

# 'Administrator of Painting': The Purchase and Distribution Book of Wolf Pronner (1586–1590) as a Source for the History of Painting Materials

Ursula Haller

The Bavarian Central State Archive in Munich preserves an inconspicuous narrow manuscript of about 140 folios, containing the notes of an official at the Munich court of Duke William V of Bavaria, Wolfgang or Wolf Pronner.<sup>1</sup> Pronner had what may be the unique title of 'administrator of painting', and as part of that role he listed inside this book the painting materials purchased and distributed by him to the artists working at the Munich court between 1586 and 1590. The first page of the book (Fig. 1) has a heading that can be translated as:

Herein will be noted everything, that I, Wolf Pronner, receive, take, and give out again, belonging to the painting of my gracious Duke and Master [that is] pulverised and beaten gold and silver also diverse sorts of colours.<sup>2</sup>

A later attached short note below states:

Nota. The above Wolf Pronner has been employed since the first of January a.<sup>o</sup> 1586 as supervisor and head of accounts over the painting colours with an annual salary of 200 fl and [this post] has been abolished with the beginning of the second quarter of 159[0], then [he] passed away immediately after.<sup>3</sup>

According to the detailed instructions of the duke, which fortunately are also preserved,<sup>4</sup> Wolf Pronner was charged with the purchase of materials of the highest quality wherever he could get them at the best possible prices and to distribute them in small quantities to the artists; he also had to note down everything with precision, specifying exactly for what purpose the materials were needed. In addition, he had to supervise the ongoing work of the painters and give at least weekly reports to the duke. Examination of Pronner's book reveals that these instructions were obviously obeyed faithfully and, while this procedure might have been of some annoyance to the court artists, the result is an extensive, accurate, reliable and unique document that allows us to reconstruct

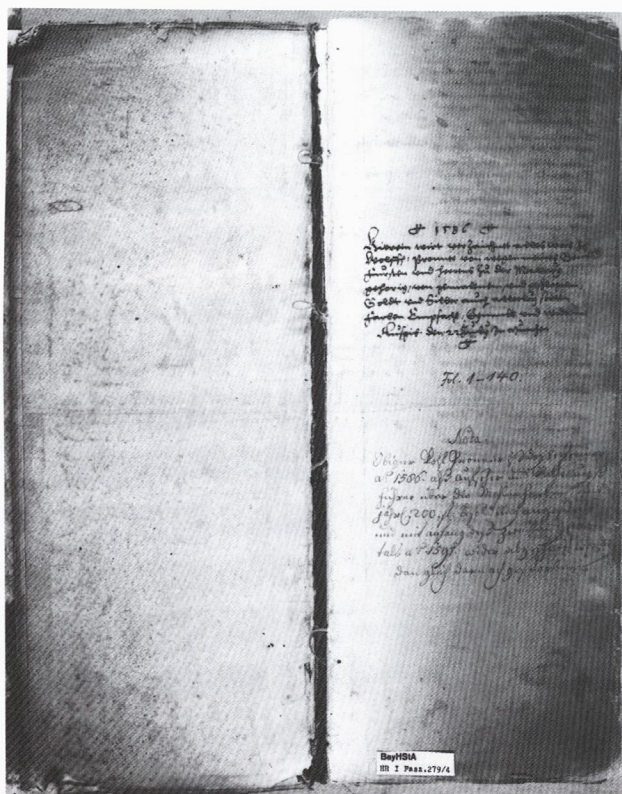


FIGURE 1. First page of Wolf Pronner's book, Bayerisches Hauptstaatsarchiv (BHStA), Munich, HR I, Fasz. 279/4, f. 1a r. Reproduced by permission of the Bayerisches Hauptstaatsarchiv, Munich.

the making of some works of art from the purchase of the materials to their completion.

Pronner administrated a wide range of painting materials of the period: natural and artificially produced pigments, lakes, metal leaf and pulverised metal, oils, resins, glues and waxes, siccatives and other chemicals or workshop supplies such as artists' brushes and paper. Taking a closer look at the spectrum of materials, we find a 'reasonable' assortment of well-known and often used materials of the time, without somewhat 'eccentric' materials such as scarce gums, resins or dyestuffs (see Table 1).

TABLE 1. Pronner's range of materials.

Pigments	lead white of different qualities [ <i>pleyweyß, schiferpleyweyß/schifferpleyweyß</i> ], chalk [ <i>Kreyden</i> ], lead-tin yellow [ <i>Pley Gelb</i> ], orpiment [ <i>gelb opriment</i> ], yellow ochre of different origin [ <i>Gelber Ogar</i> ], vermilion [ <i>Zynober</i> ], red lead [ <i>Rote Menig</i> ], red ochre [ <i>Roter Ogar</i> ], ultramarine [ <i>Ultra Maryn</i> ], azurite of different qualities [ <i>Berck plau des guten, Berck plau dz schlechten, Blau Lazur von Koffstain</i> , etc.], smalt of different origin and qualities [ <i>Blaue Oelschmalta von Schwatz</i> of different prices, <i>Plabe Oel Farb von Lantzhut, plabe oel Schmalta von Lantzhut, Wasser Blaufarb, wasser Schmalta, grob Wasser Schmalta, Esch: Schmalta</i> , etc.], natural green copper pigments of different origin and qualities [ <i>Berck Grien, schons perck grien, perck grien underdrach, Schiffergrien, schon Schifer grien, milds schons schifer grien</i> , etc.], verdigris [ <i>Span Grien</i> ], green earth [ <i>Griener Ogar</i> ], umber [ <i>Umbra, schatten farb</i> ], <i>Kesselbraun</i> (kettle brown), <i>Valet Farb</i> (violet colour), lamp black [ <i>Kyen Schwartz</i> ]
Lakes, dyes and their raw products	saffron [ <i>Saffran</i> ], yellow lake [ <i>Schitt Gelb</i> ], yellow brazilwood [ <i>Gelbe presyl, Gelbe presill</i> ], red brazilwood [ <i>Rote presyl</i> ], various red lakes [ <i>laca, laca finissima</i> ('the best' <i>laca</i> ), <i>laca fina, laca fina d(i) India, laca fina. fina, laca mezana (laca finazana, schlecht oder gemains laca), kugl lac, prau kugl lac</i> ], turnsole [ <i>Leckmoß od(er) tornazol d(i) venezia</i> ], indigo [ <i>Blau Endigo Farb</i> ], sap green [ <i>Safft Grien</i> ]
Metal leaf and pulverised metal	gold and silver leaf of different qualities and sizes [ <i>buchl of Fein Geschlagen Gold, Dopl geschlagen fein Golt, schmal geschlagen gold, brait geschlagen goldt, Feyn Geschlagen Silber, Dopl geschlagen fein Silber</i> , etc.], gold and silver powder (shell gold, shell silver) [ <i>muschelin of Gemalen Goldt and Gemalen Silber</i> ], <i>Zwischgold</i> [ <i>Zwysch Goldt</i> ], imitation gold leaf [ <i>Rausch Goldt</i> ], tin leaf [ <i>Stannoll</i> ]
Media	linseed oil [ <i>Lein Oel</i> ], walnut oil [ <i>nuß oel</i> ], olive oil [ <i>Baum Oel</i> ], pine resin [ <i>scheffel of Hartz or pech</i> ], turpentine [ <i>Therpentin</i> ], varnish [ <i>Firnys, furnies</i> ], mastic [ <i>Mastix</i> ], gum arabic [ <i>Gumy Arabicum</i> ], sturgeon glue [ <i>Hausenplasen</i> ], skin or parchment glue of different qualities [ <i>Leym, schoner leim, guter leim, mitl leim, schoner lichter leim, schwarzer leim</i> , etc.], beeswax, yellow and bleached [ <i>Gelb Wachs</i> (wax), <i>weyß wachs</i> (wax)]
Auxiliary substances and workshop supplies	alum [ <i>Alaun</i> ], borax [ <i>Burras</i> ], lead [ <i>pley</i> ], mercury [ <i>Quecksilber</i> ], saltpetre [ <i>Salitter</i> ], sulphur [ <i>Schwebel</i> ], vitriols (sulphates) of zinc and copper [ <i>Weyß Vitriol, Blau Vitriol</i> ], soap [ <i>Saiffen</i> ], emery and tripoli [ <i>Schmirgl und Tripl</i> ], fabric made of cotton and linen threads [ <i>Barchant</i> ], paper of different sorts and qualities [ <i>schreib papier, grob papier, Karten papier, schwarz papier, grob schwarz papier, Cantzley papier, Realpapier</i> , etc.], artists' brushes of different sorts and qualities (see Table 5)

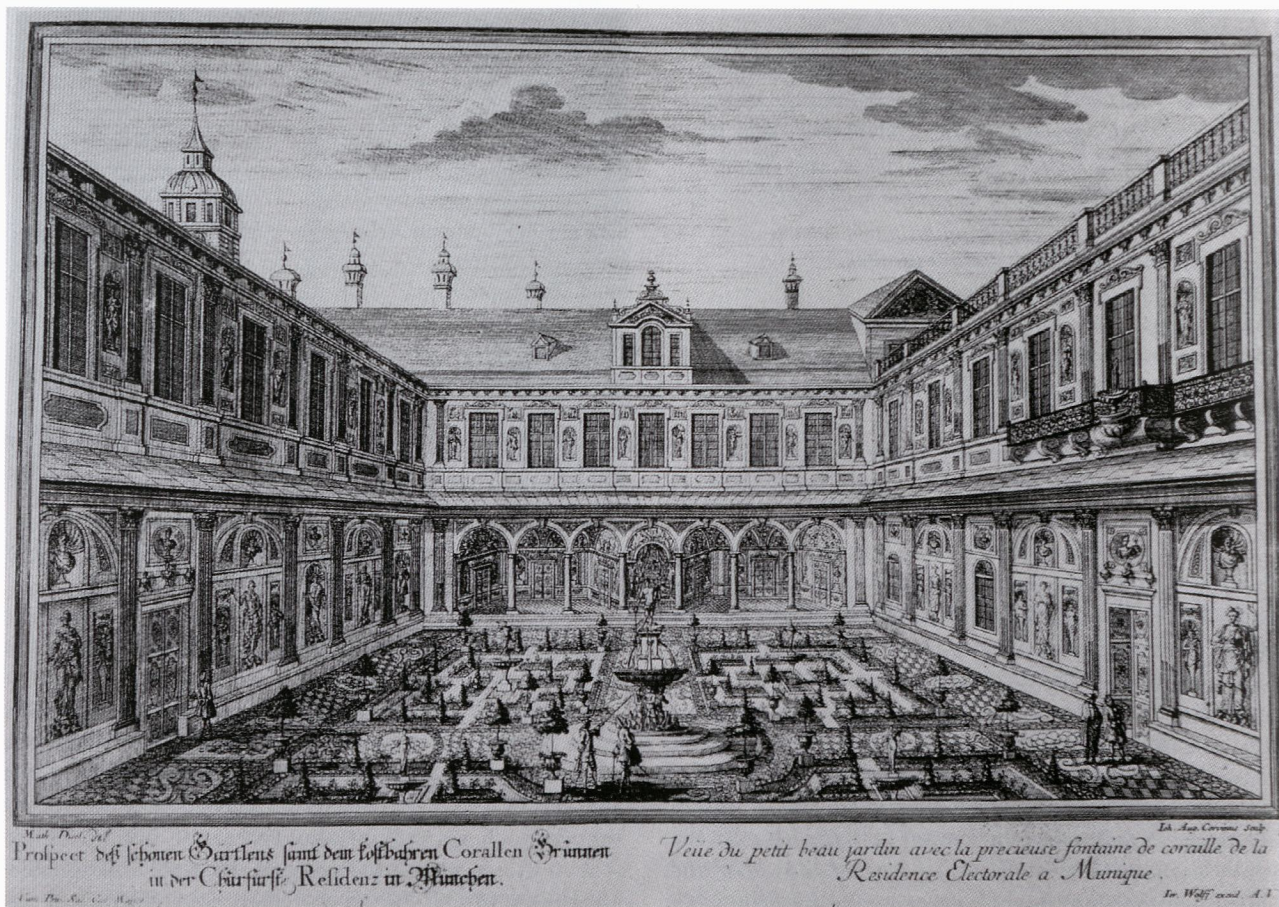


FIGURE 2. Johann August Corvinus after Mathias Diesel, *Grotto Yard of the Munich Residence with Loggia in the Background*, engraving, c.1722. Staatliche Graphische Sammlung, Munich.

There was no need for Pronner to buy the expensive pigments such as ultramarine and orpiment favoured by Italian or Venetian painters – he was able to distribute them in very small quantities from existing stocks that lasted for the whole period of his employment. However, by bringing together information about origin, trading places, prices and different grades or qualities of the pigments mentioned by him with information about their use, the document can help to broaden our knowledge of painting materials used in south Germany at the end of the sixteenth century. Unlike contemporary printed sources, Pronner's notes document the actual use of a broad spectrum of painting materials for different purposes over several years.

This paper describes Pronner's system of supplying the artists working at the duke's court and gives an overview of his suppliers, but it also focuses on a seemingly almost forgotten artificial pigment, produced mainly for glazing pottery and colouring glass but used also for painting purposes: *Kesselbraun* (literally translated as kettle brown).

#### 'ADMINISTRATOR OF PAINTING'

The first question that arises is why was it necessary to employ an official specifically in charge of painters' materials? There is no evidence for the previous existence of such an administrator at the Munich court, although former account books show the purchase of substantial amounts of pigments and other painting materials. In Munich, Friedrich Sustris (1540–1599), as head of the court artists at that time, had been responsible for providing artists' supplies – only one of his numerous duties as the duke's *Kunst-Intendant* or 'impresario of the arts' (a title he is given in modern art-historical literature). Due to Sustris's lack of financial understanding (and his inability, or lack of enthusiasm, in controlling his fellow colleagues), the court painters, who were not known for their discipline, had misappropriated the precious and expensive painting materials purchased by the court to work on other, external commissions, much to the annoyance of the duke, which he expressed in his instruction letter to Pronner. Given this and the unfavourable economic circumstances, drastic steps seemed inevitable, thereby explaining the appointment of Pronner in 1586, personally by Duke William V as his 'Aufseher und Rechnungsführer über die Mahlerfarben' (supervisor and head of accounts of painting materials). Little is known of Pronner's former life, the only possible relevant reference being from some 20 years earlier, when a Wolf Pronner is recorded as buying precious art works for the cabinet of the duke's father Albrecht V, but we do not know if this man is one and the same as that working for Albrecht's son.<sup>5</sup>

It cannot be accidental that the employment of an 'administrator of painting' coincides with the beginning of a period of intense activity of artistic production at the Munich court: projects being worked on at this

period included the wall paintings of the *antiquarium*; the construction and decoration of the adjacent small and ornately decorated courtyard (the 'grotto yard') with two *loggie* decorated with grotto incrustations (Fig. 2); wall paintings; scagliola works and cast figures; two chapels in a no longer existing part of the residence; and the opulent interior of the court church of St Michael, including the monumental high altarpiece and eight large altarpieces in side chapels (Fig. 3).

Pronner's notes provide a fairly complete picture of artists' activities at the Munich court during the late 1580s. Besides these large projects (the decoration of the two *loggie* and the St Michael altar paintings take up the majority of the space in Pronner's notes) we find that the court artists worked on numerous larger and smaller works such as paintings on canvas and panel, miniatures on ivory and copper, and the rather unusual technique of painting on fabric interweaved with gold and silver threads. The creation of painted sculptures, *bozzetti* of beeswax, works by goldsmiths, stonemasons and glasscutters also required materials from Pronner's stocks. But most interesting – since we have little information from elsewhere concerning their materials – are Pronner's entries concerning ephemeral works: decorations for celebrations at court and religious feasts such as the Holy Sepulchre at Easter, a crib at Christmas and monumental scenery for the planned staging of a play on the occasion of the consecration of the church of St Michael. Pronner even provided artists and craftsmen with appropriate materials for the decoration of the ducal ships on Lake Starnberg.

In order to realise these extensive works, William V employed a remarkable number of artists and craftsmen under the leadership of his *Kunst-Intendant* Friedrich Sustris. Pronner mentions ten other painters, among them some well-known names such as Peter Candid, Hans Donauer, Alessandro Paduano, Antonio Ponzano, Christoph Schwarz and Antonio Maria Viani – all of them, as the main court painters, being responsible for the large altarpieces and the wall paintings.<sup>6</sup> These painters were supported by their apprentices, six qualified master painters and gilders from Munich who were employed per week or per day, and by several colour grinders.<sup>7</sup> Pronner also provided five sculptors and stucco plasterers, and seven goldsmiths/stonemasons/crystalcutters with the artists' materials they needed.<sup>8</sup> Furthermore he notes the handing out of material to carpenters, stonemasons and bricklayers, gardeners, the 'master of the fountains', a glazier, a potter, a writer and a bookbinder, the court pharmacist, the cook and other employees or servants, and even members of the ducal family.

Pronner's notes are therefore also a rich source for art history, bringing together names, art works and exact dates. As the main focus of this volume is on artists' materials rather than on the artists themselves, the short lists of receivers of artists' materials above and in the notes must be sufficient to give a sense of the variety of artists and craftsmen supplied with materials at the Munich court.



FIGURE 3. Peter Candid, *Martyrdom of Saint Ursula*, 1587/88. Oil on canvas, 320 × 220 cm. St Michael, Munich; Bayerisches Nationalmuseum, Munich.

PRONNER'S NOTES

To establish how we can obtain information concerning the origin, trade and use of materials from Pronner's book, it is useful to take a closer look at his procedure of purchasing and distributing materials and at the way he has recorded these processes. During his employment Pronner noted 720 individual deliveries containing 7,590 Munich *Pfund* (4250 kg or 4¼ tons) of pigments, lakes and dyes, painting media, related chemicals and auxiliary substances.<sup>9</sup> In addition to this, his notes show the purchase and distribution of about 1,500 books of different metal leaf, 800 books of paper for drawing and for packaging, and over 3,400 artists' brushes. The distribution of all of these items is recorded in around 3,550 individually noted entries.

Pronner's practice was to write down in a continuous and random list most of the deliveries he received (Fig. 4).<sup>10</sup> He then transferred the various items of his purchases sorted by materials to the verso (left-hand) pages of his book; on the opposite (recto) pages he listed the distribution to the artists (Fig. 5). On the verso pages we find delivery date, source of supply (that is name and origin of supplier or origin of the product, which is not implicitly the same), and the price of the product, which was mostly per *Pfund*, or per *Lot*; however, in the case of very precious and expensive materials such as saffron, ultramarine or some sorts of red lakes, it was listed per *Quintlein*. At the end of each entry Pronner noted the delivered quantity. In various cases he also recorded the form in which the goods were traded or packaged, such as small sacks, barrels or casks, bladders (of cows or pigs) of pigments, cards of imitation gold leaf, shells of pulverised gold and silver or books of paper. On the opposite recto pages we find, listed with precision and in detail, the date at which the goods were handed out, how much was provided and to whom and their intended use. In accordance with the duke's instructions, Pronner distributed the amounts of materials mostly in quantities of a few *Lot*; the more expensive pigments such as lakes and ultramarine were distributed in *Quintlein*, while less expensive pigments, which were also used for the production of paint for walls or copper roofs (eg lead white, earth pigments, red lead or *Kesselbraun*), were handed out in *Pfund*.

In addition to the artists, their helpers or apprentices, a colour grinder (*Farbreiber*) named Hans Tegler is also listed as a receiver of painters' materials; he seemed to be head of at least six colour grinders at court. He often received pigments and binding media on behalf of the painters with an explanatory note by Pronner 'zuverreyben' (for grinding). The colour grinders were not only employed to supply the court painters with colours ready for use but also to prepare supports and grounds. The number and employment of these colour grinders are of interest, as it suggests another move away from the self-sufficient artists' workshop towards the use of finished or semi-finished products. Another relevant detail in this context is the 'Stannoll zur decknung der farben' (tin leaf to cover the paint) also purchased by Pronner.

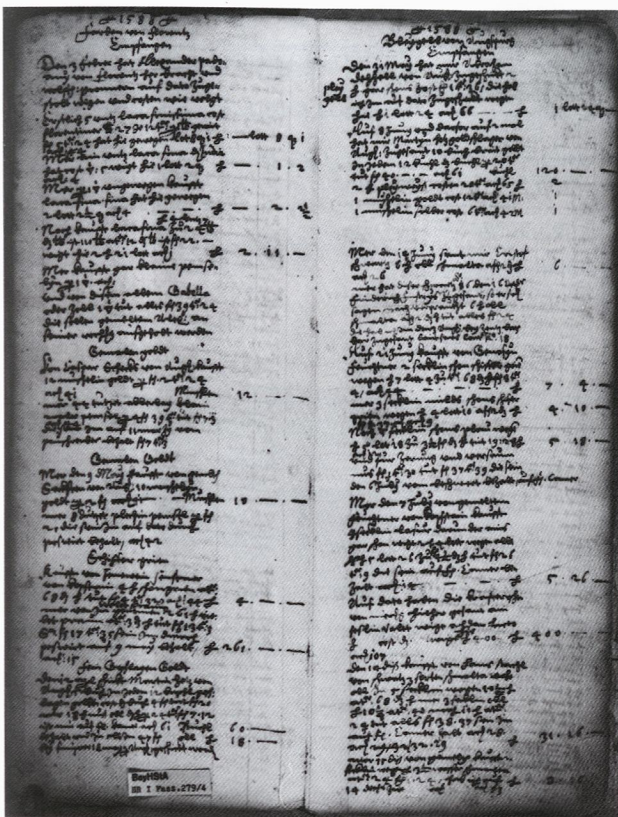


FIGURE 4. Part of Pronner's listing of purchases, BHStA, HR I, Fasz. 279/4, ff. 2a v and 3a r. Reproduced by permission of the Bayerisches Hauptstaatsarchiv, Munich.

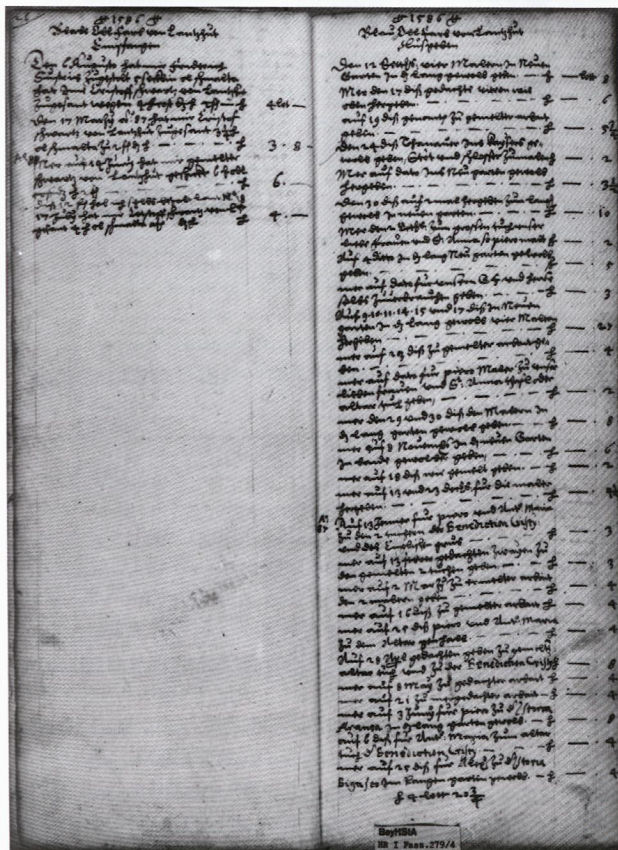


FIGURE 5. Pages of purchase and distribution of smalt from Landshut ('Blabe Oel Farb von Lantzhut'), BHStA, HR I, Fasz. 279/4, ff. 22v and 23r. Reproduced by permission of the Bayerisches Hauptstaatsarchiv, Munich.

TABLE 2. Merchants from Munich and their deliveries.

Caspar Hartschmidt, merchant	<b>Pigments:</b> lead white, chalk, lead-tin yellow, yellow ochre, vermilion, red lead, red ochre, azurite, smalt, green copper pigments, verdigris, umber, <i>Kesselbraun</i> , <i>Valet Farb</i> , lamp black <b>Lakes, dyes and their raw products:</b> saffron, yellow lake, yellow brazilwood, red brazilwood, red lakes, turnsole, indigo, sap green <b>Metal leaf and pulverised metal:</b> gold and silver leaf, <i>Zwischgold</i> , imitation gold leaf, tin leaf <b>Media:</b> olive oil, pine resin, turpentine, varnish, mastic, gum arabic, sturgeon glue, glue, beeswax <b>Auxiliary substances and workshop supplies:</b> alum, borax, lead, mercury, saltpetre, sulphur, vitriols of zinc and copper, soap, emery and tripoli, fabric made of cotton and linen threads, paper
Melchior Rapp, merchant	Lead white, chalk, red lake, indigo, smalt, gold leaf, varnish, paper
Caspar Heckel, merchant	Lead white, red lead, smalt, gold leaf
Wolf Angermaier, iron merchant	Linseed oil
Georg Lanzinger, innkeeper	Smalt, natural green copper pigment

## PRONNER'S SUPPLIERS

## Local merchants

Pronner's main supplier was neither a large trading company, nor a pharmacist, but a local merchant named Caspar Hartschmidt. From the number of deliveries he made, and the diversity of his products, it would seem that this Munich merchant held a prominent position: 520 of around 720 recorded deliveries to Pronner of very different amounts and extent originated from him (see Table 2), and were supplied on 255 separate occasions.

Hartschmidt seems to have been a purveyor of writing as well as painting materials to the court. Other documents provide evidence of deliveries of ink and chalk by him to the writing chamber and the building department (*Hofzahlamtsrechnungen*, for example BHStA, KHZ 36(1590), f. 425r). Whether Hartschmidt traded only in artists' materials or whether he sold this sort of material as part of his product range (which is more probable) cannot currently be determined, but since we know that there were specialised traders in artists' materials at that time in important artistic centres such as Venice or Amsterdam, it is not beyond the bounds of probability that he was a specialist supplier.<sup>11</sup> Alongside Hartschmidt are two smaller merchants who are of much less importance given his clear dominance in supplying the court.

Two other local merchants also provided artists' materials to Pronner. An iron merchant, Wolf Angermaier, who traded in different metals, was one of Pronner's main suppliers of linseed oil. Perhaps this medium played a more important role at court in the production of coatings for metals rather than as a binding medium for paintings. The other supplier was an innkeeper, George Lanzinger, whose pub also seemed to be a trading place for goods, perhaps from merchants passing through Munich, maybe on their way to the important autumn, new year or spring fairs, for example at Frankfurt or Leipzig. These fairs, with their broad product range, were, after direct supply from the producer, the major sources for local merchants. The nearly contemporaneous catalogue of the Frankfurt fair from 1582 lists about 200 different pigments, dyes, lakes, binding media, their raw materials and related chemicals and supplies.<sup>12</sup>

It is also likely that Pronner's local suppliers bought various products from the fairs, besides purchasing them directly from their place of processing, but unfortunately in most cases it is impossible to localise the origin of their products, with the exception of only a few pigments such as 'Smalta von Schwaz' (smalt from Schwaz) or 'Hiesigen Ogar' (local ochre).

## Trade from abroad

More interesting hints as to the extraction, production and origin of materials are to be found regarding deliveries from abroad. The Munich court was supplied with painting materials directly from Venice, Florence, Nuremberg and various manufacturing or trading locations in the Tyrol (see Table 3). Pronner's notes document the position of Venice as one of the most important production and trading places for pigments and dyes. His first noted delivery was 'ain kistlen so von venezia komen ... darin sein 11 sorten farben' (a small box coming from Venice ... with 11 sorts of colours in it), see Figure 6.<sup>13</sup> The box contained an assortment of different pigments, processed from minerals or artificially produced: ultramarine, azurite (probably from Spain), lead-tin yellow and kettle brown (*Ultra Maryn*, *plau d(i) spania* or *beadeta*, *pley gelb*, *Khessel praun* or *paonazo*);<sup>14</sup> lakes (*Laca fina*, *Laca finazana*, *Leckmoß* or *tornazol*: red lake of the best quality, red lake of average quality, turnsole) and a palette of earth pigments (*Roter Ogar*, *Griener Ogar*, *gelber Ogar*, *Umbra* or *schatten farb*: red and yellow ochre, green earth and umber). The sender was Christoph Ott, a former *Faktor* (factor or trading agent) of the Fugger trading company at Venice.

The trade from abroad would be carried out not only by purchasers who were residents in the relevant places but also mainly by large trading companies with *Faktoreien* or branches and a good working infrastructure, such as the Augsburgian trading company 'Hieronymus Kraffter sel. Erben' (The Late Hieronymus Kraffter's Heirs), who had already established trade relations with the duke's father, Albrecht V. Pronner received five deliveries of pigments from the Kraffter trading company, each of extraordinarily large scale from 10 to 400 *Pfund*. From Venice he obtained lead white, yellow and red ochre, green earth (noted as 'green ochre') and *Kesselbraun* (kettle brown). It is possible to trace the trading chain back to a member of the Kraffter company in Venice named

TABLE 3. Trade from abroad.

Christoph Ott, factor of the Fugger trading company, Venice	A box, containing ultramarine, azurite from Spain or perhaps South America(?) [ <i>plau d(i) spania oder beadeta</i> ], lead-tin yellow, <i>Kesselbraun</i> [ <i>Khessel prau, paonazo</i> ], yellow and red ochre, green earth and umber, different qualities of red lakes [ <i>laca fina, laca finazana</i> ], turnsole
Trading company 'The Late Hieronymus Kraffter's Heirs', Augsburg	<b>Venice:</b> lead white, yellow and red ochre, green earth, umber, <i>Kesselbraun</i> [ <i>kessel prau</i> ] <b>Florence:</b> different qualities of red lakes [ <i>laca der post(e) oder finissima, mitt schon laca, gemains oder lacamezana</i> ] <b>Nuremberg:</b> <i>Valet Farb</i>
Jenewein Feustner, Kufstein (Tyrol)	Azurite [ <i>Blaufarb von Koffstain, Blau Lazur von Koffstain</i> ], natural green copper pigment [ <i>Schiffer grien, schifer grien</i> ], <i>Kesselbraun</i> [ <i>Violet prau, schon violet kessel prau</i> ]
Balthasar Arainer, Schwaz (Tyrol)	Azurite [ <i>perck plau</i> ]

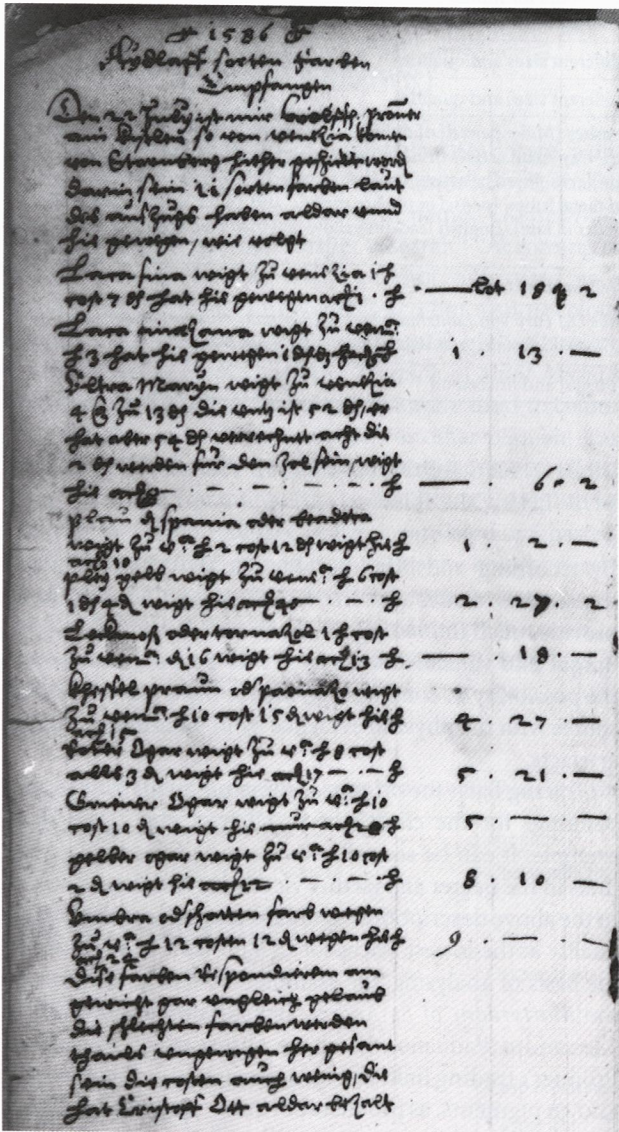


FIGURE 6. Pronner's first entries: contents of a small box, delivered from Venice, BHStA, HR I, Fasz. 279/4, f. 1a v. Reproduced by permission of the Bayerisches Hauptstaatsarchiv, Munich.

production location, may have been purchased directly from the producers. In this context, lead white (*bianco di Venecia*), vermilion, or different sorts of dyes and lakes have to be mentioned. Of particular relevance are pigments connected with the production of coloured glass such as lead-tin yellow, and different oxides of copper, iron, manganese or cobalt.

From Florence, probably the other important Italian trading centre for colorants, the Augsburgian Kraffter trading company purchased only three different sorts of red lakes; Nuremberg is named only once in Pronner's book in the context of a barrel of 400 pounds of 'Valet Farb' (violet colour). The mining regions at Tyrol around Schwaz, Brixlegg and Kufstein also played a major role as production or trading areas for certain pigments. This region had an upheaval phase in the second half of the sixteenth century which led, after a time of flourishing silver and copper extraction, to the intensification of processing secondary minerals. Hints as to which products were from Tyrol, especially azurite, are to be found in numerous contemporary documentary sources: Théodore Turquet de Mayerne for example describes the 'Lapis Armenus von Schwatz, welcher in Deutschland Bergblau genannt ist' (*Lapis Armenus* of Schwatz, called *Bergblau* in Germany).<sup>17</sup> Two suppliers of pigments from Tyrol provided Pronner with azurite of the highest quality (*Lasur*) from Schwaz, with common grades of azurite and natural green copper pigments (*Berggrün* and *Schiefergrün*), along with *Kesselbraun*. All these products are closely connected with Tyrolean mining and metal processing.

Manufacturers, processors and craftsmen

Two suppliers noted by Pronner are found in other account books of the court as 'Farbmacher von Schwaz' (colour-makers from Schwaz), both of whom delivered smalt. Until now there has been little written evidence for the independent profession of a 'colour-maker' at this time, even though research has indicated that specialised producers of pigments existed at least since the beginning of the sixteenth century.<sup>18</sup> Hans Gruber from Pillersee may also be a sort of a colour-maker, providing *Kesselbraun* (Table 4).

TABLE 4. Pigment manufacturers.

Supplier	Profession	Origin	Product
Abraham Probst	'Colour-maker'	Schwaz	Smalt
Hans Stachl	'Colour-maker'	Schwaz	Smalt
Hans Gruber	?	Pillersee	<i>Kesselbraun</i>

Christoph Hofer, whose sources are as yet unknown. However, he must have been able to choose between several *vendecolori*.<sup>15</sup> The inventory of the Venetian colour-seller Jacopo Benedetti, dating from only six years later,<sup>16</sup> seems to be representative of the spectrum of products to which an interested purchaser had access. Colorants, which were needed in high amounts or for which Venice was a well-known

TABLE 5. Local manufacturers, processors and craftsmen.

Wilhelm Distl, gold-beater from Munich	Gold leaf of different sizes and qualities
Michel Kebler, gold-beater from Munich	Gold leaf of different sizes and qualities
Martin Hotz, gold-beater from Augsburg	Gold and silver leaf of different sizes and qualities, shell gold and silver [ <i>Gemalen Gold</i> and <i>Gemalen Silber</i> , sold in <i>Muschelin</i> ], lead white, walnut oil
Landfried Gugler, <i>Fürneisser</i> (varnisher), Munich	Varnish [ <i>Firnys</i> ], turpentine
An 'Italian glassmaker' from Munich	Shell silver [ <i>Muschelin Gemalen silber</i> ]
Georg Sturzl, parchment-maker from Munich	Skin or parchment glue of different qualities [ <i>schoner rayner leim</i> , <i>gar schoner leim</i> , <i>guter leim</i> , <i>schwartzter leim</i> ( <i>ist schwartzter leim</i> , <i>leimbt aber woll</i> )]
Teubler, caster from Munich	Beeswax [ <i>von geschmeltzem wachs vom Engl</i> ]
Peter Ilsing, the duke's servant	'Rags of all colours for miniature painting' [ <i>Hadern aller Farben zum miniern</i> ]
Daniel Stengl, papermaker from Augsburg	Paper of different sizes and qualities
Sigmund Sturm, papermaker from Munich	Paper of different sizes and qualities
Caspar Schecks, artists' brush-maker [ <i>Penselmacher</i> ] from Augsburg	Artists' brushes [ <i>Maler penzel</i> ] of different size, shape and quality [ <i>allerlay sorten pensel</i> ], eg: 'very small artist's brushes' [ <i>gar klaine pensel</i> ]; 'artists' brushes of squirrel fur' [ <i>vech pensel</i> ]; 'artists' brushes of polecat fur' [ <i>Ilteß pensel</i> ]; 'artists' brushes in metal tubes' [ <i>pensel in plechin rorlin</i> ]; and 'older [artist's brushes] in quills' [ <i>elter in kiln</i> ]. English lead-tin yellow [ <i>englisch pley gelb</i> ], shell gold and silver
Abraham Debhel, producer and/or trader from Augsburg	Lead-tin yellow [ <i>Bley Gelb</i> ]
Christoph Schwarz from Landshut	Smalt [ <i>Plabe Oel Farb von Lantzhut</i> , <i>plabe oel Schmalt</i> , <i>Wasser Blaufarb von Lantzhut</i> , <i>wasser Schmalt</i> , <i>grob Wasser Schmalta</i> , <i>Esch: Schmalta</i> ]
Juliana Frumerin	Varnish [ <i>Firnys</i> ] and linseed oil

As well as these colour-makers we find others who delivered their manufactured products directly to the Munich court (see Table 5). Included among these are craftsmen from Munich and Augsburg such as gold-beaters, specialised artists' brush-makers, a papermaker and a parchment-maker who provided skin or parchment glue. The deliveries are often not limited to fabricated or processed products – an Augsburgian gold-beater also traded in lead white and walnut oil while a brush-maker, Caspar Schecks, also delivered lead-tin yellow, shell gold and shell silver.

Concerning the deliveries of the artists' brush-maker, two details are of interest. First, it seems to be one of the earliest pieces of evidence of the profession of the *Penselmacher* (as a producer of fine artists' brushes) as distinct from the *Bürstenbinder* (brush-maker). The second very interesting item is the supply of 'plechin pensel' or 'pensel in plechen rorlin' (literally translated as 'metal brushes' or 'brushes in small metal tubes'). This seems to be very early evidence of that kind of artists' brush. Pronner separated them clearly from the 'elter' (older) brushes in quills.

There are a few other people listed who sold only one product to Pronner, but there is no clear evidence as to whether they were producers or only purveyors. The most important among these was Christoph Schwarz, who delivered 'Öll: und Wasser Schmalta' (oil and water smalt) from Landshut. Until now there has been only one other hint concerning smalt from Landshut – in a documentary source about 120 years later.<sup>19</sup> Craftsmen such as a varnisher (*Fürneisser*), an Italian glassmaker and a caster sold some of their own workshop supplies including varnish (*firnis*),<sup>20</sup> turpentine, shell gold and beeswax (see Table 5).

#### PRONNER'S BOOK AND THE PAINTINGS MADE FOR THE COURT

By recording and bringing together thousands of single data entries, distributed on over 100 pages, Pronner's notes provide much interesting information.<sup>21</sup> What makes them unique and valuable for research into painting materials is the possibility of combining evidence from a documentary source with the physical evidence from paintings and other artefacts.

Tracing back the origins of some pigments for the altar paintings for the church of St Michael may serve as an example. It can be seen that Pronner had used all trading links in the nearer and farther vicinity of Munich, as set out in the above descriptions, to obtain materials of the highest quality at the lowest prices for this project. In addition, on the basis of analysing, for example, the entries concerning the *Martyrdom of St Andrew* of Christoph Schwarz and Alessandro Paduano, the above observations concerning Pronner's trading links can be summarised as follows: well-known pigments, as products obviously traded in a *Lot* – in this case lead white, lead-tin yellow, red lead, vermilion, verdigris, indigo, sap green and yellow lake ('Schitt Gelb', the English 'pink') – are delivered by local merchants from Munich. Ultramarine as a scarce and precious commodity, traded from abroad, comes directly from Venice. Various pigments are purchased directly from their places of origin or production. For example, yellow ochre, red ochre and green earth come from Venice (most likely from the well-known mining region in the Venetian hinterland), red lake comes from Florence, azurite and green copper pigments from Schwaz (Tyrol) and smalt from Schwaz or perhaps from Landshut.



Because the pigments that were used for the *Martyrdom of St Andrew* are known, Pronner's notes can help to answer open questions or confirm theories regarding terminology, origin or use and even chemical composition of a broad spectrum of artists' materials especially in comparison with other contemporary written sources and with the results of scientific examinations. A closer look at this work and another altar painting from St Michael, the *Triumph of Saint Michael*, including a limited amount of scanning electron microscopy with energy-dispersive X-ray analysis (SEM-EDX) and X-ray diffractometric examinations revealed some astonishing facts.<sup>22</sup>

#### KESSELBRAUN (KETTLE BROWN)

The unusually high ratio of copper in the brown paint layers and the extraordinarily high amounts purchased by Pronner of a brown pigment named *Kesselbraun* (kettle brown) demanded further research.<sup>23</sup> According to Pronner's notes, kettle brown was not only used as a pigment for paintings in oil and fresco but also to colour grounds such as that of the monumental high altarpiece in the church of St Michael, the *Triumph of Saint Michael* by Christoph Schwarz. Large amounts were used to colour stucco pastes, mortars and screeds. No other pigment was purchased by Pronner in anywhere near similar amounts (over 700 kg) and quantities (the largest delivery, supplied by Hans Gruber from Pillersee in Tyrol, consisted of 5 barrels of 100 *Pfund* each).<sup>24</sup> In addition to this, he bought nearly 450 *Pfund* of a pigment he called 'Valet Farb' (violet colour), another brown or brown-violet pigment, which seems to be closely related to *Kesselbraun* (see Table 6). Suppliers of kettle brown, a pigment of average price category, include

the merchant Caspar Hartschmidt from Munich as well as Christoph Ott and the Kraffter trading company, both of whom purveyed Venetian *Kesselbraun*, called 'paonazo', but the largest amount of kettle brown was that mentioned above, supplied by Hans Gruber. Jenewein Feustner from Kufstein in Tyrol also purveyed 261 *Pfund* under the term 'schon violet kesselbraun' (beautiful violet kettle brown) or 'Violet braun' (violet brown).

*Kesselbraun* is found in several documentary sources from the fifteenth to the nineteenth century. An interesting description concerning the nature and production of this pigment is provided by one of the key manuals for copper-smiths from the first half of the nineteenth century:<sup>25</sup>

It has been mentioned earlier, that, when melting copper to hard pieces you will get slags ... These slags as well as the oxide, which is formed when cooling the copper in the cask and sinks to the ground as well as the coarse hammer-scale of copper which peels off when hammering and the fine copper ashes can be reduced to metal copper again.<sup>26</sup>

After a description of the reducing processes is the following advice:

In regions where you can find many potteries the hammersmiths will rarely reduce their copper ashes to metal copper again, because they can sell them with much more profit to the potters, who need this metal in high amounts to produce glazings.<sup>27</sup>

Johannes Mathesius, a contemporary of Pronner, writes as early as 1587 in his *Bergpostilla oder Sarepta*, in chapter 7, 'Sermon on Copper':

TABLE 6. Deliveries of *Kesselbraun* (kettle brown) and *Valet Farb* (violet colour).

Delivery date	Term	Supplier	Amount	Price
22.07.1586	<i>Khessel praun, paonazo</i>	Christoph Ott, Venice	10 Venetian <i>Pfund</i> (4 Munich <i>Pfund</i> , 27 Lot)	15 Venetian <i>soldi</i>
30.09.1587	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	12 Munich <i>Pfund</i>	6 <i>Kreuzer/Pfund</i>
03.12.1587	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	10 Munich <i>Pfund</i>	6 <i>Kreuzer/Pfund</i>
12.01.1588	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	16 Munich <i>Pfund</i>	4 <i>Kreuzer/Pfund</i>
06.02.1588	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	25 Munich <i>Pfund</i>	4 <i>Kreuzer/Pfund</i>
26.03.1588	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	10 Munich <i>Pfund</i>	4 <i>Kreuzer/Pfund</i>
11.04.1588	<i>Valet Farb</i>	Caspar Hartschmidt	10 Munich <i>Pfund</i>	–
02.05.1588	<i>Valet Farb</i>	Caspar Hartschmidt	10 Munich <i>Pfund</i>	–
09.05.1588	<i>Violet praun, schon violet kessel praun</i>	Jenewein Feustner	261 Munich <i>Pfund</i>	3 <i>Kreuzer/Pfund</i>
27.05.1588	<i>Valet Farb</i>	Caspar Hartschmidt, Munich	20 Munich <i>Pfund</i>	–
07.07.1588	<i>Valet</i> [from Nuremberg]	'The Late Hieronymus Kraffter's Heirs'	400 Munich <i>Pfund</i> in a barrel	–
28.11.1588	<i>Valet Farb</i>	Caspar Hartschmidt	4 <i>Pfund</i>	–
28.07.1589	<i>kessel praun, kesselpraun</i>	Hans Gruber	500 Munich <i>Pfund</i> in 5 barrels	4 barrels at 2 fl 1 barrel at 5 fl
22.09.1589	<i>kessel praun</i> [from Venice]	'The Late Hieronymus Kraffter's Heirs'	20 Venetian <i>Pfund</i>	1 Venetian <i>libra</i> , 3 <i>bagattini</i>
02.01.1590	<i>Kessel Braun Farb</i>	Caspar Hartschmidt	10 Munich <i>Pfund</i>	4 <i>Kreuzer/Pfund</i>

At the coppersmiths you find the raw and black copper / ... / the coarse hammer-scale / and on the anvil after hammering / the small and fine hammer-scale / which is called copperbrown / ... / the potters use it to colour their glazes green.<sup>28</sup>

Martin Ruland gives the German translation *Kupfferbraun* for *Aeris squama tenuis* (fine copper hammer-scaleblow) in his *Lexicon Alchemiae* of 1612.<sup>29</sup> In pharmacy price lists or apothecaries' *Taxae* we find the terms *Kesselbraun* and *Kupferbraun* (kettle brown and copper brown) often used synonymously and connected with different copper products such as *squama aeris tenuis* (translated as copper scale, copper hammerscale, copper hammer slags, copper slags or copper ashes) or *Aeris flos* (*Flores aeris*, translated as copper flowers or copper grains); see Table 7.<sup>30</sup>

What we can derive from these very few and short excerpts and other documentary sources is that a pigment was produced in high amounts for the glazing of pottery or the colouring of glass but – comparable to smalt – was also used to produce painting colours.<sup>31</sup> It was most likely made from fine grade of copper hammerscale, copper slags or copper ashes.

From the chemical point of view, kettle brown or copper brown is a mixture of black and red oxides of copper.<sup>32</sup> It will be of great importance in the future to re-evaluate examination reports on works of art concerning copper-containing brown paint layers. Our greatest problem in dealing with historical pigment terminology is that the same name could have been used at different times, or indeed at the same time, for different powders of similar colour and consistence.<sup>33</sup> The terms *paonazo*, *Violet Kesselbraun* (violet kettle brown) and *Violet Braun* (violet brown), but especially the *Valet Farb* (violet colour), used by Pronner, partly synonymous with and partly in addition to the simple *Kesselbraun*, indicate that brown pigments of different

shades from red to violet – not naturally consisting of the same substances – could have been sold under similar names. It is not to be excluded completely that the above-mentioned trading locations at Tyrol – Pillersee and Kufstein – may also suggest a connection with iron processing,<sup>34</sup> or for example the extraction of ferric oxides as the remains of distillation during the production of sulphuric acid from iron vitriol.<sup>35</sup> The Krünitz Encyclopedia identifies *Kesselbraun* as a brown earth too,<sup>36</sup> most likely also containing ferric oxides. And finally, in contemporary written sources we can find connections with manganese oxides, used to colour glass or glazings.<sup>37</sup> More scientific examinations that can be compared with Pronner's notes will also possibly provide further clarification.

This paper has demonstrated the unique possibilities provided by Pronner's book to bring together a wealth of information on traders, purchasers and users of artists' materials, and existing artefacts of all kinds. Beside surprising facts about terminology and use of pigments, lakes and media as well as workshop supplies, Pronner's notes provide a rather sober image of the working processes of court artists and their workshops at the end of the sixteenth century. Independent professions such as the 'colour grinder' or the 'colour-maker' show the extent of the division of labour, which is contradictory to a somewhat romantic image of the self-sufficient artist's workshop and give a lively impression of the customs of trading and supplying artists' materials at the period.

## NOTES

1. Munich, Bayerisches Hauptstaatsarchiv (BHStA), HR I, Fasz. 279/4.
2. *Hierein wirt verzeichnet alles was ich Wolf(gang) Pronner von wegen meines Gened(igen) Fürsten und herrns zu der Malerey gehorig, von gemalenen und geschlagnem Goldt und Silber auch allerlay sorten Farben Empfange, Eynimbe und widerum Ausgib.* Munich, BHStA, HR I, Fasz. 279/4, f. 1a<sup>r</sup>.
3. *Nota. Obiger Wolf Pronnern ist den VI Jenner a<sup>o</sup> 1586 alß aufseher und Rechnungsführer über die Mahlerfarben mit jährl(ich) 200 fl: besoldung angestellt und mit anfang deß zweiten Quartals a(nno) 159[0] wider abgeschafft worden dan gleich darauf gestorben.* Munich, BHStA, HR I, Fasz. 279/4, f. 1a<sup>r</sup>.
4. Munich, BHStA, HR I, Fasz. 95/15.
5. Stockbauer, R. (1874) 'Die Kunstbestrebungen am Bayerischen Hofe unter Herzog Albrecht V. und seinem Nachfolger Wilhelm V. nach den im K. Reichsarchiv vorhandenen Correspondenzacten', *Quellenschriften für Kunstgeschichte und Kunsttechnik des Mittelalters und der Renaissance*, vol. 8, ed. R. Eitelberger v. Edelberg, Wien: Braumüller. Reprinted Osnabrück: Zeller 1970, pp. 90–91, 108.
6. Pronner mentions also – but less often – Hans von Aachen, Engelhardt de Pée, David Steber and Jakob Sandtner.
7. Apprentices listed are: Georg Ramsler, Hans Werl and Hans Schwarz; Munich painters and gilders employed per week or per day are: Hans Heinrich, Jakob Jehle, Hans Keller, Christoph Mittermayer, Friedrich Vogel and Thomas Zechetmayer; colour grinders listed are: Hans Tegler with Caspar Perckhamer, Peter Herrer and 'Jorgen Farbreiber', probably Georg Prandt.
8. Sculptors and stucco plasterers are: Blasius Fistulator, Hubert Gerhardt, Hans Krumper, Carlo Pallago, Gaudenz Ramata and Piero (della Motta?); goldsmiths, cutters of stone and crystal

TABLE 7. *Kesselbraun* (kettle brown) and *Kupferbraun* (copper brown) in apothecaries' *Taxae* between 1553 and 1618.

Place and year of publication of the <i>Taxa</i>	Pharmaceutical term	Translation
Lignitz 1568	–	<i>Kesselbraun</i>
Lignitz 1584	–	<i>Kesselbraun</i>
Eisleben 1598	–	<i>Kesselbraun</i>
Cöthen 1609	–	<i>Kesselbraun</i>
Gera 1617	–	<i>Kupfferbraun</i>
Frankfurt 1582	<i>Aeris Squama tenuis</i>	<i>Kesselbraun</i> , <i>Kupfferbraun</i>
Worms 1582	<i>Squama aeris tenuis</i>	<i>Kupfferbraun</i>
Passau 1586	<i>Squamae aeris tenuioris</i>	<i>Kupferbraun</i>
Mainz 1605	<i>Squama aeris tenuis</i>	<i>Kupferbraun</i>
Laugingen 1618	<i>Aeris Squama Tenuis</i>	<i>Kupffer- oder Kesselbraun</i>
Berlin 1574	<i>Aeris flos</i>	<i>Kupfferbraun</i>
Sachsen 1580	<i>Aeris flos</i>	<i>Kupffer braun</i>
Henneberg 1596	<i>Aeris flos</i>	<i>Kupfferbraun</i>

- are: Georg Eisele, Hans Oexl, Zacharias Peltzer, Hans von Schwanenburg, Ulrich Schwegler, Georg Stamler and Christoph Zech.
9. A Munich *Pfund* weighed 560 grams at that time, a Munich *Lot* 17½ grams and a Munich *Quintlein* about 4½ grams.
  10. In this list we find smaller and larger deliveries containing different pigments perhaps from Venice or Nuremberg, or deliveries of single products directly from the producer ('delivery ex works') or from specialised merchants.
  11. Matthew, L.C. (2002) "'Vendecolori a Venezia': the reconstruction of a profession", *Burlington Magazine* 144, pp. 680–86; Krischel, R. (2002) 'Zur Geschichte des Venezianischen Pimenthandels: Das Sortiment des Jacobus de Benedictis à Coloribus', *Wallraf-Richartz-Jahrbuch* 63, pp. 93–158; Kirby, J. (1999) 'The painter's trade in the seventeenth century: theory and practice', *National Gallery Technical Bulletin* 20, pp. 5–49.
  12. Frankfurt (1582), *Catalogus Oder Register / aller Apoteckischen Simplicien vnd Compositen / so in den beyden Messen zu Franckfurt am Mayn / durch die Materialisten / Kauffleut / Würtzeltrager und Kräutler / auch durch die Apotecker daselbst verkaufft werden*. Frankfurt/Main: Nicolaus Basseus.
  13. Munich, BHStA, HR I, Fasz. 279/4, f. 1a<sup>v</sup>.
  14. Noting this delivery from Venice, Pronner uses (for the only time in his book) some German names together with their Italian synonyms. Most likely the Italian terms had been marked on the delivery note.
  15. Matthew 2002 (cited in note 11); Krischel 2002 (cited in note 11).
  16. Krischel 2002 (cited in note 11). See also the contribution by Andreas Burmester *et al.* in this volume (pp. 314–24).
  17. Berger, E. (1901) *Quellen für die Maltechnik während der Renaissance und deren Folgezeit (XVI.-XVIII. Jahrhundert) in Italien, Spanien, den Niederlanden, Deutschland, Frankreich und England nebst dem DeMayerne Manuskript*, Munich: Callwey. Reprinted Vaduz 1993, p. 129.
  18. Burmester and Krekel published a document of 1514, naming a 'colour burner' Michel, who probably produced lead-tin yellow at Hersbruck, situated at the hinterland of Nuremberg. See Burmester, A. and Krekel C. (1998) 'Von Dürers Farben', in G. Goldberg, B. Heimberg and M. Schawe (eds) *Albrecht Dürer. Die Gemälde der alten Pinakothek*, Munich: Braus, p. 66. Matthew 2002 (cited in note 11), p. 681, describes workshop documents from 1551 of a Venetian manufacturer of lead white, called Giovanni Griffalconi, giving evidence of his trade relations to Venetian colour-sellers.
  19. J.K. (1707) *Wieder neu aufgerichtete und vergrößerte in Zwey Theilen angewiesene Curieuse Kunst- und Werck-Schul*, Nuremberg: Johann Ziegler, p. 730.
  20. The term *firmis* (varnish) is not an exact description of a material. Whether it means sandarac as a solid resin or dissolved and ready for use, amber or another product containing linseed oil cannot be proved at this time.
  21. To facilitate working with the thousands of single entries in Pronner's book, it was crucial to transfer it into a computer database in order to link the different materials, names, dates and works of art under different aspects.
  22. The examinations have been carried out at the Doerner Institut Munich. I am much obliged to Heike Stege and Christoph Krekel.
  23. For further information see Haller, U. (2005) *Das Einnahmen- und Ausgabenbuch des Wolfgang Pronner. Die Aufzeichnungen des 'Verwalters der Malerei' Herzog Wilhelms V. von Bayern als Quelle zu Herkunft, Handel und Verwendung von Künstlermaterialien im ausgehenden 16. Jahrhundert*, München: Siegl, pp. 127–33. A monograph about *Kesselbraun* will soon be published together with Heike Stege, Christoph Krekel and Andreas Burmester.
  24. Other products purchased in high amounts (up to 100 *Pfund*) are: lead white, chalk, glue, linseed oil, red and yellow ochres.
  25. Höhne, F. and Rösling, C.W. (1839) *Das Kupferschmied-Handwerk*. Weimar: Voigt. Reprint Hannover o.J.
  26. 'Es wurde schon früher erwähnt, dass sich beim Schmelzen des Kupfers zu Hartstücken Schlacken ergeben, welche vermittelst der Stampfen klar gepocht und geschlemmt werden. Diese Schlacken, sowohl, als auch dasjenige Oxyd, welches sich beim Abkühlen des Kupfers im Plätzfaß ergibt und in demselben zu Boden sinkt, wie auch der beim Schmieden sich ablösende grobe Kupferschlag und die feine Kupferasche können wieder auf metallisches Kupfer gebracht werden'; Höhne and Rösling 1839 (cited in note 25), pp. 124–5.
  27. 'In vielen Gegenden, in welchen die Töpferarbeiten stark gehen, kommen die Hammerschmiede selten dazu, ihre Kupferasche wieder auf metallisches Kupfer zu reduciren, indem sie dieselbe mit weit größerem Vorteil an die Töpfer, welche dieses Metall in großer Quantität zur Bearbeitung ihrer Glasuren bedürfen, verwerthen können'; Höhne and Rösling 1839 (cited in note 25), p. 125.
  28. 'Bey den Kupferschmiden findet man von dem rohen und schwartzen Kupffer / in der beisse / wie auch in seigerhütten / den gröbsten Hammerschlag / und auff dem amboß nach dem treiben und hemmern / den kleinen oder subtilen hammerschlag / welches man kupfferbraun nennet / damit man alte schäden an vieh und leuten heilet / und die töpffer ir glette grün ferben'; Mathesius, J. (1587) *Bergpostilla oder Sarepta*, Nuremberg, p. 65 (2nd edn of the original edition of 1562).
  29. Ruland, M. (1612) *Lexicon Alchemiae sive Dictionarium Alchemisticum*, Frankfurt/Main: Palthenius. Reprint of the 2nd edn. Hildesheim/Zürich/New York 1987, pp. 13, 18.
  30. See the paper by Andreas Burmester *et al.* in this volume (pp. 314–24).
  31. Zecchin, L. (1986) *Il ricettario Darduin. Un codice vetrario del seicento trascritto e commentato edito a cura Stazione Sperimentale del Vetro*, Venice: Arsenale, p. 251.
  32. Copper hammerscale contains black CuO (tenorite) and red Cu<sub>2</sub>O to form a brown pigment. See, for example, Brepohl, E. (1998) *Theorie und Praxis des Goldschmieds*, 13th edn, Munich: Fachbuchverlag Leipzig im Hanser-Verlag, p. 33.
  33. See the discussion about the terminology of natural copper green pigments such as *Berggrün* or *Schiefergrün* in Burmester, A. and Resenberg, L. (2003) 'Von Berggrün, Schiefergrün und Steingrün aus Ungarn', *Restaurio*, 109, p. 187.
  34. With Pillersee and Glemm an der Weissach, Tyrol had important iron mines with connected iron processing. See Mutschlechner, G. (1993) 'Bayerisch-tirolische Beziehungen im Berg- und Hüttenwesen', in *Tiroler Landesmuseum Ferdinandeum* (ed.) *Beitragsband zum Katalog der Tiroler Landesausstellung 1993*, Innsbruck: Althesia-Tyroliia, p. 205.
  35. The Italian term corresponding to *Valet Farb* (violet colour) is the violet *morello*. Violet hues were produced mostly with colour mixtures or different lakes. In addition to this we know of Borghini's *pagonazzo di sale*, Lomazzo's *Morello di ferro*, *Morello di sale* or *Vitriuolo cotto*, which are most likely ferric oxides such as Fe<sub>2</sub>O<sub>3</sub>. The modern term would be *Caput mortuum*, which originally meant only the ferric oxide that is formed as the remains of distillation during the production of sulphuric acid from ferric sulphate. See Haller 2005 (cited in note 23), pp. 131–2. See also the paper by Gunnar Heydenreich in this volume (pp. 297–313).
  36. Krünitz, J. G. (1773–1858) *Oekonomisch-Technologische Encyclopaedie [...]* (242 volumes), vol. 37 (1786), Berlin: Pauli, p. 75.
  37. Petrus Albinus describes *Glaszköpfe* (*Braunstein*), manganese dioxide minerals, which 'provide a beautiful kettle brown colour for the potters'; Albinus, P. (1589) *Meißnische Land- und Bergk-Chronica*, Dresden, p. 151; see Haller 2005 (cited in note 23), pp. 132–3. The famous *Ricettario Darduin*, the book of recipes of the Darduin, a Venetian family of glassmakers, describes *pavonazzo* as a violet hue, produced through the addition of manganese dioxide to the molten glass. See Zecchin 1986 (cited in note 31), p. 258. The recipes also contain cobalt oxides and refer to *manganese de Piamonte*; see Zecchin 1986 (cited in note 31), p. 126. Manganese dioxide was used as *Magnesia vitriaorum* or *Haematitum spurium* by potters to produce glazes; see Horschik, J. (1978), *Steinzeug. 15. bis 19. Jahrhundert*, 2nd edn, Dresden: VEB Verlag der Kunst, p. 31.