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► To cite this version:

Ingrid Houssaye Michienzi, Dominique Cardon. Sourcing and Consumption of Alum in the Dyeing Company Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore in Florence (1483-1498). *Artefact : techniques, histoire et sciences humaines*, 2022, 16, pp.145-165. 10.4000/artefact.12120 . hal-03887014v2

HAL Id: hal-03887014

<https://hal.science/hal-03887014v2>

Submitted on 7 Jan 2025

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Artefact

Techniques, histoire et sciences humaines

16 | 2022

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Electronic version

URL: <https://journals.openedition.org/artefact/12120>

ISSN: 2606-9245

Publisher:

Association Artefact. Techniques histoire et sciences humaines, Presses universitaires de Strasbourg

Printed version

Date of publication: 15 June 2022

Number of pages: 145-165

ISBN: 979-10-344-0137-6

ISSN: 2273-0753

Electronic reference

Ingrid Houssaye Michienzi and Dominique Cardon, "Sourcing and Consumption of Alum in the Dyeing Company *Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore* in Florence (1483-1498)", *Artefact* [Online], 16 | 2022, Online since 15 June 2022, connection on 15 June 2022. URL: <http://journals.openedition.org/artefact/12120>



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Sourcing and Consumption of Alum in the Dyeing Company *Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore* in Florence (1483-1498)

Ingrid Houssaye Michienzi, Dominique Cardon

Abstract

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Based on evidence provided by three manuscript account books preserved in the Archivio Salviati (Pisa), this study offers a direct insight into the importance of alum used in mordanting processes, in a dyeing company specialized in fast mordant dyes in Florence at the end of the fifteenth century. It provides further evidence confirming the new rise in Florentine broadcloth production in the second half of the fifteenth century, largely linked to the conquest of the huge markets of the Ottoman Empire by Florentine merchants.

Keywords

Account books, alum, dyeing company, Florence, Salviati

” Ingrid Houssaye Michienzi, Dominique Cardon, « Sourcing and Consumption of Alum in the Dyeing Company *Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore* in Florence (1483-1498) », *Artefact*, n° 16, 2022, p. 145-165.

Approvisionnement et consommation de l'alun dans la teinturerie de Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore à Florence (1483-1498)

Résumé

Cette étude, basée sur les informations fournies par trois livres de comptes conservés au sein de l'*Archivio Salviati* (Pise), offre un aperçu de l'importance de l'alun utilisé dans les processus de mordantage dans une entreprise de teinture en grand teint spécialisée dans les colorants à mordants, à Florence à la fin du xv^e siècle. Elle fournit des preuves supplémentaires confirmant le nouvel essor de la production florentine de draps dans la seconde moitié du xv^e siècle, en grande partie lié à la conquête des immenses marchés de l'Empire ottoman par les négociants florentins.

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Mots-clés

alun, compagnie de teinture, Florence, livres de comptes, Salviati

We are deeply grateful to Maddalena Taglioli, Curator of the Salviati Archive, and to all the team at the Scuola Normale Superiore in Pisa for their unfailing kindness and helpfulness and to all our colleagues and friends of the ANR ENPrESA program, for very fruitful exchanges.

This study offers a direct insight into the importance of alum used in mordanting processes, in a dyeing company specialized in fast mordant dyes (*Arte Maggiore*) in Florence at the end of the fifteenth century. It is based on evidence provided by the study of three manuscript account books preserved in the Salviati Archive, at the Scuola Normale Superiore, in Pisa (Italy). The Salviati Archive is one of the most important archives in Europe for economic and social history. It contains

thousands of account books and documents written from the fourteenth to the seventeenth century, concerning textile production, bank and international trade with many places in Europe and beyond. The present study was but a small part of a vast interdisciplinary research program based on the study and publication of the Archive, under the acronym ENPrESa.¹ Our contribution to this joint effort includes a focus on the documents of this Archive that concern the history of dyeing.

The three account books mentioned above are the only documents that have been preserved about the dye company of *Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore in Firenze*. Francesco's father, Giuliano Salviati, was involved, with two of his cousins (Iacopo and Alamanno Salviati), in the production of wool broadcloth of high and medium qualities. Iacopo Salviati was also involved in the production of silk textiles. Francesco Salviati, through his dye company, was thus complementing the activities of an important family business that operated in textile production.

The two first books —Reg. 394, *Libro azzuro, seg. A* (Fig. 1), corresponding to the years 1483 to 1486 and Reg. 395, *Libro giallo, seg. B* (Fig. 2), corresponding to the years 1486 to 1491— record all the company's commercial dealings organized by products and providers (buying dyes and mordants, paying furnishers, dyers, local custom duties, etc.). Those two books corresponded to the main ledgers (often called *libro mastro*, *libro grande* or *libro debitori e creditor*). In the Tuscan accounting systems of the fourteenth-sixteenth centuries, this kind of books was the result of a particularly complex accounting chain. In fact, the Florentine agents multiplied the number of preparatory entries, most often recorded on a daily basis. The third register we studied, Reg. 396, is a *Giornale* (Fig. 3), recording all daily commercial activities from 1490 to 1498. *Giornale* register were later debited and credited in the main ledger. The books referred to each other through constant writing techniques. The only way to really understand the operations is to cumulate the information contained in the different registers. Generally speaking, the books that are most focused on a specific activity, commercial or technical, are those that offer the most detail. As the information goes to the ledger, it is more and more synthesized.

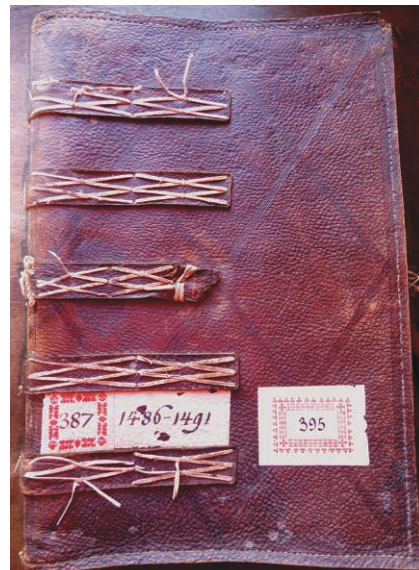
1. ENPrESa : *les Salviati 14^e-16^e*, <https://salviati.hypotheses.org/>. The program focuses on three main topics: account-book keeping and monetary exchanges; trade networks and European territories; textile production and trade.

Consequently, to have the maximum amount of information, one needs to juggle between the registers, thanks to internal cross-references. These complex, seemingly dry sources are extremely rich and shed new light on the economic and social history of the time. Unfortunately, no book on the technical aspects of the dyeing activity of the firm having been preserved, all that can be known about Francesco Salviati's company therefore is: what dyestuffs, mordants and connected products were bought and used, in what quantities each year, how and from where they were obtained, at what prices. All this information allows to better understand the kind of dyeing in which he specialized.



**Fig.1. – The blue book, signed A
(Libro azzuro, segnato A)**

Reg. 394 in the Salviati Archive,
registrations from November 1483
to the end of December 1486.



**Fig.2. – The yellow book, signed B
(Libro giallo, segnato B)**

Reg. 395 in the Salviati Archive,
registrations from December 1486
to November 1491.



Fig. 3. – The *Giornale*, diary

Reg. 396 in the Salviati Archive, recording all daily activities from October 1490 to June 1498.

The lack of any mention of blue dyestuff, either woad or indigo, shows that the company did not include a vat-dyeing branch. It obviously specialized in dyeing in fast dyes in boiling baths. The commodities most frequently and massively bought were, on one hand, the typical ingredients of mordanting baths as described in contemporary Italian treatises and regulations on dyeing: alum (*alume*), tartar (*gromma*) and bran (*crusca*); and on the other hand, red and yellow dyestuffs. Sources of reds included madder (*robbia*), kermes (*grana*), a local *Porphyrophora* cochineal (*chermisi di Marche*), sappanwood (*verzino*), processed orchil and orchil-producing lichens (*oricello* and *raspa*). Sources of yellows included saw-wort (*ceretta*), weld (*gualda*), young fustic (*scotano*) and a still unidentified yellow dye-plant, *guilicie*.²

2. Cardon, 1995; Cardon, Houssaye Michienzi, 2021.

“.. li tentori di panni & lane, alli quali non è manco necessario chel pane al’huomo...”

As vital to wool dyers of broadcloths, or of wool in the fleece, as bread is to humans: this is how Vannoccio Biringuccio presents alum in the sixth chapter of the second book of his treatise *Pirotechnia*, first published in Venice in 1540: “*Dell’alume di rocca, et sua minera*”.³ No wonder then, that alum was the third product being bought, on November 20th 1483, six days after Francesco di Giuliano Salviati established his dye company. It appears at folio 5 of Reg. 394, the *Libro azzuro*. The first had been madder, recorded at folio 3, the earliest purchase of it being dated November 19th. Next to be purchased was saw-wort, recorded at folio 4, with the first consignment dated November 20th, the same day as alum. A source of red and a source of yellow: these were the two basic colors of the art of dyers in fast dyes, the *Arte Maggiore*. From then on, recordings of purchases of the complete range of red and yellow dyestuffs used in Italy at the time keep appearing regularly in the three books of the company, in parallel with massive purchases of alum.

This in itself is telling, since alum was not necessary in all branches of dyeing. It was useless, particularly, for blue dyeing in the woad vat used for wool or in the indigo vat used for silk, because the indigo from woad or from the exotic product, reduced to its colorless soluble form in these vats, precipitates into and onto the wool or silk fibers and takes back its blue form, simply through the action of oxygen from the air. The only additions needed in these processes are bran, which helps maintain the bacterial fermentation responsible for the reduction of the indigo, and ashes or lime, to maintain the alkaline pH necessary to the survival and proliferation of the reducing, alkaliphile, bacteria.⁴ Since the dawn of the art of dyeing, however, dyers had noticed that some dyestuffs would not bind strongly enough with textile fibers to give intense, fast colors. Their empirical intuition helped them understand somehow that this had to do with the nature of these colorants —their chemical composition— and inspired them to

3. Biringuccio, 1540, p. 31.

4. Descriptions of the woad vats and indigo vats processes with biochemical explanations in Cardon, 2007, p. 345-348; Cardon, 2014, p. 332-341; Cardon, 1992.

use “mordants” to “bite” into the fibers and help such colorants get fixed more tightly to them. The mordants mostly used in such cases were metallic salts that facilitated the formation of a complex between colorant, metal and the fiber to be dyed.⁵ Alum was one of the most anciently and most massively used mordants, both because the diverse aluminum salts that were commonly referred to as “alum” were quite easily available — aluminum being the most common metal found in the earth’s crust— and because mordanting with aluminum did not alter the color of the dyes.⁶ Since all the colorants he used belong to the group of dyestuffs which need the textile to undergo a mordanting process, Francesco di Giuliano Salviati had to make sure that, from the start, his dyeworks were supplied with the indispensable *alume*.

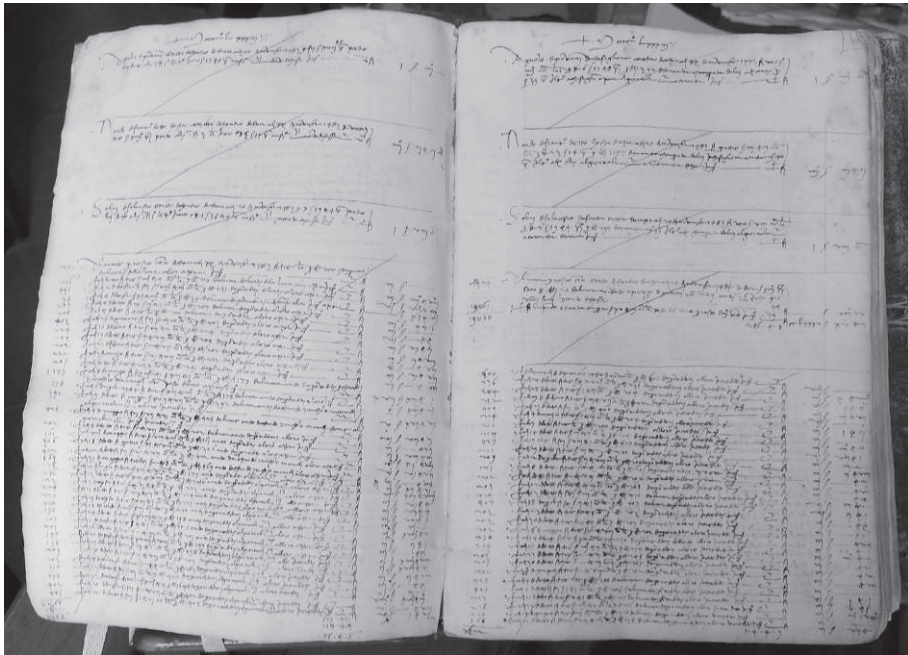


Fig. 4. – Folio 5
Reg. 394: First records of purchases of alum.

5. Cardon, 2007, p. 4-6, 20-48; Cardon, 2014, p. 14-15, p. 29-41.

6. Singer, 1948, p. xvii-xviii.

On folio 5 of the *Libro azzuro* (Fig. 4) are recorded all the purchases of alum made by the Company between November 1483 and June 1485. The transcript below presents those made between the date of the beginning of the company and the end of that year, that is, from November 20th 1483 to March 8th 1484 (the Florentine year then began on March 25th, the day of the Annunciation). It will serve as a representative example for all entries, since these are all in the same standardized and much abbreviated format. These accounting data were copied from another type of record, the journal or *giornale*, where transactions were recorded daily.

In each reference the following information is given:

- the quantity of alum purchased by the company, in Arabic numerals, written in the left margin in order to facilitate final additions;
- the date of the purchase;
- the amount of the purchase, in Roman numerals as well as in Arabic numerals, and the currency in which it was expressed. Different types of florins were then in use in Florence.⁷ Prices here are expressed in florin *a oro larghi*, which was a gold currency;
- the quantity expressed in pounds, in Arabic numerals;
- the name of the supplier;
- the last part mentions the accounting counterpart of the creditor, with the corresponding folio number. The notion of double-entry implies that each entry in one account must find a symmetrical counterpart in another account. In fact, any amount charged to the accounts will be recorded twice: once as a debit to one account and a second time as a credit to another account. This principle ensures the balance of accounting transactions since any amount credited to one account will have to be offset by an identical transaction debiting another account;
- finally, the amount is again written on the right margin, to facilitate final additions.

7. Goldthwaite, Mandich, 1994.

Table 1. – Register 394, fol. 5, left page (considering the standardized, repetitive structure of the entries, an example of translation needs only be given for the first two occurrences)

<p>“200 Alume per nostro conto de’ dare a dì xx di novembre 1483 <i>fiorini</i> tre <i>larghi</i> per <i>libbre</i> 200 chonpramo da l’arte della lana; a lei avere in questo <i>carta</i> 2; f. III s.”</p> <p><u>Translation:</u></p> <p>“200 Alum for our account must give on November 20th 1483, florins three <i>larghi</i> for pounds 200 we bought from the <i>Arte della Lana</i>; hers to have in this book folio 2; f. III s.”</p> <p>“216 E a dì detto <i>fiorini</i> tre <i>soldi</i> III^o <i>denari</i> 9 a oro <i>larghi</i> per <i>libbre</i> 216 d’alume da l’arte della lana; a lei avere in questo <i>carta</i> 2; f. III s. III^o d. VIII^o”</p> <p><u>Translation:</u></p> <p>“216 same day, florins three sols III^o deniers 9 a oro <i>larghi</i> for pounds 216 of alum from the <i>Arte della Lana</i>; hers to have in this book folio 2; f. III s. III^o d. VIII^o”</p> <p><u>Continuation of the transcript:</u></p> <p>“431 E a dì 2 di dicembre <i>fiorini</i> sei <i>soldi</i> VIII^o <i>denari</i> III a oro <i>larghi</i> per <i>libbre</i> 431 da <i>proveditori</i> de l’arte; a loro avere in questo <i>carta</i> 7; f. VI s. VIII^o d. III</p> <p>34 E a dì 4 di dicembre <i>soldi</i> XI <i>denari</i> III^o a oro <i>larghi</i> per <i>libbre</i> 34 d’alume da Giovanbatista di Nerozo; a loro in questo avere <i>carta</i> 9; f. - s. XI d. III</p> <p>207 E a dì 8 detto <i>fiorini</i> III <i>soldi</i> II <i>denari</i> I a oro <i>larghi</i> per <i>libbre</i> 207 d’alume da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7 f. III s. II d. I</p> <p>200 E a dì x detto <i>fiorini</i> tre <i>larghi</i> per <i>libbre</i> 200 d’alume da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. -</p> <p>403 E a dì 26 di gennaio [1484] <i>fiorini</i> sei <i>soldi</i> – <i>denari</i> 10 a oro <i>larghi</i> per <i>libbre</i> 403 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. VI s. - d. x</p> <p>224 E a dì 16 di febraio [1484] <i>fiorini</i> tre <i>soldi</i> VII <i>denari</i> 2 a oro <i>larghi</i> per <i>libbre</i> 224 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. VII d. II</p> <p>209 E a dì 19 di detto <i>fiorini</i> tre <i>soldi</i> II <i>denari</i> VIII a oro <i>larghi</i> per <i>libbre</i> 209 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. II d. VIII</p> <p>202 E a dì 27 di febraio [1484] <i>fiorini</i> tre <i>soldi</i> – <i>denari</i> VII a oro <i>larghi</i> per <i>libbre</i> 202 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. - d. VII</p> <p>222 E a dì 3 di marzo [1484] <i>fiorini</i> tre <i>soldi</i> VI <i>denari</i> VII a oro <i>larghi</i> per <i>libbre</i> 222 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. VI d. VII</p> <p>201 E a dì detto <i>fiorini</i> tre <i>soldi</i> – <i>denari</i> 3 a oro <i>larghi</i> per <i>libbre</i> 201 da <i>proveditori</i>; a loro avere in questo <i>carta</i> 7; f. III s. - d. III</p> <p>1 177 E a dì 8 di marzo [1484] <i>fiorini</i> diciasette <i>soldi</i> XIII <i>denari</i> I a oro <i>larghi</i> per <i>libbre</i> 1 177 d’alume auto da <i>proveditori</i> per Ghuido e Nicholò Mannegli e compagnia; posto debino avere in questo <i>carta</i> 22; f. XVII s. XIII d. I.”</p>	153 —
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The three books thus allow to follow the consumption of alum by the company during twelve years. Most entries, and the most important quantities, concern purchases of alum. However, in a few occasions Francesco's company resold some alum to other dyers and, only once, to a clothier. In Table 2, therefore, the quantities resold have been subtracted from the totals for each year, in order to offer a more precise picture of the amount of alum that was actually used in the company. All quantities are recorded in Florentine pounds. Our conversions are based on the equivalence: 1 Florentine pound = 0.339 kg.⁸

Table 2. – Weights of alum bought and not resold by the Company of Francesco Salviati from 1483 to 1495, in Florentine pounds (upper line) converted into kilograms (lower line), and corresponding prices

Source	Year	Weights Pounds Kilograms	Prices in <i>denari</i>	Average price for 100 pounds in <i>denari</i>
Reg. 394 (1483-1486)	1483	1 288 437	4 649	360.95
	1484	10 151 3 441	36 505	359.62
	1485	14 742 4 998	52 998	359.50
	1486	17 686 5 996	63 648	359.88
	TOTAL	43 867 14 871	157 800	359.72
Reg. 395 (1487-1490)	1487	21 377 7 247	76 905	359.76
	1488	24 713 8 378	88 981	360.06
	1489	19 653 6 662	70 710	359.79
	1490 (until October)	15 651 5 305	56 642	361.90
	TOTAL	81 394 27 592	293 238	360.27

8. Doursther, 1840, p. 221.

Source	Year	Weights <i>Pounds</i> Kilograms	Prices in <i>denari</i>	Average price for 100 pounds in <i>denari</i>
Reg. 396 (1490-1495)	1490 (October- December)	9 605 3 256	34 577	359.99
	1491	20 734 7 029	74 606	359.82
	1492	29 932 10 146	107 780	360.08
	1493	25 856 8 765	93 064	359.93
	1494	17 862 6,055	64 287	359.91
	1495	15 687 5 318	48 221	307.39
	TOTAL		119 676 40 570	422 535
TOTAL	1483-1495	244 937 83 033	873 573 (F. 3 639 s.17 d.9)	356.65

The sourcing of alum

The picture emerging from the three books of Francesco Salviati's dye company is that of a rather strict administrative control of the alum trade in Florence during that period. This is shown by two characteristics of the records. Firstly, the commodity appears to be nearly exclusively in the hands of *provveditori dell'Arte della Lana*, providers from the guild of clothiers: 220,461 pounds of alum (= 74,736 kg, more than 90% of the total quantity purchased by Francesco's company) are obtained from them, directly or through intermediaries who turn out to be clothiers, members of the *Arte*, such as Guido and Niccolò Mannelli e comp., *lanaioli*. In a few cases (amounting to a total quantity of 416 pounds or 141 kg), alum is simply mentioned as being "bought from the *Arte della Lana*". In a few other instances a more precise mention seems to imply a special organization concerning the sourcing and distribution of alum within

the *Arte della Lana*: the providers are identified as *provveditori dell'alume e dell'Arte della Lana* (the corresponding transactions amounting to 1,386 pounds or 470 kg) or as *provveditori dell'Arte della Lana e dell'alumeria* (this concerns purchases for a total of 2,575 pounds or 873 kg). Six individual providers are mentioned for fifteen purchases: they can be identified as clothiers and dyers from Florence and the price at which alum is obtained from them is the same as in the other transactions.

The remarkable stability of the prices recorded during the twelve years documented by the three books is another sign—and result—of the administrative control on alum. The cost of the mordant only varies from its constant—obviously regulated—value of 359/360 *denari* per 100 pounds in the last year, 1495, when its price suddenly drops. It had remained the same, around 359/360 *denari*, until April 1495 and then, the last twenty-two entries concerning alum in the *Giornale*, dated from May to September 1495, mention prices in the range of 288 *denari* per 100 pounds. As these are the last accounting records of alum in the Salviati archive, it is impossible to know from this source whether the market price fell and then remained stable, or whether it recovered afterwards. Fortunately, the records of a Medici dyeing company, preserved at Harvard University, complement these data and shed further light on the prices of alum until the early sixteenth century. These are three account books, all *giornali*, where transactions were recorded on a daily basis.⁹ They come from the company of Raffaello di Francesco de' Medici (1498-1505), then of Giovenco e Giovanni di Giuliano de' Medici (1508-1511). All these businessmen involved in craft activities, like Francesco Salviati, were *tintori d'Arte Maggiore*. The city of Florence had numerous *arti*. The term 'arts' was used to describe the unions of craftsmen, merchants and workers, who exercised the same profession and were subject to certain rules. There were major arts (*Arti Maggiori*) grouping the professions involved in the most important economic, commercial and financial activities, and minor arts (*Arti Minori*) concerning less important sectors. The art of the *Tintori*, born during the Ciompi revolt in 1378, in a context of radical questioning of the power relations between all the different professions of the textile industry, starting with wool merchants, was short-lived. It was suppressed in 1382, as

9. HBS Medici Family Collection, Baker Library Special Collections, Harvard Business School, MS544-3, MS545, MS551-1.

soon as merchants and bankers returned to power. The dyers were thus dependent on other arts linked to the textile activities and divided into several categories.

In the oldest account book, concerning purchases made in 1498-1499, the price of alum constantly stays around 288 *denari* for 100 pounds of product. These references indicate that the price of alum has remained stable since 1495.

Table 3. – Purchases of alum in the first register of Raffaello de' Medici (1498-1499)

Period	Weights <i>Pounds</i> Kilograms	Prices in <i>denari</i>	Average price for 100 pounds in <i>denari</i>
July-August 1498	3 939 1 335	11 349	288.12
September 1498	2 516 853	7 251	288.2
October- November 1498	2 698 914	7 776	288.21
November 1498	3 131 1 061	9 024	288.21
January 1499	3 359 1 139	9 696	288.66
March-July 1499	8 352 2 831	24 075	288.25
TOTAL	23 995 8 134	69 171 (F. 288 s.4 d.3)	288.27

Prices then increased to an average of 371 *denari* per 100 pounds in the second register (purchases made between 1502 and 1505), and even went up to 571 *denari* per 100 pounds in the last book preserved (purchases made between 1508 and 1511), in spite of the fact that the supplier was always the same, i.e., the *Arte della Lana*.

Such administrative control over a raw material of strategic importance, as is revealed by the Salviati archive, obviously brings to mind the parallel with couched woad, the only source of fast blues used by the dyers of wool broadcloths and wool in the fleece at that time. The *Statutum Universitatis Artis Lanae* of Florence had already ordered in 1317 that a warehouse

dedicated to the storing of woad be created in order to better control the trade in this dyestuff of prime importance: “statutum et firmatum est quod pro arte lane fiat et fieri debeat fundacus, in quo vendatur et ematur et vendi et emi debeat totum guadam quod conducetur et emetur in civitate, burgis et subburgis”.¹⁰

The same policy was now applied to alum in order to secure the supply: Franco Franceschi has identified a period around 1441-1442 when the Consuls of the *Arte della Lana* feared a shortage of alum, *caristiam aluminum*, and did their best to replenish the stocks.¹¹ The stability of its price during most of the period documented by the Salviati archive seems to place this product out of competition and out of the interplay of supply and demand, and results from a desire for control by the authorities through the corporations. One of the objectives was certainly to avoid both the shortage of raw materials and sudden rises or falls in prices which could have major repercussions and cause important and sometimes dangerous tensions in a society whose economy and wealth were based on the textile industry.

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The three books of Francesco Salviati's dye company unfortunately do not provide all the elements that can explain the price of alum on the Florentine market and its fluctuations at the end of the fifteenth century. There obviously was a close link between the origin of alum, the control of the supply chains and the resulting price, but what particularly is missing in the records is information on the type(s) or provenance(s) of alum bought: native alum from Egypt, from the Solfatare of Pozzuoli, or from the Lipari and Aegean islands? Potash alum from the alunite mines of Phocaea or La Tolfa?

By contrast, some elements about the origin of alums appear in the account books of the Salviati commercial company of Florence, kept during the same period (*Averardo di Alamanno e Iacopo di Giovanni Salviati e compagnia di Banco di Firenze*). These records refer to purchases of alum, in very large quantities, from Tuscan deposits, for export purposes. Different places of alum extraction are mentioned.¹² In 1473, for example, they bought 900 *cantares* of alum of Montaone (nowadays Montioni where the alum

10. Agnoletti, 1940, p. 72, Cap. 40 “De faciendo fundacum guadi pro Arte lane”.

11. Franceschi, 2012, p. 167-168.

12. We would like to thank Ana Clarinda Cardoso for the pictures of the registers sent from Pisa.

mine of the Lord of Piombino was located) from Zaccaria di Francesco Strozzi of Siena for 1890 gold florins, immediately loaded on Rinaldo Altoviti's boat bound for the coasts of Provence.¹³ Other sources of alum are mentioned: alum from Piombino (in 1488),¹⁴ from Massa (in 1491),¹⁵ or alum from Campiglia shipped to Flanders during the years 1494-1497.¹⁶ These alums all came from Tuscany.¹⁷

Throughout the fifteenth century, merchants never ceased to try and bring the raw material closer to the place of consumption, with the obvious aim of reducing costs. The exploitation of new alum deposits made it possible to free the local textile industry from supply constraints, in the same way as what happened with the development of sericulture in Tuscany. Alum and silk were then fundamental raw materials for the textile industries. The silk used in Florentine workshops, at first imported mainly from Persia and Spain, then came mostly from Calabria, and then from places closer and closer to Florence through the development of sericulture in Marche, Abruzzo and Tuscany.

In a parallel way, and at the same time, the exploitation of alum mines closer to Florence made it possible to compete with the discovery of the mines of Tolfa, even if they did not provide enough alum of the required quality for the needs of the textile industries. While some accounts suggest that Tuscan deposits were exploited, these alums were mostly purchased from Sienese intermediaries for long-distance export. No alum purchased for the Florentine market is recorded in the registers of the commercial company Salviati of Florence, nor in the registers of the Salviati company of wool workers (*Francesco d'Alamanno Salviati e fratelli, lanaioli in San Martini di Firenze*), although they belong to the *Arte della Lana*. They are not mentioned in the registers of the dyeing company of Francesco Salviati either.

These account books —just like the Medici ones— thus definitely appear not to be the kind of sources in which to look for a better understanding of the relative importance and chronology of the different regions of production of alum at the end of the Middle Ages. They nevertheless raise

13. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 348, fol. 24.

14. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 353, fol. 128, 358, 31.

15. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 364, fol. 166.

16. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 367, fol. 32, 108, 111, 253, 319.

17. Boisseuil, 2014; Franceschi, 2014; Boisseuil, 2016; Fiumi, 1948.

interesting questions for further research. Concerning the drop in the price of alum recorded in 1495, for instance, it might be connected with the fact that, that same year, the mine of Campiglia was incorporated into the *Arte della Lana*.¹⁸

Alum as production indicator

Do the three account books prove more useful sources to understand the business volume of Francesco Salviati's dye company and its evolution over the years? In a broad prospect, they do. The quantities of alum bought are plainly massive: not taking into account the data for the uncomplete first year 1483, one can see that during the following year, already, the weight of alum bought and not resold adds up to nearly three and a half metric tons, even after deduction of a small amount of 27 pounds (9 kg) resold to another dyer. After 1484, the figures constantly ranged between five and more than ten metric tons in the peak year 1492. The quantities of alum resold to other dyers do not alter much the overall picture, because they were usually small (two times 27 pounds, once 40 pounds or 13.56 kg), only exceptionally bigger (once 228 pounds or 77 kg, two times 200 pounds or 68 kg). The purpose of these resales obviously was to help colleagues out in occasions when they had not planned a sufficient supply of alum, in the same way as, in fifteen occasions, Francesco's company had to purchase additional quantities of alum from individual providers, as mentioned above.

How much textile could be mordanted with such quantities of alum? This is a more difficult question, which the Salviati account books do not allow to answer directly nor indeed very precisely. They do not allow to answer it directly because one first has to connect the quantities of alum used with the quantitative data recorded for those red and yellow dyestuffs which are always used after previously mordanting the cloth or wool in the fleece with alum. But a further problem is that the proportions of alum employed varied according to the colorants used and to the colors desired, as shown by other sources, such as regulations and technical treatises on dyeing. For instance, the tariff of the Florentine wool dyers, dated 1463, mentions the use of 25 pounds (8.5 kg) of alum per piece of cloth dyed scarlet in the

18. Farinelli, 2009.

style of Lucca (“panni luchesini con 25 lbr. d’allume pro panno per alluminare...”) or dyed peony or rose colors with kermes (“Paghonazzi e rosati di grana”).¹⁹ And we know from occasional records that the company of Francesco Salviati dyed cloths in these colors with kermes, for instance in April 1486 and in March 1487.²⁰ But in the same tariff of Florentine wool dyers, 10 pounds (3.39 kg) of alum only were required to dye a cloth in imitation scarlet with madder (“Panni scarlatini per fini con 10 lbr. d’allume e 20 lbr. di ciocchi”) and 8 pounds (2.712 kg) to dye cloths in shades of green, tan, yellow, flax flower, peach flower and tan (“Panni Verdi, tanè, gialli, fiordilino et fiordipescho o ranci con 8 lbr. pro panno”). While the three account books reveal that Francesco Salviati’s dye company bought and used enormous quantities of madder and of yellow dye-plants (weld, saw-wort, and young fustic), they do not mention how many cloth pieces were dyed in these different colors. It nevertheless is interesting to relate some data offered by the three books on the quantities of dyestuffs bought, with the consumption of alum that the use of these colorants would have involved for their mordanting. Taking madder as an example, one has to subtract a certain amount of resales (44,237 pounds or 14,996 kg) from the enormous quantities of madder bought by the Company between 1483 and 1495, i.e. 210,308 lbr or 71,294 kg. As a result, the Company kept for its own use as much as 166,000 lbr of madder (56,298 kg). Three mediaeval Italian sources mention an identical amount of madder—22 lbr—as the quantity to be used per piece of cloth to be dyed in imitation scarlet.²¹ With the total amount of madder mentioned above—166,000 lbr—7,545 cloth pieces could therefore be dyed into mock scarlet. Since the same sources mention that 10 to 13 pounds of alum per piece should be used in the mordanting process, mordanting these 7,545 *scarlattini* cloths would have required 75,450 to 100,348 pounds of alum (25,578 to 34,018 kg). Examining the quantities involved for mordanting the yellow and green

19. Doren, 1901, p. 513.

20. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 394, fol. 51d, 15th of April 1486: “*lb. 33 di grana di Valenza per tignere 2 panni paonazi*”; Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, register 395, fol. 69d, 15th of March 1487: “*Lb. 30 di polvere adoperata a tigniere lo panno bianco fatto luchesino*”; the powder mentioned here is constituted of the eggs of the adult females, separated from the mothers’ dry bodies. Cf. Cardon, 2014, p. 596-597.

21. Dyebook of the *Compagnia della Tinta* of Francesco di Marco Datini and Nicolo di Piero del Giunta, in Prato, Archivio di Stato di Prato, Datini, register 312, memoriale segnato F, 1396, fol. 17; Tariff of Florentine wool dyers of 1428, Doren, 1901, p. 512; Venetian *Manuale di Tintoria*, end of 15th, Rebora, 1970, p. 127, Cap. 142.

cloths dyed with saw wort and weld is equally revealing. On a total of 37,123 lbr (12,585 kg) of saw wort bought by the Company, 664 lbr (225 kg) were resold. Since 80 pounds of dry plant are used per piece of cloth, it implies that 456 cloths could have been dyed with the 36,459 lbr (12,360 kg) of saw wort kept and used by the Company. The quantities of weld bought are much bigger: 436,111 lbr (147,842 kg) and even after important resales, for a total amount of 10,977 lbr (3,721 kg), the quantity of weld kept by the Company for its own use, 425,134 lbr (144,120 kg), would have allowed to dye 4,251 cloths yellow or green, using 100 lbr of dry plant per piece as ordered in the Florentine tariffs. The same amount of alum —8 lbr per piece— being used in the mordanting processes of the 456 pieces dyed with saw wort and the 4,251 pieces dyed with weld, mordanting these 4,707 pieces would have required 37,659 pounds or 12,766 kg of alum. Nearly thirteen metric tons! A reliable and reasonably cheap supply of alum was indeed vital to a dye company.

Final thoughts

The significance of the quantitative data obtained through the patient deciphering of the three books is easiest to understand once they are arranged, as above, in a table allowing to visualize at a glance the massive quantities of alum used yearly in the dye company *Francesco di Giuliano Salviati e Comp., tintori d'Arte Maggiore*. They are particularly impressive when one takes into account that Francesco Salviati's dye company was neither the only one nor the most important in Florence at the time: in his three books, at least thirty other dyers then in business in Florence are mentioned. The precise data provided by these three books open vertiginous prospects on the huge need of mordant and dyestuffs that accompanied the massive development of wool broadcloth production in many parts of Europe during the Middle Ages. The three Salviati books thus provide further evidence confirming the new rise in the Florentine broadcloth production which Hidetoshi Hoshino argued happened in the second half of the fifteenth century, in contrast with Alfred Doren's vision of the "decadenza" of this industry at that period.²² Hoshino attributed this new development largely to the conquest of the huge markets of the Ottoman Empire by

22. Hoshino, 1970, p. 238, p. 240, p. 243.

Florentine merchants. The increased need of alum to mordant cloths then dyed in varied shades of reds, and of yellows to produce greens on various blue grounds, again confirms this view. An illustration of this has been provided by Ingrid Houssaye Michienzi's recent study of three account books written between 1491 and 1493 from Ottoman Constantinople by Giovanni di Marco Salviati, a distant cousin of Francesco's.²³

Source

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23. Scuola Normale Superiore di Pisa, Archivio Salviati, seria I, registers 397, 398, 399, 1491-1493. See 22. Houssaye, Michienzi, 2015.

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