Fabien-Gautier d'Agoty (1781) and the first mineralogy book to be printed in color

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The 18th century is a particularly interesting period in the history of mineralogy and science in general. In the 17th century, natural research was mainly the field of scientific societies (such as the Royal Society in London, founded in 1660 and the Académie Royale des Sciences in Paris, founded in 1666) and the domain of only a limited number of researchers. This changed in the 18th century and science enjoyed the interest of a much wider public. For the elite at the time, it was cultural fashion to engage in science. Wealthy citizens purchased scientific instruments (such as the vacuum pump, the electrification machine, telescopes for astronomy, etc.). Some of those enthusiasts tried to do serious research with them, but in many cases the instruments served merely as scientific toys (physique amusante) or acted as status symbols.

In addition, there was also an increased interest in natural history. This resulted, among other things, in the creation of collections of stones, fossils, shells, etc., that illustrated the scientific knowledge of nature. In contrast to the cabinets of curiosities (known since the 16th century) where the focus was mainly on the rarity and the spectacular character of the objects, scientific insight was now central. What interests us most are the mineral collections built up by wealthy amateurs in the course of the 18th century (see Wilson, 1994, pp. 43-150). Mineral collecting was a craze in 18th-century Paris (Simon, 2002). The Enlightenment is often characterized as the age of classification, and the minerals in such collections were ordered according to one of several systems in circulation at the time.

Mineralogical science itself made great strides in the second half of the 18th century. On the one hand there was the development of crystallography. In 1772, Romé de l'Isle (1736-1790) published his "Essai de Cristallographie" in which he classified crystals according to their morphology. On the other hand, there was increasing knowledge in the field of chemistry (originated from alchemy) and a number of mineralogists (such as Wallerius, Cronstedt, Bergman) came to understand that the true nature of a mineral was determined by the nature of the matter of which it consists. They considered the chemical composition as the main characteristic for identifying and classifying minerals.

As formulated by Simon (2002) and Maës (2017), these advances in mineralogy have been the subject of debate among amateurs, physicists and chemists. The question was whether a mineral should be identified and subsequently classified on the basis of easily observable external characteristics or on the basis of its internal composition as determined by chemical analysis. For the mineral collector, the research of crystallographers and chemists was more of a source of confusion than a source of information. Romé de l'Isle's "Essai de Cristallographie" was not exactly a manual for amateurs, and chemistry was still a developing science and not the domain of the layman.

For the collector, identification and classification on the basis of external characteristics was the most obvious. But there was no such thing as a beautifully illustrated "Field Guide to Rocks and Minerals" that could serve as a tool to give minerals their correct name. The Parisian Jean Fabien Gautier d'Agoty (1747-1781), whom we here simply call Gautier d'Agoty, would change that. In 1776 he planned to publish a work on the vegetable, animal and mineral kingdoms and the part on minerals would be published first (advertisement, 1781). It would consist of color plates, each of which would be provided with a descriptive text so that the book would acquire both an informative and aesthetic value. If anything with color plates appeared in that period, the plates were made from copper engravings that were colored by hand after printing. However, Gautier d'Agoty's work involves color printing (the first color printing of minerals ever); he was a professional engraver and came from a family with a reputation in the new field of color printing.

Gautier d'Agoty wanted to make a book in which minerals were clearly depicted which would help the reader to recognize / identify his finds. In the introduction to his book (Gautier d'Agoty, 1781) he pointed out the difficulty of correctly representing minerals. More specifically, he talked about the subtlety of colors and transparencies and wrote the following:

"*Comment en effet rendre une multitude de corps lisses ou diaphanes, des surfaces luisantes comme l'acier poli, ou changeantes comme la gorge des pigeons ? Comment faire sentir les nuances infiniment variées des couleurs métalliques, & les tons qui distinguent, par exemple, une Mine d'Argent grise, d'une Galène, d'une Pyrite Arsénicale, d'une Mine de Cobalt grise, d'une Mine de Fer ou d'Antimoine, d'une Molybdène, ou d'un Mica ? Ce sont sans doute ces difficultés qui sont cause que jusqu'à présent on n'a rien donné de bien satisfaisant sur cet objet : aussi, sans le secours des formes cristallines ou polyèdres, qui caractérisent bien décidément chaque espèce, aurois-je absolument renoncé à ce projet.*"

> free translation:
>
> How are you supposed to represent a multitude of smooth or translucent crystals, shining like polished steel or with colors as changeable as a dove's throat? How do you show the infinitely varied nuances of metallic colors and shades that distinguish between, for example, tetrahedrite, galena, arsenopyrite, skutterudite, hematite or stibnite, from molybdenite or mica? This may be the reason that nothing satisfactory has been published in this field so far: without the help of crystal morphology characteristic of each species, I would certainly have given up on this project (translation of mineral names according to de Fourestier, 1999).

Not being a scientist, Gautier d'Agoty contacted mineralogist and chemist Balthazar Georges Sage (1740-1824) who introduced him to the renowned Romé de l'Isle who would provide all the plates with accompanying texts. That was an excellent choice because Romé de l'Isle was well known in the Parisian mineral collectors circle; he organized many of their collections and also provided descriptions of minerals in various auction catalogs.

Romé de l'Isle may have put the emphasis on depicting crystallized specimens. He probably came up with the idea of adding images of individual crystals of a featured mineral which were characteristic of the species in question. This considerably increased the value of the images for the identification of minerals and as such the current state of science was linked to beautiful drawings. It is likely that he was also responsible for the choice of the shown specimens. After all, he knew many of the leading Parisian collections and was thus able to select representative specimens. Each colored plate would bear the name of the owner of the specimen depicted.

In April 1781, Gautier d'Agoty announced the publication of his natural history in the journal "Observations sur la physique, sur l'histoire naturelle et les arts" (the future Journal de physique) beginning with the section on the mineral kingdom. Most information about this publication comes from this magazine which was founded in 1752 by Gauthier d'Agoty's father.

The color printing technique used for this work consisted of building an image from the three primary colors (red, yellow, blue) plus black. A separate copper engraving had to be made for each color of ink and by printing those engravings in succession on top of each other an accurate color representation of the mineral to be imaged was obtained. That also meant that all the copper plates had to be positioned exactly in relation to the impression. This method required considerable experience to convert the required final color into the individual color components and may have involved a lot of trial and error. In addition, hand coloring of the images was added where necessary. All in all, a fairly time-consuming and expensive process requiring a great deal of experience.

Because of this high cost, the book would be published in stages of 10 plates with accompanying text (so-called decades); a method not uncommon in expensive illustrated books. These decades were then bound in a provisional cover, a so-called interim binding (figure 1). When the series was complete, the buyer had his bookbinder bind all interim bindings into one book in the style of his own library.

The work would be published in large quarto format (about 25 x 35 cm) and probably comprise 80 or at most 100 plates and thus consist of 8 to 10 decades. The April announcement stated that the first decade would be completed in May 1781 and the next on July 1. One decade would then cost 15 Livres, which according to the "convertisseur de monnaie d'ancien régime" (https://convertisseur-monnaie-ancienne.fr) converted to today would amount to € 224 (converted to April 9, 2021). That was a considerable amount and one also had to pay for two decades in advance (figure 3). Therefore it is not surprising that only a limited number were sold and printed.

The first and second decade appeared as announced, but the third decade was delayed and only appeared in February of 1782. In a review in the journal "Observations sur la Physique, etc." (anonymous, February 1782) this third decade was praised for the perfection of the images, but at the same time announced the sad news that Gautier d'Agoty had passed away (probably november 1781[1]). He could have produced only

[1] a notary statement dated November 24, 1781 "Inventaire après décès de Fabien Gautier Dagoty, époux de Marie Anne Madelaine Poupion" resides in the Archives Nationales in Paris and proves he passed away before that date

three decades (30 color plates). However, his widow wanted the work to continue, and her name appeared on the wrapper of the fourth decade (figure 2). Romé de l'Isle would continue to provide the text and a new engraver François Louis Swebach-Desfontaines (date of birth and death unknown) would continue to take charge of the production and would provide the images in collaboration with engraver Louis Bonvallet (1748-1818).

In the "Observations sur la Physique, etc." (anonymous, November 1782) the fourth decade (with plates 31-40) was announced. Those plates were signed by Swebach-Desfontaines and by Bonvallet and came with the accompanying text by Romé de l'Isle. But the newcomers apparently had great difficulty with the complicated printing process, which slowed down further production and again led to the production of hand-colored plates. The further history of the work is unclear and after 1782 nothing can be found in "Observations sur la Physique, etc.". Over a longer period, another three decades appeared. These were signed by Swebach-Desfontaines and only the first two decades were provided with text by Romé de l'Isle. The last set of plates, 61 to 70, of which only two copies are currently known, came without text and was most likely produced after the death of Romé de l'Isle in 1790. So a total of 70 color plates were produced between 1781 and 1791 or 1792. The parts about plants and animals were never published.

About what is depicted on the plates, Gautier d'Agoty (1781) wrote the following in his introduction:

"*Chaque Planche représente un ou plusieurs groupes bien caractérisés ; & , comme les formes polyèdres ou cristallines sont un des principaux caractères que doivent consulter les Naturalistes, je m'attache surtout à celles qui sont très-distinctes, & le moins altérées qu'il est possible ; je cherche aussi à rencontrer plusieurs variétés réunies dans le même morceau, afin qu'on ait sous un seul point de vue les objets de comparaison, & que le passage d'une forme primitive à une forme secondaire, ou d'un polyèdre à l'autre, s'apperçoive du premier coup d'œil. Chaque morceau met ainsi sous les yeux la forme angulaire propre à chaque substance dans l'état de cristallisation. C'est pour rendre cette forme encore plus sensible, que je donne, au bas de la Planche, les Cristaux solitaires & détachés de même forme que ceux qui composent le groupe ; souvent même j'y joins leurs variétés ; &, lorsque la figure en est trop compliquée, j'en présente la coupe ou le développement.*"

free translation:

"Each plate shows one or more well-characterized crystal groups and because crystal morphology is one of the most important properties that naturalists should pay attention to, I mainly focus on very distinct and as little altered crystals as possible; I also try to depict specimens that show multiple forms in one specimen so that the transition from a primitive form to a secondary form, or from one polyhedron to another, is immediately apparent. Each specimen shows crystals that are specific to the mineral in question. To emphasize the crystal form even more clearly, at the bottom I show single crystals of the same shape as those constituting the crystal group; often I even add their varieties; and if the picture is too complicated, I present a section or an unfolding."

Gautier d'Agoty thus wanted to place a clear emphasis on crystallized specimens and of the 30 plates he produced, only 2 depict non crystallized specimens. In this way he emphasized the importance of crystals for the identification and cataloging of minerals. The same also applies to the other plates that were made by his successor Swebach-Desfontaines, where only 2 out of the remaining 40 plates do not show crystals.

To clarify the morphology, Gautier d'Agoty also showed loose crystals on 19 of the 30 plates and depicted more than one specimen on half of the plates. Certain parts of the images were carefully numbered and referenced in the accompanying texts by Romé de l'Isle (figure 4). This combination of crystallized specimens, loose crystals, color printing and an accompanying text for each plate, turned this work into a didactic handbook and a delight to the eye at the same time.

Swebach-Desfontaines deviated slightly from its predecessor in his approach. Apparently he wanted to put more emphasis on the representative mineral specimen because in 32 of the 40 remaining plates he showed only one specimen and in just under half of those plates also showed loose crystals (figure 5).

If we look at the localities, it appears that more than half of the minerals come from France and Germany (about the same amount from both countries) and to a lesser extent from Italy, Great Britain and Austria. But there are also specimens from Russia, Spain, Denmark, Iceland, Romania and even more remote areas such as South Africa, Peru and Sri Lanka.

The mineral specimens themselves came from 13 different collections (cabinets). Romé de l'Isle himself supplied specimens for 23 plates. 15 came from the cabinet of Gigot d'Orcy, 10 from Jacob Forster, 6 from de Joubert, 4 from Sage, 3 from Abbé Nolin, 2 from de la Bove and also 2 from the Marquis de Cubieres. The other collectors each accounted for one copy; Bertin, Besnier de la Pontonnerie, de Cramayel, Ecole Royale de Minéralogie docimastique, Gautier d'Agoty, de Croisset, Carrangeot. Incidentally, in the last 10 plates there are no more minerals from the collection of Romé de l'Isle because he died in 1790 and therefore places the publication of these plates after 1790 (figure 6). In that series we do find 6 specimens from the collection of Gigot d'Orcy (1733-1793), who died in 1793, which places the end date of the publication around 1791-1792.

Because the whole event (engraving, writing texts, publication of the book) took place in Paris, it is also to be expected that the relevant mineral cabinets were located in this city. In "The History of Mineral Collecting 1530-1799" by Wendell Wilson (1994) we find all the collectors and it turns out that they all lived in Paris with the exception of Jacob Forster, a British mineral dealer and collector who regularly worked in Paris. In a tourist guide to Paris (Thiery, 1788) which also discussed the most important cabinets of the time, we even find the address where Forster stayed when he was in Paris and it appears to be at the same address as that of the residence of Romé de l 'Isle.

Gautier d'Agoty's book is one of the most beautiful colored mineral books ever published. But it is also one of the rarest books of its kind. Schuh (2007) describes its rarity as "very rare" (meaning that he has only been able to trace between 6 and 12 copies). Since there was clearly a gap in the publishing of the volumes after Gautier d'Agoty's death (up to 10 years after the 4th decade in 1781), most copies consist of 40 plates and copies with more plates are extremely rare. Because the color printing process was so complicated and time-consuming and because Swebach-Desfontaines did not master this technique well, hand-colored plates were also produced after plate 40. Plates in color print can be recognized by four register holes on the corners of the plate that served to position the paper and the copper engravings exactly in relation to each other.
In 1991 the Mineralogical Record published a facsimile reprint with historical notes (Wilson, 1991).
A digitized copy with 40 plates can be admired on the website of the "Bibliothèque patrimoniale numérique de l'École nationale supérieure des mines de Paris (Mines ParisTech) at
https://patrimoine.mines-paristech.fr/document/Gautier_d_Agoty_Histoire_naturelle.

Acknowledgements:

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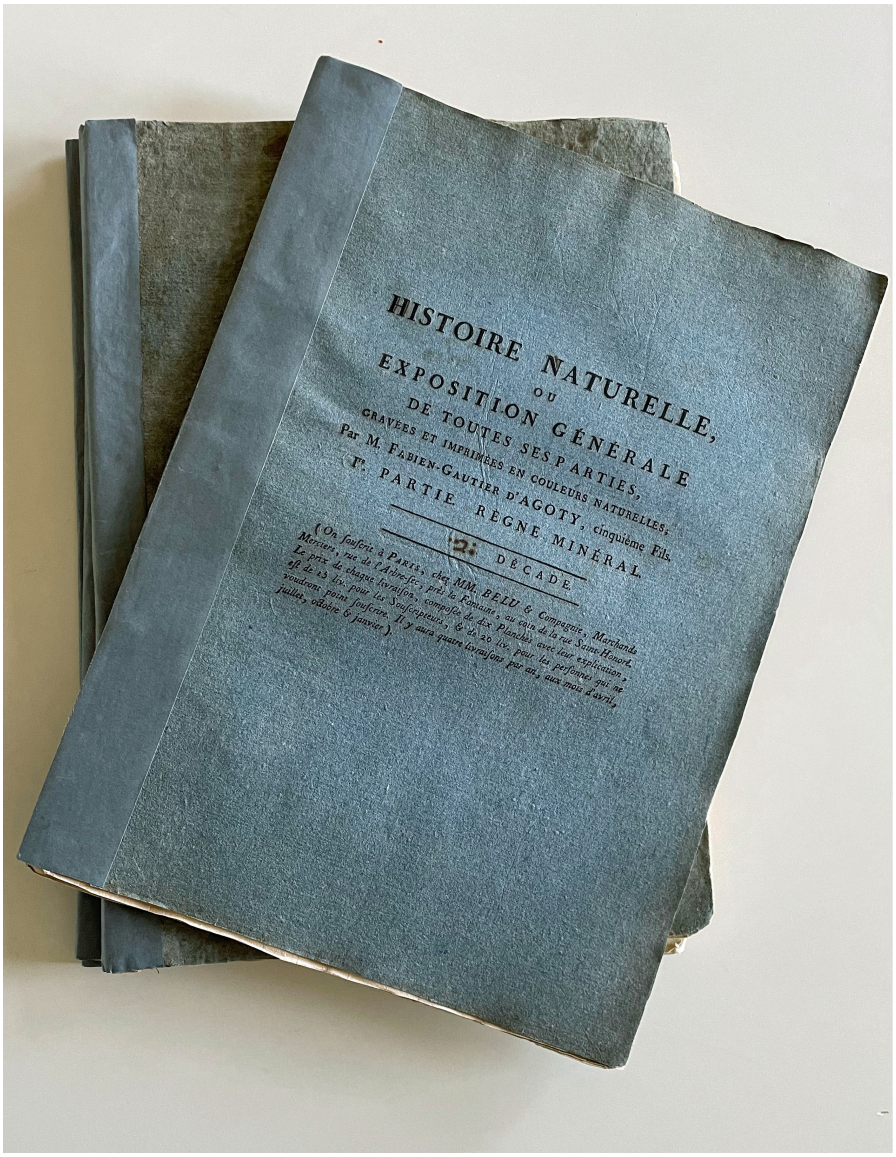


Figure 1
The first four decades in their original interim binding. The number of the decade was entered by hand in ink. Once the work was complete, the decades would be bound in one book

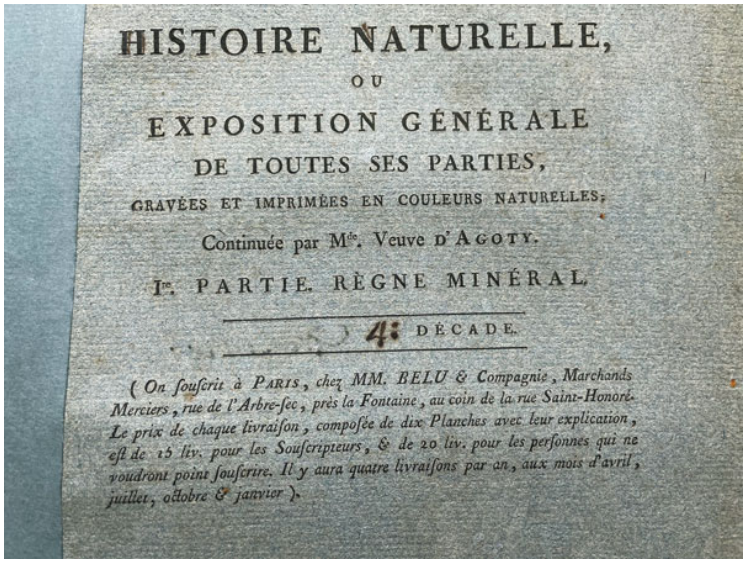
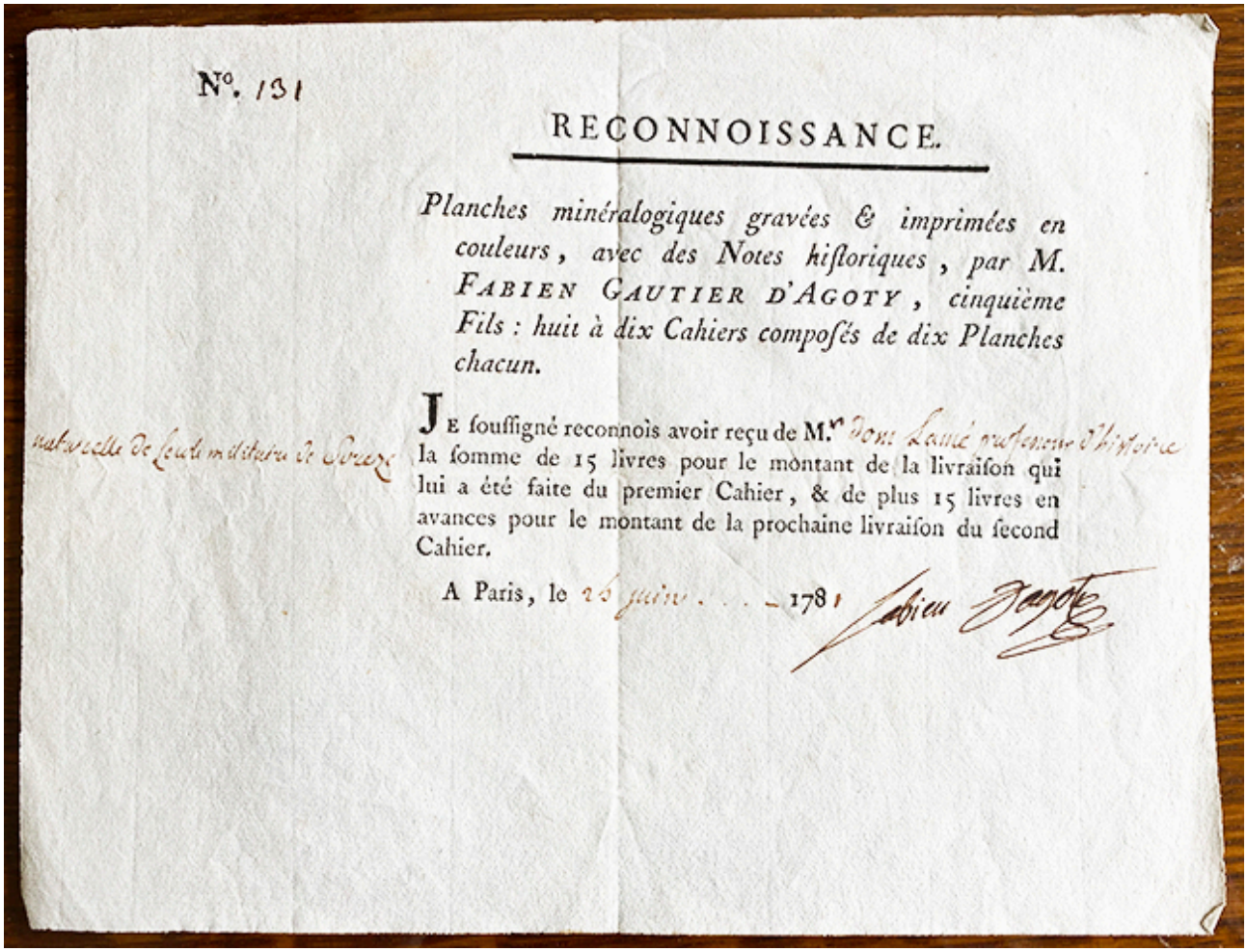


Figure 2
After the death of Gautier d'Agoty, his widow took over the production of the work, as is evident from the text on the wrappers of the fourth decade.



N°. 131

RECONNOISSANCE.

Planches minéralogiques gravées & imprimées en couleurs, avec des Notes hiſtoriques, par M. FABIEN GAUTIER D'AGOTY, cinquième Fils : huit à dix Cahiers compoſés de dix Planches chacun.

naturelle de l'école militaire de Sorèze

JE ſouſſigné reconnois avoir reçu de M.r Dom Lamé professeur d'histoire la ſomme de 15 livres pour le montant de la livraiſon qui lui a été faite du premier Cahier, & de plus 15 livres en avances pour le montant de la prochaine livraiſon du ſecond Cahier.

A Paris, le 25 juin . . . – 1781 Fabien Dagoty

Figure 3
Printed receipt signed by Fabien Dagoty on June 25, 1781, for the purchase of the first two decades by Dom Lamé, professeur d'histoire naturelle de l'école Militaire de Sorèze
collection and photo © Herb Obodda

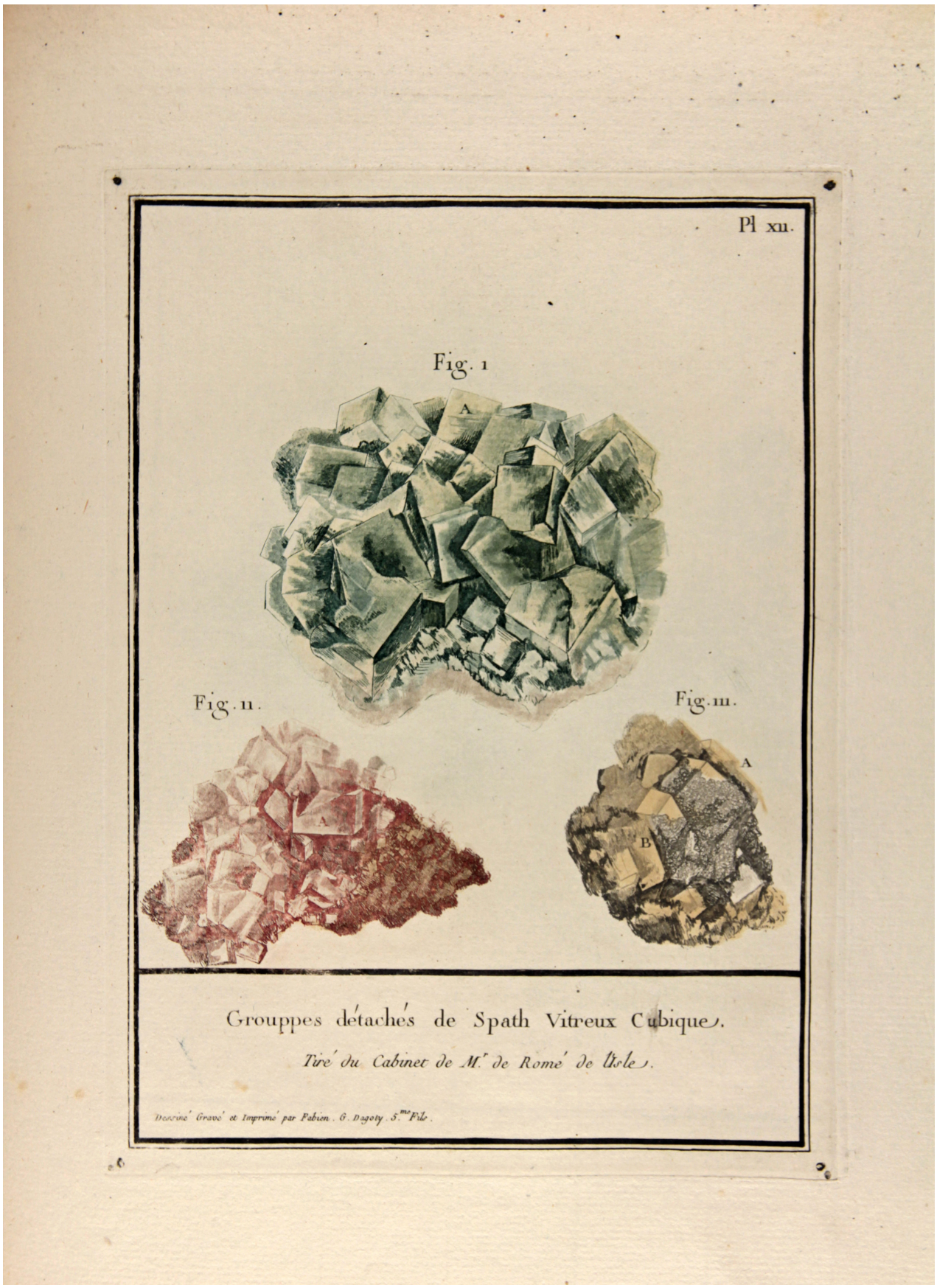


Figure 4
Plate XII from the second decade by Gautier d'Agoty (1781) with the color print image of three fluorite specimens from the collection of Romé de l'Isle.
Note the register holes on the corners of the engraving

Figure 5
Plate LIV of the sixth decade by Swebach-Desfontaines of a specimen of topaz and quartz crystals from the Schneckenstein, depicting loose crystals illustrating the morphology of topaz, from the collection of Gigot d'Orcy (1737-1793)

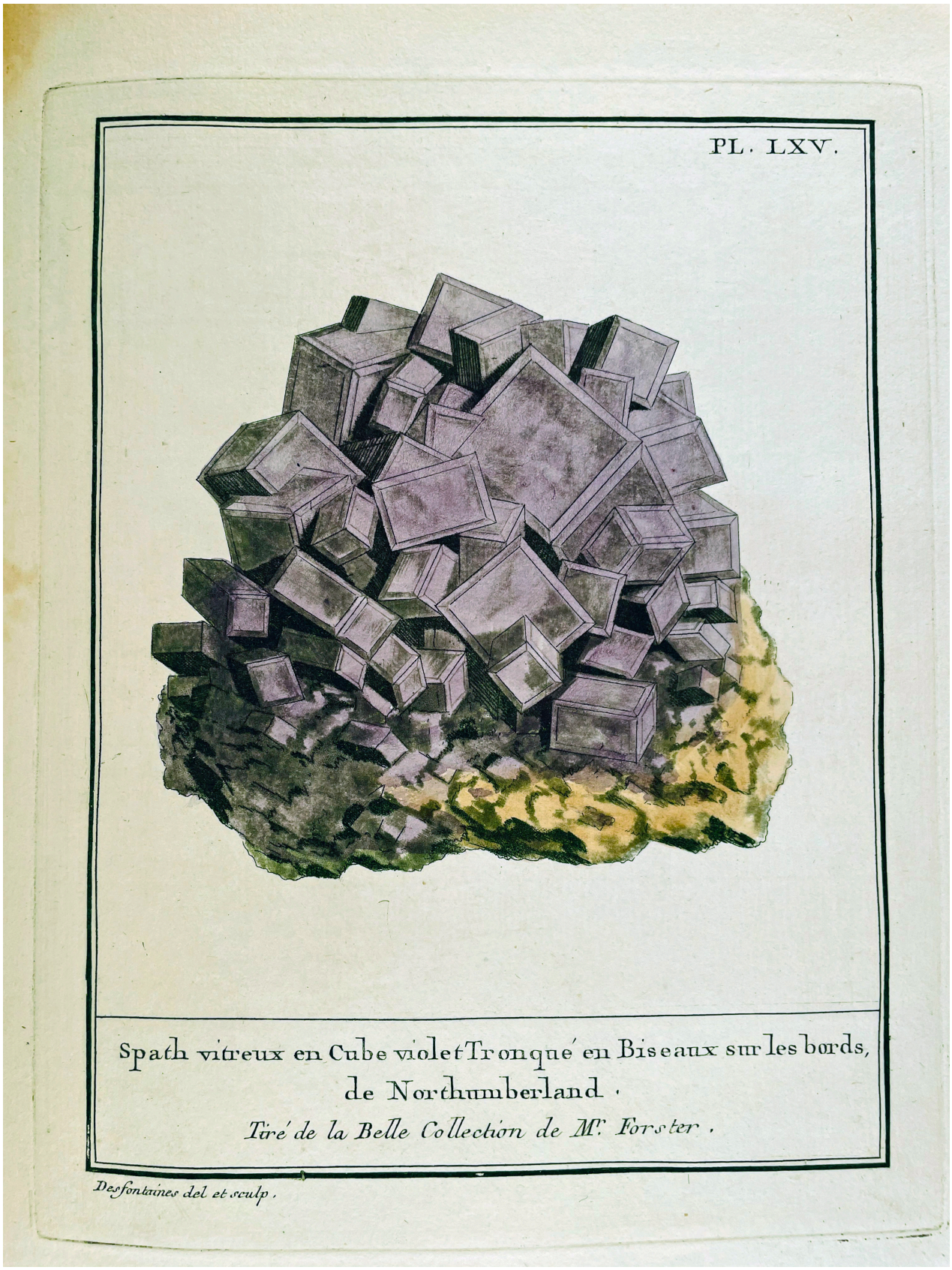


Figure 6
Plate LXV, from the seventh and last decade with the hand-colored image by Swebach-Desfontaines of a specimen of fluorite crystals from Northumberland, from the collection of Jacob Forster (1739-1806)