compete against each other. But it is interesting to note that, for oil painting at least, the most frequent choice encountered in our corpus was between ultramarine and Prussian blue. In the context of the wider art world, this sample might be skewed by the socioeconomic status of the artists concerned, since the vast majority of paintings that have undergone pigment analysis were produced by the elite artists of the Académie (painters who often worked for the Crown and the aristocracy). But it also suggests that, while money was certainly a factor in pigment choice, other criteria could also prove influential.

When it comes to money, two landscapes by Vernet offer an intriguing comparison regarding the role of cost in choosing blues. In many ways, *A River with Fishermen* (plate 13) and *A Sea-Shore* (plate 14) are quite similar works; they are painted on supports of comparable size and their compositions are structurally analogous, with a body of water winding its way between landscaped *coulisses* towards a low horizon. In the choice of blue pigment for their skies, however, they differ: in *Sea-Shore*, Vernet used





**13 Claude-Joseph Vernet,**  
**A River with Fishermen, 1751.**  
 Oil on canvas, 59.1 × 74.3 cm.  
 London: National Gallery.  
 Photo: © National Gallery.

ultramarine; in *River*, he used Prussian blue. One compelling explanation for his different choices is to be found in the monetary value that Vernet intended for the finished artworks. As Humphrey Wine has shown, the client who commissioned *Sea-Shore* expressly wanted a luxury object, sparing no expense along the way, including a costly copper support (quite rare for Vernet) that set him back forty-seven livres, with a further seventy-two livres spent on the frame.<sup>102</sup> While there is no specific record of the client requesting ultramarine, Vernet's use of it certainly adds to the artwork's opulence, further enhancing its value and justifying its luxury status. Much less is known about the history of *A River with Fishermen*, but it was clearly a more 'standard' work, painted on canvas, using less costly materials and depicting a lower, more generic subject. Whether it was commissioned by a less wealthy client or painted speculatively for the market, Vernet's *A River with Fishermen* is an instance where the more 'populuxe' Prussian blue evidently sufficed.

Another decision-driving factor was the pigment's aesthetic qualities. This was likely another criterion in Vernet's choices for *River* and *Sea-Shore*, where the two subjects called for different chromatic qualities. In the elegant port scene of the *Sea-Shore*, the brightness of ultramarine produced a clear and luminous sky, ideally suited to the refined scene of aristocratic figures surveying a majestic vista of maritime civilization on the shoreline. By contrast, in *River*, the deep colour of Prussian blue



produced a darker rugged sky, creating a more appropriate tone for this rustic scene of peasants fishing. A further instance is to be found in another landscape (a genre that nearly always requires a choice of blue), this time by Charles-François de Lacroix. His *Seaport* (plate 15) offers a particularly interesting case because Lacroix used both ultramarine and Prussian blue on the same canvas.<sup>103</sup> Employing both suggests that this was not a decision determined by cost, but rather by the particular tonal qualities that the artist sought from each. For the radiant sky, glowing in the light of the setting sun, Lacroix selected ultramarine, harnessing the pigment's lustrous intensity. Meanwhile, he chose Prussian blue to create the colour of the seawater, mixing it with Naples yellow to achieve the desired murky green effect. While Lacroix's swampy sea might not show Prussian blue at its most beautiful, he was exploiting the raw pigment's greenish hue, which resulted from a chemical reaction in some of the methods used in its production. Thus Lacroix's choice was driven by the tonal effects he sought for the different parts of his composition, with each blue pigment admirably performing its task.

A third criterion in colour choice might be described as symbolic value, where there was a semiotic relationship between the pigment and the thing it represented. A compelling instance of this kind of choice is to be found in Lagrenée's *Death of the Dauphin* (plate 16), another painting in which the artist used both ultramarine and Prussian blue for different purposes. Lagrenée employed ultramarine for the blue sashes worn by the members of the royal family, but chose Prussian blue to paint the purple curtain held by putti above the deathbed.<sup>104</sup> While ultramarine certainly provided a bright

**14 Claude-Joseph Vernet,**  
*A Sea-Shore, 1776. Oil on  
copper, 62.2 × 85.1 cm.*  
London: National Gallery.  
Photo: © National Gallery.





blue for the sashes, Lagrenée's choice in this instance may also have been driven by the pigment's symbolic connotations. Ultramarine had, since the Middle Ages, been widely regarded as a prestigious substance due to its extravagant cost. As a result, it was often used for similarly prestigious subjects, most notably to depict the robe of the Virgin Mary, who became iconographically associated with the colour blue.<sup>105</sup> Lagrenée's use of ultramarine to convey royal status via the sashes seems to continue in that tradition. Its use here was not to increase the monetary value of the artwork (as with Vernet's *Sea-Shore*), but rather to indicate the symbolic value of the subject painted (the sash as signifier of royal status). Meanwhile, the curtain draped overhead was simply a curtain, connoting nothing beyond itself, so the blue pigment selected did not need to carry any additional symbolic weight.

While it has been possible to generate speculative conclusions about Prussian blue's use in the studios of oil painters, it has been more difficult to analyse its use in a broader artistic context. The vast majority of objects where Prussian blue has so far been detected are oil paintings, but this reveals more about the priorities driving technical analysis than it does about actual patterns of use in the eighteenth century. Other artistic trades' interest in Prussian blue is evident in the work of chemists to adapt its preparation (especially for dyeing textiles) and in the expansion of the commercial industry, not least in its geographic siting. The centre of production in the Faubourg Saint-Antoine certainly suggests connections to the furniture trade, borne out in a *secrétaire* that once belonged to Madame de Pompadour (plate 17) and is among several pieces of furniture and decorative art in our corpus of works.

**15 Charles-François de Lacroix, *A Seaport*, c. 1760.**  
Oil on canvas, 97.2 × 134 cm.  
London: National Gallery.  
Photo: © National Gallery.





16 Louis-Jean-François Lagrenée, *Death of the Dauphin*, 1767. Oil on canvas, 129 × 96 cm. Fontainebleau: Château de Fontainebleau. Photo: © RMN-Grand Palais (Château de Fontainebleau)/ image RMN-GP.



Lacquered rather than painted, the *secrétaire* was created using a technique known as *vernis Martin* (developed by brothers Etienne-Simon and Guillaume Martin) to imitate Asian lacquers. Analysis of samples taken from the *secrétaire* (plate 18) and several other *vernis Martin* objects in the Musée des Arts Décoratifs has revealed Prussian blue to be a key ingredient in the technique.<sup>106</sup> Overall, objects found in our investigation suggest that Prussian blue was adopted increasingly in oil painting, furniture and decorative arts, textile dyeing, and pastels (including Jean-Baptiste Perronneau's *Girl with a Kitten* (1743; National Gallery, London)), but we also encountered a rarer instance of its use in sculpture. Several traces of Prussian blue were found in samples from the surface of Paul-Ambroise Slodtz's *Dragon* (plate 19), once part of an arched entrance to Antoine Crozat's residence near Saint-Germain-des-Prés.<sup>107</sup> Despite its appearance now as

17 Attributed to Adrien Delorme (ébéniste), Etienne-Simon Martin and Guillaume Martin (vernisseurs), *Secrétaire en pente* (originally from the collection of Mme de Pompadour in the Château de Bellevue), c. 1749–50. Wood, vernis Martin, bronze, 88 × 69 × 43 cm. Paris: Musée des Arts décoratifs. Photo: © Les Arts Décoratifs.



raw stone, Slodtz's *Dragon* was originally painted a blueish-green. Such a discovery suggests that polychromed sculpture may have been more common in this period than previously assumed, in turn shifting our vision of the urban environment of eighteenth-century Paris. While the available data from pigment analysis of decorative objects and sculpture does not yet permit broader interpretation, examples like this underscore the importance of extending our investigations beyond painting to understand the widespread use of Prussian blue and its impact on artistic production, commerce, and urban development.

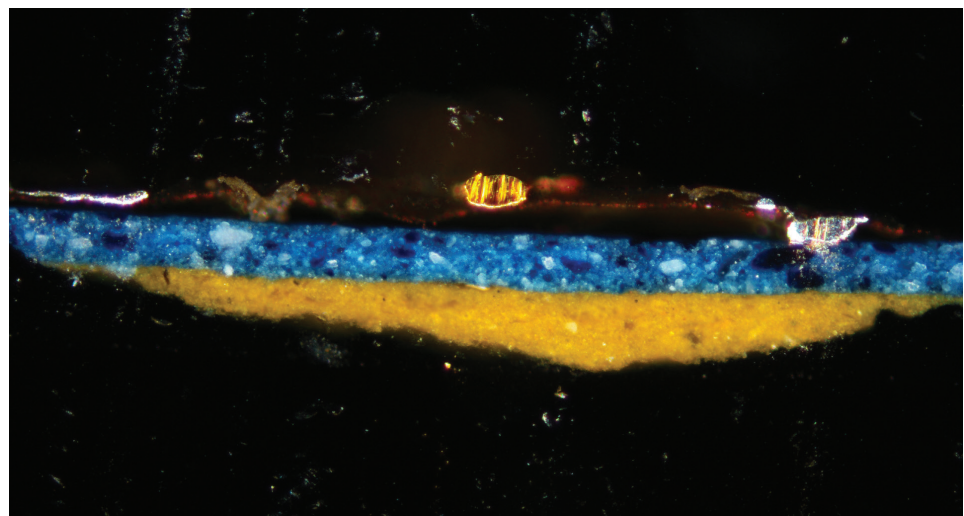
### Conclusion

Prussian blue's celebrated origin story is a dramatic tale of accidental discovery and revolutionary transformation. The microhistorical narrative proposed in this study is somewhat less sensational, if historically far more intriguing. In this alternative history of Prussian blue, we have traced a more nuanced picture of the pigment's



adoption by eighteenth-century artists. Rather than being the revolutionary blue that ‘changed everything’ (*pace* Pastoureau), Prussian blue was not adopted immediately, nor did it supersede the use of other blue pigments. Instead, from tentative beginnings, it increasingly became one of the blues of choice, growing in popularity over the course of the century, but never clearly becoming the principal blue in every painter’s palette. Likewise, tracing it through the world of chemistry, even Prussian blue’s ‘invention’ in Dippel’s Berlin workshop is challenged, for while this was certainly its starting point, the chemical product of Prussian blue was actually created through decades of international experimentation and theorization, leading to a multiplicity of competing recipes and methods. As this article has shown, ‘Prussian blue’ was never a single substance in the eighteenth century, even after its commercialization. Rather, this was a name denoting a synthetic colour that, while sharing tonal qualities, might be composed from different ingredients and processes than another ‘Prussian blue’ sold in the same colour merchant’s shop. Far from shaking market faith in the product, however, these material differences were construed by colour makers and entrepreneurs as enhancing consumer choice, providing customers with a variety of products and a range of prices.

Prussian blue may have been less dramatically transformative in the history of blues than apocryphal narratives suggest, but in the larger history of artists’ materials it was certainly a pigment that changed everything. Emerging through those interconnected worlds of chemists, apothecaries, manufacturers, entrepreneurs, colour merchants, and artists, Prussian blue marks a fascinating starting point in the development of artists’ pigments, which, since the eighteenth century, have come increasingly to sit within that innovative chemistry-commerce-art nexus. Shaped and observed by those intersecting social worlds, Prussian blue’s development in Paris not only poses a challenge to its own origin story, but also to the equally mythical narratives of artistic creation that permeate art history. Distinct from that conventional idea of artistic creation as an intellectual process that begins and ends in the artist’s studio, our approach in this study recontextualizes the creation of an artwork in the broader *chaîne opératoire* of a single pigment used in its making. Placing art objects into this larger ecosystem of production and commerce expands even the kind of ‘art world’ conceived by Howard Becker, implicating an extensive network of actors and spaces in eighteenth-century art-making, evidenced in Boucher’s experiments with Cadet de



**18** Collected sample of Prussian blue from the *Secrétaire* observed with optical microscope. Photo: © C2RMF Céline Daher.



**19 Paul-Ambroise Slodtz,**  
*Dragon keystone from an*  
*arched entryway to the hôtel*  
*particulier of Antoine Crozat*  
*on Rue de l'Egoût, 1728–32.*  
 Stone, 190 × 295 × 135 cm.  
 Paris: Musée du Louvre.  
 Photo: © RMN-Grand Palais  
 (musée du Louvre)/  
 René-Gabriel Ojeda.

Gassicourt, Boilly's relationship with Gohin, or Godefroy's debts at Prévotel's shop. This study has also highlighted the competing aesthetic, practical, and financial decisions that took place in the studio, whether in Lemoyne's cautious testing of a new product, or Vernet's shrewd choices of pigments to harmonize tones or manipulate prices. Moreover, developing a corpus of artworks based on pigment choice has also compellingly eroded some of the canonical narratives in which eighteenth-century art has been embedded. Tracing Prussian blue has, for instance, brought lesser genres like landscape to the fore (with all their blue skies and bodies of water), while also dissolving aesthetic hierarchies by bringing disparate objects together: a royal portrait of the Dauphin (see plate 16) set in relation to a populuxe table (see plate 17).

The alternative history of Prussian blue presented in this article has been guided by two intentions. Firstly, it has sought a 'thick description' of this colour's development in eighteenth-century Paris – a microhistory of a single pigment – to grant new perspectives on the forces, challenges, and motivations at play in and across the worlds of art, chemistry, and commerce during that period. Complicating the sensationalist narratives of rupture so often found in histories of colour, this thick description of Prussian blue reveals instead a slow and uneven development through a series of pragmatic innovations and displacements. Far from distinguishing Prussian blue's creation as a unique development, the pigment's narrative emerges as one firmly embedded in and contingent on a wider landscape of change at this moment with regard to scientific methods, commercial practices, and professional identities. Prussian blue's supersession as the new blue on the block in the early 1800s,



thanks to Thénard's and Guimet's artificial versions of ultramarine, compellingly underscores its place in these histories of innovation as both unprecedented yet unexceptional.

Finally, and more broadly, this article offers a new methodological framework for exploring artists' materials that is grounded in a collaborative interdisciplinary approach. Building on important recent developments in material art histories that emphasize *technè*, materials, and process,<sup>108</sup> our investigation has combined methods from art history, social history, anthropology, and conservation science to explore a rich tapestry of sources including archival documents, chemical treatises, trade manuals, artworks, and technical data from physico-chemical analysis. Brought together through a synthesizing mode of contextual interpretation, this study has been an effort to explore artists' materials at a new scale of analysis, following one pigment simultaneously through all its historical and disciplinary habitats – from the surface of the canvas, the chemist's laboratory, the colour merchant's shop, and back to the artist's studio. A misleading effect of this synthesis, however, might be to imply that this melding of interdisciplinary perspectives takes place without tensions. Though we have sought to resolve these in our analysis, that is certainly not the case, particularly when it comes to disjunctions between the production of technical data and the questions we want to ask of it. The vast majority of technical analysis is undertaken in response to conservation inquiries concerning the preservation or restoration of objects, not for art historians trying to reconstruct art-world networks, or economic historians investigating the commerce of pigments. For a project like ours, that necessarily limits and randomizes the pool of objects to be drawn on, while also leaving some tantalizing gaps in the narrative. Boucher, for instance, was clearly a key figure in Paris's art-chemistry nexus, but very few of his paintings have been subject to the kind of pigment analysis that might confirm how these connections played out on his canvases. As such we hope that this study of Prussian blue might serve both as evidence of the insights to be gained from this interdisciplinary approach, but also as a call for more sustained collaboration between art history and conservation science in order to achieve it.

#### Notes

**This article is drawn from a research project funded by DIM Matériaux Anciens et Patrimoniaux, Région Île-de-France in 2018/19. Our research was facilitated by numerous institutions including: Centre de recherche et de restauration des musées de France (C2RMF), Paris; National Gallery, London; Musée du Louvre, Paris; Wallace Collection, London; and National Gallery of Art, Washington, DC. Our investigations benefited greatly from many individuals who generously lent their time and expertise: Myriam Eveno, Alexandra Gent, Yuriko Jackall, Sigrid Mirabaud, Nicole Ryder, Marika Spring, and Francesca Whitlum-Cooper. We would also like to thank the two anonymous readers for *Art History* for their thoughtful suggestions to improve the text.**

- 1 The Batavian flag replaced the Statenvlag. Both flags were horizontal tribands, but a key difference was the band of blue, which changed from light to deep navy.
- 2 David's use of Prussian blue in the portrait of Blauw has been confirmed through technical analysis. Jo Kirby and David Saunders, 'Fading and Colour Change of Prussian Blue: Methods of Manufacture and the Influence of Extenders', *National Gallery Technical Bulletin*, 25, 2004, 97.

- 3 Prussian blue's early history has been well documented in: Alexander Kraft, 'On the Discovery and History of Prussian Blue', *Bulletin of the History of Chemistry*, 33: 2, 2008, 61–67; Alexander Kraft, 'Addendum to "On the Discovery and History of Prussian Blue"', *Bulletin of the History of Chemistry*, 41: 1/2, 2016, 1–2; Alexander Kraft, 'The History of Prussian Blue', in *Prussian Blue Nanoparticles and Nanocomposites: Synthesis, Devices, and Applications*, ed. Yannick Guari and Joulia Larionova, Singapore, 2019, 1–26.
- 4 Kraft, 'The History of Prussian Blue', 10. Soon after starting the business, Frisch began to sell Prussian blue not only in Berlin and in the Kingdom of Prussia but also in other German regions. In 1710, Prussian blue was sold in England for the first time. In 1711, it was delivered to Switzerland and then in 1716 to Russia. In 1714, Frisch mentions in one of his letters that he sold 100 pounds of Prussian blue.
- 5 Letter from Frisch to Leibniz, 19 September 1716, transcribed in L. H. Fischer, ed., *Joh. Leonh. Frisch's Briefwechsel mit G. W. Leibniz. Ein Beitrag zur Geschichte des geistigen Lebens in Berlin am Anfang des 18. Jahrhunderts*, Berlin, 1896, 47.
- 6 Michel Pastoureaux, *Bleu. Histoire d'une couleur*, Paris, 2000, 115–116.
- 7 Sarah Lowengard, 'Prussian Blue: Transfers and Trials', in *The Materiality of Colour: The Production, Circulation, and Application of Dyes and Pigments*,

- 1400–1800, ed. Andrea Feeser, Maureen Daly Goggin, and Beth Fowkes Tobin, London and New York, 2012, 167.
- 8 Borrowed from Geertz, the concept of thick description conveys our efforts to trace the historically specific material of Prussian blue by recontextualizing it in the web of actions and interactions around it, including observing the ways it was understood by the different actors involved. Clifford Geertz, 'Thick Description: Towards an Interpretative Theory of Culture', *The Interpretation of Culture: Selected Essays*, New York, 1973, 3–30.
  - 9 Tim Ingold, 'The Textility of Making', *Cambridge Journal of Economics*, 34, 2010, 91–201. On microhistorical approaches to the 'trace', see also: Carlo Ginzburg, 'Signes, traces, pistes. Racines d'un paradigme de l'indice', *Le Débat*, 6, 1980, 3–44; Carlo Ginzburg, 'Microhistoire: Deux ou trois choses que je sais d'elle', in *Le fil et les traces. Vrai faux fictif*, Lagrasse, 2010, 361–405.
  - 10 Our survey of technical analysis reviewed over one thousand reports undertaken by conservation scientists at C2RMF on objects in French national museums. This was supplemented with additional technical analysis of artworks undertaken by the National Gallery in London and the National Gallery of Art in Washington, DC. Works included in the corpus were those where Prussian blue had been firmly detected either through infrared and Raman spectroscopy or through a combination of multiple analysis techniques.
  - 11 On the *chaîne opératoire*, see Marie Soressi and Jean-Michel Geneste, 'The History and Efficacy of the *Chaîne Opératoire* Approach to Lithic Analysis: Studying Techniques to Reveal Past Societies in an Evolutionary Perspective', *PaleoAnthropology*, 2011, 334–350.
  - 12 There are earlier synthetic pigments (like Egyptian blue), but Prussian blue is the earliest modern synthetic pigment. See François Delamare, 'Le bleu de Prusse', in *Bleus en poudres: De l'art à l'industrie, 5000 ans d'innovations*, Paris, 2008.
  - 13 Both Thénard's and Guimet's new blues were intended as artificial alternatives to natural ultramarine, which continued to be expensive and limited in supply. Cobalt is also the chemical source of colour in the pigment smalt, but Thénard's experiments were focused on replacing ultramarine, which was a more sought-after colour for artists and, unlike smalt, more compatible with oil. Louis-Jacques Thénard, 'Considérations générales sur les couleurs, suivies d'un procédé pour préparer une couleur bleue aussi belle que l'outremer', *Journal des Mines*, 86, 1803–4, 128–136.
  - 14 Janaki Challa, 'Why Everybody's Mad at Anish Kapoor', *The Architect's Newspaper*, 11 July 2017, <https://archpaper.com/2017/07/anish-kapoor-blackest-black/> (accessed 30 April 2020).
  - 15 On the Berlin history, see Kraft, 'On the Discovery and History', 61–67; and Kraft, 'The History of Prussian Blue', 1–26. On the Paris developments, see Lowengard, 'Prussian Blue', 167–181; Sarah Lowengard, *The Creation of Color in Eighteenth-Century Europe* (Guttenberg e-book, 2005); Christine Lehman, 'L'art de la teinture à l'Académie royale des sciences au XVIIIe siècle', *Methodos*, 12, 2012, <http://journals.openedition.org/methodos/2874>.
  - 16 Jo Kirby, 'Fading and Colour Change of Prussian Blue: Occurrences and Early Reports', *National Gallery Technical Bulletin* 14, 1993, 63–70; Barbara H. Berrie, 'Prussian Blue', in *Artists' Pigments: A Handbook of Their History and Characteristics*, vol. 3, ed. Elisabeth West FitzHugh, Washington, DC, 1997, 191–217; Jo Kirby and David Saunders, 'Fading and Colour Change of Prussian Blue: Methods', 73–99; Claire Gervais et al., 'Why Does Prussian Blue Fade? Understanding the Role(s) of the Substrate', *Journal of Analytical Atomic Spectrometry*, 28, 2013, 1600–1609; Fernande Grandjean, Louise Samain, and Gary J. Long, 'Characterization and Utilization of Prussian Blue and its Pigments', *Dalton Transactions*, 45, 2016, 18018–18044.
  - 17 Jens Bartoll et al., 'Early Prussian Blue: Blue and Green Pigments in the Paintings by Watteau, Lancret and Pater in the Collection of Frederick II of Prussia', *Technè*, 25, 2007, 39–46; Jens Bartoll and Bärbel Jackisch, 'Prussian Blue: A Chronology of the Early Years', *Zeitschrift für Kunsttechnologie et Konservierung*, 24: 1, 2010, 88–102; Myriam Eveno, Éric Laval, Élisabeth Martin, and Jens Bartoll, 'La palette de Watteau et de ses épigones: l'analyse des pigments', *Technè*, 30–31, 2009–2010, 27–51.
  - 18 Johannem Woodward, 'Praeparatio Caerulei Prussiacci Ex Germania Missa', *Philosophical Transactions of the Royal Society of London*, 33, 1724–25, 15–17.
  - 19 John Brown, 'Observations and Experiments upon the Foregoing Preparation', *Philosophical Transactions of the Royal Society of London*, 33, 1724–25, 17–24.
  - 20 Etienne-François Geoffroy, 'Observations sur la préparation du Bleu de Prusse, ou de Berlin' (1725) and 'Nouvelles Observations sur la préparation du Bleu de Prusse' (1726), *Histoire de l'Académie royale des Sciences*, 1727, 153–172, 220–237.
  - 21 Bernard Joly, 'Etienne-François Geoffroy, entre la Royal Society et l'Académie royale des sciences: ni Newton, ni Descartes', *Methodos*, 12, 2012, 1–15, <https://journals.openedition.org/methodos/2855>.
  - 22 Claude-Joseph Geoffroy, 'Différents moyens de rendre le Bleu de Prusse plus solide à l'air et plus facile à préparer' (1743), *Histoire de l'Académie royale des sciences*, Paris, 1746, 33–50; Pierre-Joseph Macquer, 'Mémoire sur une nouvelle espèce de teinture bleue, dans laquelle il n'entre ni pastel ni indigo' (1749), *Histoire de l'Académie royales des Sciences*, 1753, 255–265; Louis-Claude Cadet de Gassicourt, *Analyse des eaux minérales de M. de Calsabigi, nouvellement découvertes à Passy: à laquelle on a joint une suite d'expériences sur la manière de retirer, de ces mêmes eaux, le Bleu de Prusse*, Paris, 1755, n.p.; Louis-Claude Cadet de Gassicourt, *Analyses chimiques des nouvelles eaux minérales, vitrioliques, ferrugineuses, découvertes à Passy dans la Maison de Madame de Calsabigi avec les propriétés médicinales de ces mêmes Eaux, fondées sur les Observations des Médecins & Chirurgiens des plus célèbres dont on rapporte les certificats authentiques*, Paris, 1757; Jean Hellot, 'Sur la préparation du bleu de Prusse' (1756), *Histoire de l'Académie royale des Sciences*, Paris, 1757, 53–59.
  - 23 On connections between the worlds of chemistry and art in the British context, see Matthew Hunter, 'Joshua Reynolds's "Nice Chemistry": Action and Accident in the 1770s', *Art Bulletin*, 97: 1, 2015, 58–76.
  - 24 Etienne-François Geoffroy, 'Observations sur la préparation', 154. Geoffroy's assessment of its properties was enthusiastic but not entirely accurate regarding the pigment's stability. Prussian blue is not stable to alkalis (like quicklime) and goes brown as ferric hydroxide is formed.
  - 25 Etienne-François Geoffroy, 'Observations sur la préparation', 153–154.
  - 26 Lehman, 'L'art de la teinture'; François Delamare, 'Le bleu de Prusse', in *Bleus en poudres: De l'art à l'industrie, 5000 ans d'innovations*, Paris, 2008, 181–234.
  - 27 Bernard Joly, 'Un siècle de chimie à l'Académie royale des sciences de sa création (1666) à l'arrivée de Lavoisier (1768)', *Methodos*, 12, 2012, 1–3, <http://journals.openedition.org/methodos/2937>.
  - 28 See, for example, Hellot, 'Sur la préparation du bleu de Prusse', 54–56.
  - 29 Etienne-François Geoffroy, 'Observations sur la préparation', 160.
  - 30 In describing the pigment-making process, we have attempted to keep the focus on eighteenth-century materials while providing an understanding in modern chemistry terms. Accordingly, we have described the type of chemical and given the eighteenth-century materials used, but provided modern chemical equivalents in footnotes. The latter are generally far purer and operate in more predictable ways than their early modern forerunners, making direct comparisons with historical processes difficult.
  - 31 Tartar is potassium hydrogen tartrate (potassium bitartrate), also known as cream of tartar. Nitre or saltpetre is mineral potassium nitrate.
  - 32 Woodward, 'Praeparatio Caerulei Prussiacci', 15–17; and Brown, 'Observation and Experiments', 17–24. On the transmission of the German method to England, see Alexander Kraft, 'On Two Letters from Caspar Neumann to John Woodward Revealing the Secret Method for Preparation of Prussian Blue', *Bulletin for the History of Chemistry*, 34: 2, 2009, 134–140.
  - 33 Etienne-François Geoffroy, 'Observations sur la préparation', 164. Vitriol or copperas is ferrous sulphate; alum was a highly variable substance in the eighteenth century but often indicates potassium aluminium sulphate; spirit of wine is a concentrated aqueous solution of ethanol.
  - 34 Kirby and Saunders, 'Fading and Colour Change of Prussian Blue: Methods', 73–99; and Grandjean, Samain, and Long, 'Characterization and Utilization of Prussian Blue', 18018–18044.
  - 35 Beyond its implications for Prussian blue, this emphasis grants fascinating insights into the development of chemistry in this part of the eighteenth century, when, as a science, it was still very much in its infancy.
  - 36 Etienne-François Geoffroy, 'Nouvelles observations', 223, 226, 227; Cadet de Gassicourt, *Analyse des eaux minérales*, 25.
  - 37 Claude-Joseph Geoffroy, 'Différents moyens', 33–50.
  - 38 Hellot, 'Sur la préparation du bleu de Prusse', 53–59.
  - 39 Etienne-François Geoffroy, 'Observations sur la préparation', 153–172.
  - 40 Bernard Le Bovier de Fontenelle, 'Chimie – Sur le Bleu de Prusse' (1725), *Histoire de l'Académie royale des sciences*, Paris, 1727, 34.

- 41 Claude-Joseph Geoffroy, 'Différents moyens', 49.
- 42 Etienne-François Geoffroy, 'Observations sur la préparation', 153–172; Claude-Joseph Geoffroy, 'Différents moyens', 33–50.
- 43 Cadet de Gassicourt, *Analyse des eaux minérales*, 1–37; Cadet de Gassicourt, *Analyses chimiques*, 1–130.
- 44 Cadet de Gassicourt, *Analyse des eaux minérales*, 30–36.
- 45 Claude-Joseph Geoffroy, 'Différents moyens', 35–36.
- 46 Claude-Joseph Geoffroy, 'Différents moyens', 36.
- 47 On the locations of artists' studios, see Hannah Williams, 'Artists and the City: Mapping the Art Worlds of Eighteenth-Century Paris', *Urban History*, 46: 1, 2019, 106–131.
- 48 Philippe Macquer, *Dictionnaire raisonné universel des arts et métiers, contenant l'histoire, la description, la police des fabriques et manufactures de France et des pays étrangers*, nouvelle édition, Paris, 1773, vol. 1, 276–279; Etienne-François Geoffroy, 'Observations sur la préparation', 153–172.
- 49 Pierre-Joseph Macquer, 'Sur une nouvelle espèce de teinture bleue', 255–265.
- 50 Claude-Joseph Geoffroy, 'Différents moyens', 36; Paul-Jacques Malouin and Paul Landois, 'Bleu de Prusse', in *Encyclopédie ou dictionnaire raisonné des sciences, des arts et des métiers par une société de gens de lettres*, ed. Denis Diderot and Jean le Rond d'Alembert, Paris, 1751–65, vol. 2, 284.
- 51 Hellot, 'Sur la préparation du bleu de Prusse', 58–59.
- 52 Etienne-François Geoffroy, 'Observations sur la préparation', 155.
- 53 Claude-Joseph Geoffroy, 'Différents moyens', 33, 37.
- 54 Claude-Joseph Geoffroy, 'Différents moyens', 36–37, 46.
- 55 Cadet de Gassicourt, *Analyse des eaux minérales*, 22, 36–37. Cadet de Gassicourt (1731–89) was trained by Claude-Joseph Geoffroy and became an associate member of the Académie in 1770. See Paul Dorveaux, 'Apothicaire membres de l'Académie des Sciences: X. Louis-Claude Cadet, dit Cadet de Gassicourt, alias Cadet-Gassicourt', *Revue d'histoire de la pharmacie*, 88: 22, 1934, 385–397; and Paul Dorveaux, 'Apothicaire membres de l'Académie des Sciences: X. Louis-Claude Cadet (suite et fin)', *Revue d'histoire de la pharmacie*, 89: 23, 1935, 1–13.
- 56 Cadet de Gassicourt, *Analyse des eaux minérales*, 33.
- 57 Pierre-Joseph Macquer, 'Mémoire sur une nouvelle espèce de teinture bleue', 256.
- 58 Pierre-Joseph Macquer, 'Sur une nouvelle espèce de teinture bleue', 260, 263–264; Hellot, 'Sur la préparation du bleu de Prusse', 53–59.
- 59 Bernadette Bensaude-Vincent, *Matière à penser: Essais d'histoire et de philosophie de la chimie*, Paris, 2008, 179–180.
- 60 Pierre-Joseph Macquer, 'Sur une nouvelle espèce de teinture bleue', 264.
- 61 Howard Becker, *Art Worlds*, Los Angeles and London, 1982.
- 62 Clothilde Rothmayer, *Les marchands de couleurs à Paris au XIX<sup>e</sup> siècle*, PhD, Paris, 2004; Séverine Sofio, 'Les marchands de couleurs au XIX<sup>e</sup> siècle, marchands ou experts?', *Paris and Tours, Ethnologie française*, 1, 2017, 75–86; Laura Anne Kalba, *Color in the Age of Impressionism: Commerce, Technology and Art*, University Park, 2017.
- 63 Lacombe mentions a 'Monsieur Auteresse' in the Marais as the city's first manufacturer of the colour, but he has so far proved untraceable. Jacques Lacombe, *Encyclopédie méthodique. Arts et métiers mécaniques*, Paris, 1782, vol. 1, 221.
- 64 'Marchands de couleur et fabricants'. 'Société Louis Grandjean, Michel Savoye & autres', Paris, 24 March 1751, AN/MC/ET/XXVII/257.
- 65 It makes an early appearance in the archives in 1723 with a 'Marie Leroy' who is described as a 'maîtresse peintresse et marchande de couleurs pour peinture'. 22 June 1723, Paris, AN, MC/ET/XXXI/79.
- 66 *Almanach de Paris, contenant les Noms & demeures des principaux Artistes, Marchands, Fabricants, &c pour l'année 1789*, Paris, 1789, 2nd partie.
- 67 On representations of work in eighteenth-century Paris and the pragmatic role of factum in the juridical definition of guilds: Steven L. Kaplan and Cynthia J. Koepp eds, *Work in France: Representation, Meaning, Organization and Practice*, Ithaca and London, 1986; Michael Sonenscher, *Work and Wages: Natural Law, Politics and the Eighteenth-Century French Trades*, Cambridge, 1988.
- 68 Art. V, *Nouveaux règlements de l'Académie de Saint Luc*, Paris, 1738.
- 69 BNF, FOL-FM-12421, *Second mémoire servant de réponse pour les maîtres et gardes du corps des marchands épiciers contre les marchands apothicaires* (no date), 7.
- 70 A rental document gives the location of their premises on Rue d'Orléans, 18 October 1761, AN/MC/ET/XCIV/306.
- 71 Sarah Lowengrad, 'Prussian Blue: Transfers and Trials', *The Materiality of Color: The Production, Circulation and Application of Dyes and Pigments, 1400–1800*, ed. Andrea Feeser, Maureen Daly Goggin, and Beth Fowkes Tobin, London and New York, 2012, 174.
- 72 *Registre de l'Académie Royale des Sciences*, 84, 9 February 1765, Bibliothèque nationale de France.
- 73 Shop sale of François-Charles Prévotel, 29 July 1743, AN, MC/ET/XXIV/693.
- 74 'Etat des sommes dues', Estate inventory of François-Charles Prévotel, 16 July 1743, AN, MC/ET/XXIV/693, fol. 13. On Godefroy, see Noémie Étienne, 'La pensée dans la pratique: le cas de Marie-Jacob Godefroid, restauratrice de tableaux au XVIII<sup>e</sup> siècle', *Plumes et Pinceaux: Discours de femmes sur l'art en Europe (1750–1850)*, ed. Mechthild Fend, Melissa Hyde and Anne Lafont, Dijon, 2012.
- 75 Paris, AN, MC/ET/LXX/765, Estate inventory of Marie-Suzanne Arthur, wife of Louis-Julien Gohin, 23 April 1807.
- 76 Paris, AN, MC/ET/XXIV/800, 26 November 1765, Estate inventory of François Redon: twenty-four ounces of Prussian blue were sold for six livres fifteen sols and twenty ounces of indigo commun were sold for three livres fifteen sols.
- 77 *Description du procédé de M. Raymond, professeur de chimie à Lyon, pour teindre la soie avec le bleu de prusse, d'une manière égale, solide et brillante*, Paris, 1811.
- 78 Michael Baxandall, *Painting and Experience in Fifteenth-Century Italy: A Primer in the Social History of Pictorial Style*, Oxford, 1972.
- 79 Cadet de Gassicourt, *Analyse des eaux minérales*, 30–31.
- 80 Cadet de Gassicourt, *Analyse des eaux minérales*, 30.
- 81 Jamie Mulherron, 'Prussian Blue, Boucher, and Newton: The Material, the Practice, and the Theory of Rococo Painting', *Object*, 3, 2001–2, 68–93.
- 82 Paris, AN, MC, et /LXIX/942, 20 December 1821. Estate inventory of Charles-Louis Cadet de Gassicourt: 'deux tableaux de Boucher dont Persée et Andromède dans leurs bordures de bois doré'.
- 83 Jessica S. Priebe, *Conchyliologie to Conchylomanie: The Cabinet of François Boucher, 1703–1770*, PhD dissertation, University of Sydney, 2011.
- 84 Paris, BNF, *Catalogue raisonné des curiosités qui composoient le cabinet de feu Mme Dubois-Jourdain*, Paris, 1766, 70, lot number 511 with annotations.
- 85 Gly and Dheur's factory was operating largely without competition until the 1770s.
- 86 Paris, AN, F/12/1508, 14 Ventôse an 7, Letter from Victor-Noël Vernezobre: 'de Nouvelles couleurs, assez belles pour remplacer celles qui nous viennent des Indes et de l'Etranger à des prix Excessifs'. On Vernezobre, see Neil Jeffares, <http://www.pastellists.com/Articles/VERNEZOBREjn.pdf>; and [https://neiljeffares.wordpress.com/2018/06/18/vernezobres-clients/#\\_ftn3](https://neiljeffares.wordpress.com/2018/06/18/vernezobres-clients/#_ftn3).
- 87 *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Paris, 1803, 5, 53, 110–111.
- 88 Paris, AN, MC/ET/LXX/765, 23 April 1807, Estate inventory of Marie-Suzanne Arthur, wife of Louis-Julien Gohin. This level of production also led to issues of pollution. See André Guillerme, 'La chimie parisienne entre artisanat et industrie (1760–1830)', *Comptes Rendus Chimie*, 15: 7, 2012, 569–579, <https://www.sciencedirect.com/science/article/pii/S1631074812000860>; and Judith Rainhorn, *Blanc de plomb. Histoire d'un poison légal*, Paris, 2019.
- 89 On the second portrait, see Francesca Whitlum-Cooper, *Boilly: Scenes of Parisian Life*, London, 2019, 76–77.
- 90 Roger de Piles, *Eléments de peinture pratique*, Paris, 1766 (first ed. 1684), 101–107.
- 91 On Boilly, see Susan L. Siegfried, *The Art of Louis-Léopold Boilly: Modern Life in Napoleonic France*, London and New Haven, 1995; Charlotte Guichard, *La griffe du peintre. La valeur de l'art, 1720–1815*, Paris, 2018, chapter 8; Etienne Bréton and Pascal Zuber, *Louis Léopold Boilly*, Paris, 2019.
- 92 Estate Inventory of Jean-Baptiste-Marie Pierre, 25 May 1789, AN MC/ET/XXXI/253.
- 93 Our investigation concentrated primarily on pigment analysis undertaken by the Centre de Recherche et de Restauration des Musées de France (C2RMF), but also made valuable use of analysis undertaken by the National Gallery of London and the National Gallery in Washington.
- 94 See Frisch's correspondence in Fischer, ed., Joh. Leonh. Frisch's Briefwechsel, 47.
- 95 C2RMF laboratory report on F8818 (Jean-Paul Rioux), no. 4597, 2000. This report analyses several paint samples. Prussian blue was only found in the lowest layers, painted directly over the prepared canvas, both in this sample and another from the clump of foliage in the left



- foreground. No Prussian blue was found in a sample taken from the sky, where only ultramarine was found, but this was a shallow sample of upper layers only.
- 96 On the pigment's earliest decades, see Bartoll and Jackisch, 'Prussian Blue: A Chronology', 88–102.
- 97 A particularly detailed understanding of Prussian blue's use by this circle of artists is identified in the collaborative technical analysis undertaken in 2009 by C2RMF, Musée du Louvre, and Schloss Charlottenburg, see Myriam Eveno, Éric Laval, Élisabeth Martin, and Jens Bartoll, 'La palette de Watteau et de ses épigones: l'analyse des pigments', *Technè*, 30–31, 2009–10, 27–51; Jens Bartoll et al., 'Early Prussian Blue: Blue and Green Pigments in the Paintings by Watteau, Lancret and Pater in the Collection of Frederick II of Prussia', *Technè*, 25, 2007, 39–46.
- 98 Analysis of samples and XRF scans suggest that Prussian blue is highly probable. C2RMF laboratory report on F11713 (Myriam Eveno), no. 17005, 2009; C2RMF laboratory report on F11713 (Eric Laval, Myriam Eveno, Élisabeth Martin), no. 17153, 2009.
- 99 De Troy's use of Prussian blue has been brought to light particularly through pigment analysis undertaken by the National Gallery. Kirby and Saunders, 'Fading and Colour Change of Prussian Blue: Methods', 73–99.
- 100 C2RMF laboratory report on F10836 (Élisabeth Martin), no. 2234a, 1987; C2RMF laboratory report on F11242 (Élisabeth Martin), no. 2543, 1987.
- 101 Kirby and Saunders, 'Fading and Colour Change of Prussian Blue: Methods', 97.
- 102 Humphrey Wine, *National Gallery Catalogues: The 18th-Century French Paintings*, London, 2018, 514–517.
- 103 Wine, *National Gallery Catalogues*, 245–251.
- 104 C2RMF laboratory report on C2RMF74532 (Gilles Bastien and Elisabeth Ravaud), no. 31365, 2016.
- 105 On the association of the Virgin Mary with blue, see Pastoureaux, *Bleu*, 44–47.
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- 107 C2RMF laboratory report on FZ20506 (Sylvie Colinart), no. Z1848, 1991.
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