Category: 2014_Fall

2014 Fall Final Annotations

Imitation Coral _3r

July 1, 2015 mkp-admin 2014_Fall, Annotation
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Maria Alessandra Chessa

V&A/RCA

BnF Ms. Fr. 640, fol. 3r

Making and Knowing Coral

Fol. 3r, transcription

<title id="p003r_a1 >Coral contrefaict</title>

<ab id="p003r_b1 >Il fault premierement faire les branches de **boys** ou<lb/>

prendre une **branche despine** bisarre puys fondre une<lb/>

lb. de **poix resine claire** de la plus belle et y mectre<lb/>

une once de **vermeillon** broye subtillem{ent} avecq **huile de noix**<lb/>

Et si tu y adjoustes un peu de **laque platte de venise**<lb/>

la couleur en sera plus vive et remuer le tout dans la<lb/>

resine fondue sur foeu de **charbon** et non de flamme de<lb/>

peur que le feu ne sy prenne Apres trempe en tournoya{n}t <lb/>

tes branches dedans & sil y restoit quelque filament<lb/>

tourne la branche sur la chaleur du **charbon**</ab>

<note id="p003r_c1a">La **colophonie** nest aultre chose que<lb/>

rousine recuite Pour bien la faire<lb/>

Ayes un pot **plombe** & fais fondre la<lb/>

resine & bouillir sur brasier une bonne<lb/>

heure & jusques a ce quelle ne demonstre<lb/>

estre poinct espesse ains<lb/>

claire & liquide co{mm}e<lb/>

eau & que facillement<lb/>

elle coule & file au bout<lb/>

d'un baston avecq lequel tu la broyes & en fais<lb/>

lessay Lors coule la<lb/>

par quelque gros **caneva**<lb/>

ou **estamine** bien claire<lb/>

de sorte quen coulant<lb/>

elle tombe dans du<lb/>

vinaigre le plus fort<lb/>

que tu pourras Car le **vinaigre** luy donne<lb/>

force & lempesche destre<lb/>

si frangible Reitere<lb/>

cela deulx ou trois<lb/>

fois & elle sera belle<lb/>

& bien purifiee pour<lb/>

contrefaire ton **coral**<lb/>

Tu peulx mesler la<lb/>

quarte partie de **mastic**<lb/>

parmy ta **rousine** purifiee<lb/>

pour la rendre plus ferme<lb/>

et plus belle & si tu prenois<lb/>

la seule larme du **mastic**<lb/>

tant mieulx seroit mais<lb/>

il seroit trop long</note>

<note id="p003r_c1b">**soufre** & **vermeillon**<lb/>

faict le mesme effect</note>

<note id="p003r_c1c">Le **coral** faict **desmail de gueule** endure la lime et le polissem{ent}</note>

<note id="p003r_c1d">Il se faict co{mm}e le **ciment** qui est<lb/>

plus fort mesle de **verre** (que de) <lb/>

pile que de **brique** Ainsy on y<lb/>

mesle avecq le **vermeillon** de **lesmail**<lb/>

de gueule qui est rouge en corps bien<lb/>

pile Ainsy de toutes couleurs **desmails**</note>

Fol. 3r translation

<title id="p003r_a1 >Imitation coral</title>

<ab id="p003r_b1 >One must first make the branches from **wood** or take a fantastical **thorn branch**, then melt a pound of the best possible **clear pine resin** and add one ounce of finely ground **vermilion** together with **walnut oil**, and if you add a little **Venice lake** the color will be all the more vivid, and stir all together into the **resin**, molten over a **charcoal** fire, not over an open flame, lest it catch fire. Then dip in your branches with a swirling motion. And should there remain any filaments, turn the branch over the heat of the **charcoal**.</ab>

<note id="p003r_c1a">**Colophony** is nothing other than **resin** that has been cooked again. To do it well, you take a **leaded** pot and melt the **resin**, boiling it over the brazier for a good hour until it appears not thick but clear and liquid like **water** and it easily runs as a thread off the end of a stick, which you use to crush and test it. Then pour it through a coarse **canvas** or **tammy cloth** so that it falls into the strongest **vinegar** you can find, because the **vinegar** makes it strong and makes it less brittle. Repeat this two or three times and it will be fine and well purified. To imitate your **coral**, you can mix a fourth part of **mastic** with your purified **resin** to make it more solid and finer, and if you should use just one drop of **mastic**, it would be all the better, but it would take too long.</note>

<note id="p003r_c1b">**Sulfur** and **vermilion** have the same effect.</note>

<note id="p003r_c1c">**Coral** made of **red enamel** withstands filing and polishing.</note>

<note id="p003r_c1d">It is made like **cement**, which is stronger when mixed with crushed **glass** rather than with **brick**. In the same way, together with the **vermilion**, one mixes in **opaque red enamel**, finely ground. It is the same way with all **enamel** colors.</note>

The perceived nature of coral in the early modern period was the outcome of a combined cultural sedimentation of different traditions. These were transmitted by a core of widespread literary texts among the learned, including physicians, artists, humanists and naturalists, and penetrated

including physicians, artists, humanists and naturalists, and penetrated popular culture in the form of long lasting belief and knowledge systems.

The most important source was Ovid's *Metamorphoses* written in the first decade CE. The poem defined the origins of coral in a compelling mythological framework as the product of an obscure transformation. When Perseus laid the severed head of Medusa on the seashore, some seaborne sticks came in contact with the Gorgon's head and were soon turned into stone: coral was born. Ovid's poem was exceptionally popular through the centuries, laying the foundation for a persistent tradition that was incorporated in Pliny's encyclopaedic work. *Naturalis Historia*, written only 70 years after Ovid's *Metamorphoses*, was a most influential source to which, even after centuries, early modern European scholars continued to refer. When discussing coral, Pliny stated that it was also named Gorgonia as its original soft material turned into the hardness of stone interlocking the myth of Medusa to the supposed property and nature of coral.

In the course of the sixteenth century some of this information started to be questioned. Pietro Andrea Matthioli in 1563 argued that the berries of coral mentioned by Pliny were nothing else than the polished beads made by artisans.1 However the idea of the transformative nature of coral turning from a soft material into a hard one when removed from water persisted, conceivably due to the lack of any direct knowledge of its condition under the sea. Significantly one of the first texts questioning that information refers to the evidence from coral hunters: Daniello Bartoli in his treatise on coagulation, dated 1681, refers to an entrepreneur in the coral hunt who ascertained coral as being hard even under the sea.2 Nevertheless Bartoli still accepted a hardening process taking place in the reproductive season, which demonstrates a resilience of such a belief and the struggle in fitting new evidence within traditional knowledge.3 An early empirical challenge to the textual tradition can be traced in the 1609 *Gemmarum et Lapidum Historia* by Anselmus de Boodt. When discussing the nature of coral he refers to a specific branch examined in the antiquarium of Rudolf II, which apparently showed both a vegetal part and a mineral one.4 On such an evidence he rejects the common belief of coral turning into stone outside seawater and reports a theory based on a "stonifying sap" of coral (called *succus lapidescens*). According to him the stonifying sap gradually turned the vegetal plant of coral into stone.5 That was based on the current opinion among scholars as expressed in Jamnitzer's hybrid idea for the Daphne as materializing the concept of metamorphosis. In Jamnitzer's artefact the transformative nature of coral meaningfully conveyed Ovid's myth of the nymph turned into a laurel tree. [Fig. 1, Jamnitzer, *Daphne*, Dresden, Grünes Gewolbe]

The current classification of the natural world indeed considered coral as an entity halfway between the vegetal and mineral spheres. Ferrante Imperato, when organizing the complexity of nature in a taxonomical structure placed coral after the stones and before mushrooms and plants. His definition of coral, similarly to De Boodt's, described a leafless bush made of a "stony substance" (*sostanza pietrigna*) that could grow as a plant both on rocks and on other shrubs by covering their branches "like a dressing" (*in modo di veste*).6 This is why, he reports, when coral accidentally snaps, we can occasionally see an inner core of wood (*si scopre l'interno legnoso*).7 It would appear likely that he was looking at a branch of imitation coral, as this coincides precisely with the appearance of the imitation coral produced following the recipe for "Imitation coral" on fol. 3r. (Fig. 2)

Our contemporary knowledge of coral differs from both Imperato's and de Boodt's observations. Coral does not have an internal ligneous structure or any vegetal components at all. Unfortunately it is impossible to trace extant objects to which those naturalists referred, however, in the absence of any additional clue, it is licit to speculate whether what they examined was natural coral or not.

The practice of producing imitation coral, as it appears in the sources, was a common one. In my brief survey I have identified several recipes for imitation coral from the sixteenth to the early eighteenth century.8 These recipes fall into three main typologies (some authors provide more than one recipe): The first type of imitation coral recipe is the most common to appear in the texts. It consists of a mouldable paste to be pressed into moulds and dried. The paste was a combination of horn powder mixed with ashes and water and the addition of cinnabar as a red dyeing agent. This first type was apparently the most appropriate for paternoster beads.9

A second type of recipes involved the use of fragments of natural coral. Coral was crushed into a fine powder and left in a solution of lemon or orange juice, mixed with a dyeing agent such as cinnabar, minium or sinoper and kept under a layer of horse droppings for a number of days. The paste thus obtained was left to dry. This recipe, as mentioned by Giovanni Battista della Porta, produced a material very similar to natural coral, and was recommended for making small objects like cups, but also as a substance for repairing broken coral.10 De Boodt also mentions this second method as used by forgers who expressly wanted to imitate the properties and powers of coral. On the other hand, he writes, other forgers are instead interested in imitating the shape and colour of coral, and this is the third type of recipe.11

The recipe in the French manuscript at the BNF can be mentioned as the

The recipe in the French manuscript at the BNF can be mentioned as the third different method for imitation coral involving the use of a vegetal branch of a plant. The only other versions that I was able to trace among the texts were the recipe mentioned by Anselmus De Boodt and its short copy by Thomas Nicols.12 De Boodt mentions the use of a twig of wild pear tree. Once cleaned it was covered with a solid and warm paste made of clarified pine resin, white wax, and cinnabar.13 The mixture was then moulded around the twig over the heat of charcoal fire.14 This procedure was supposed to produce a perfect imitation of coral that only experts could distinguish. This recipe is thus a slightly different and less detailed version of the one in Ms Fr. 640, although the result must have been substantially similar.15 The Ms. Fr. 640 recipe appears more practically oriented, as the author mentions the use of Venice lacque as an alternative pigment and the use of walnut oil as a solvent for ground vermillion.

The procedure for this third type of imitation coral is no doubt the most interesting one, not just because of the fine result achievable, but also because of the process it entails. It is therefore reasonable to reflect on the analogy that it presents with the perceived transformative process of natural coral: The viscous red substance, called *emplastre* in the recipe described by de Boodt, could easily call to mind the “stonifying sap” of natural coral in his treatment of natural coral. In the same way, as the stonifying sap was responsible for the transition of coral from a yielding vegetal material into the hardness of stone, accordingly the thick red mixture of the recipe for imitation coral solidified like stone. Finally, it is worth considering the distinctive way the same red substance coated the branches in the recipe, as it reminds us of the vivid description of natural coral given by Ferrante Imperato, presenting coral as an organism that, like a parasite, could grow over other sea-plants and covers their branches in a process very similar to that described in the recipe.16

The homologies between the descriptions of the two naturalists and the third type of recipe are particularly suggestive. Thus, such recipes should not be treated as from a separate sphere, set off from the system of knowledge regarding the genesis of stones and stony substances. In particular, we should keep in mind that not all imitations and forgeries were considered in the same light. Some methods for making artificial gems, as Ferrante Imperato tells us, could indeed be similar to the natural processes of the formation of stones, implying the possibility that forgers, through the study of nature, could have tried to harness its processes in order to imitate it more perfectly.17 Finally, it is useful to ponder whether and how the circulation of some high quality artificial products could have influenced early observations of natural phenomena. In the specific case of coral, it seems likely that the creation of forgeries and imitations that aspired to

repeat natural processes stimulated the scholars' views of the processes of nature, as much as the other way around.

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1 Pietro Andrea Matthioli, *I discorsi di M. Pietro And. Matthioli Sanese*, (Venezia, 1563) p. 717 https://books.google.co.uk/books?id=xF1cAAAAcAAJ&pg=PA18&dq=mattioli+discorsi+sui+libri+di+dioscoride&hl=en&sa=X&ei=vdxRVYa2Kuqd7Aa6x4HgCA&ved=0CEgQ6AEwBQ#v=onepage&q=bacche%20simili%20alle%20corniole&f=false

2 Daniello Bartoli, *Del ghiaccio e della coagulatione*, (Roma, 1681) p. 220 https://books.google.co.uk/books?id=sBwD-n9jyyUC&printsec=frontcover&dq=%22daniello+bartoli%22+del+ghiaccio&hl=en&sa=X&ei=qOFRVZOBJYOE7gbDq4C4CA&ved=0CCoQ6AEwAQ#v=onepage&q=gentilhuomo&f=false

3 *Ibid.*, p. 221

4 Anselmus de Boodt, *Gemmarum et lapidum historia*, (Hannover, 1609) p. 154 https://books.google.co.uk/books?id=SrAUAAAAQAAJ&printsec=frontcover&dq=gemmarum+et+lapidum&hl=en&sa=X&ei=K-RRVbyLFufD7gb2m4OIBA&ved=0CCMQ6AEwAA#v=onepage&q=antiquarium&f=false

A further connection to generation and reproduction is indicated by Rabelais, who, with typical spirit, provides a list of terms that men give to their male member: "L'une la nommoit 'ma petite dille', l'aultre 'ma pine', 'l'aultre 'ma branche de coural'...." *Gargantua*, ch. 11, p. 35, in *Oeuvres complètes* (Paris: Gallimard, 1994). Thanks to Charlotte Buecheler for this reference.

5 *Ibid.*

6 Ferrante Imperato, *Dell'Historia Naturale*, 1599 (ed. Venezia, 1672) p. 622

https://books.google.co.uk/books?id=heGCGe1Rn3YC&printsec=frontcover&dq=ferrante+imperato+historia+naturale&hl=en&sa=X&ei=w_FRVdrSLcWC7gbyuoDYDA&ved=0CCgQ6AEwAQ#v=snippet&q=corallo%20rosso%20vegetale%20marino&f=false

7 *ibid.*

8 Giovanni Villani (?), *Segreti di Giovanni Villani*, 16th century manuscript, (maybe from the 14th c.). Modena, Biblioteca Estense Universitaria, Ms. Campori R.5.17

Girolamo Ruscelli (?), *La seconda parte de' secreti del Reverendo Donno Alessio Piemontese*, ed. 1559

Gabriele Falloppio, *Secreti diversi et miracolosi*. 1563

Timoteo Rossello, *Della summa de' secreti universali*, 1565

Anselmus de Boodt, *Gemmarum et lapidum historia,* 1609

Anselmus de Boodt, Le parfaict joaillier, 1644

Thomas Nicols, *Lapidary or the history of precious stones*, 1652

Giovan Battista della Porta, *Dei miracoli et maravigliosi effetti dalla natura*, 1662

Lazaro Grandi, *Alfabeto di secreti medicinali*, 1666

Domenico Auda, *Breve compendio di maravigliosi secreti*, 1670

Giuseppe Quinti, *Meravigliosi secreti medicinali*, 1711

9 Giovanni Villani (?), *Segreti di Giovanni Villani*, 16th century manuscript (perhaps from the 14th c.). Modena, Biblioteca Estense Universitaria, Ms. Campori R.5.17. Download the transcription here: http://bibliotecaestense.beniculturali.it/info/img/cat/i-mo-beu-stru-archeo-gamma.r.5.17.pdf See recipes n. 470 (*A fare coralli contrafatti),* p. 89 in the transcription document and also 1071 (*A fare coralli contrafatti),* p. 202 in the transcription document.

10 Giovan Battista della Porta, *Dei miracoli et maravigliosi effetti dalla natura prodotti,* (Venezia, 1562) p. 121 https://books.google.co.uk/books?id=fJJXAAAAcAAJ&pg=RA3-PT94&dq=Giovan+Battista+della+Porta,+Dei+miracoli+et+maravigliosi+effetti+della+natura&hl=it&sa=X&ei=TQRSVeHqIqyp7AbL_oCoBA&ved=0CC0Q6AEwAw#v=onepage&q=raschiature&f=false

11 Anselmus de Boodt, Le parfaict joaillier, 1644 p. 405 https://books.google.co.uk/books?id=HrM-AAAAcAAJ&printsec=frontcover&dq=anselmus+de+boodt&hl=it&sa=X&ei=

AAAAcAAJ&printsec=frontcover&dq=anselmus+de+boodt&hl=it&sa=X&ei=JQNSVYmQGorbUZv8gKgD&ved=0CEEQ6AEwBQ#v=onepage&q=Chapitre%20CLVI&f=false

12 Thomas Nicols, *Lapidary or the history of precious stones*, (Cambridge, 1652). p. 162

13 Interestingly these same constituents (pine resin or *colofonia* and white wax, apart from the cinnabar pigment) were also traditionally used in the assemblage of the Florentine *commesso di pietre dure.* Annamaria Giusti, *L'Arte delle Pietre Dure,* (Firenze: Le lettere, 2005) p. 256. The use of a resin (a solidified secretion from a plant) that hardens composing a work of stones appears extremely meaningful, as it replicates the same principle of the "stonifying sap" mentioned by de Boodt, which turned the vegetal organism of coral into a mineral one.

14 Anselmus de Boodt, Le parfaict joaillier, 1644p. 405-406.

https://books.google.co.uk/books?id=HrM-AAAAcAAJ&printsec=frontcover&dq=anselmus+de+boodt&hl=it&sa=X&ei=JQNSVYmQGorbUZv8gKgD&ved=0CEEQ6AEwBQ#v=onepage&q=Chapitre%20CLVI&f=false

15 The French recipe instructs the reader to dip the branch in the resin instead of coating it directly as mentioned by de Boodt.

16 Ferrante Imperato, *Dell'Historia Naturale*, 1599 (ed. Venezia, 1672) p. 622

https://books.google.co.uk/books?id=heGCGe1Rn3YC&printsec=frontcover&dq=ferrante+imperato+historia+naturale&hl=en&sa=X&ei=w_FRVdrSLcWC7gbyuoDYDA&ved=0CCgQ6AEwAQ#v=snippet&q=corallo%20rosso%20vegetale%20marino&f=false

17 Ferrante Imperato, *Dell'Historia Naturale*, 1599 (ed. Venezia, 1672) p. 521
https://books.google.co.uk/books?id=heGCGe1Rn3YC&printsec=frontcover&dq=ferrante+imperato+historia+naturale&hl=en&sa=X&ei=w_FRVdrSLcWC7gbyuoDYDA&ved=0CCgQ6AEwAQ#v=snippet&q=%22generazion%20naturale%22&f=false

Wax Tallow_109r

July 1, 2015 mkp-admin 2014_Fall, Annotation
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Transcription [from tc_p109r]

<title id="p109r_a1">Esbaucher en cire</title>

<ab id="p109r_b1">Quand la cire est trop dure on y mesle de la tourmentine ou<lb/>

un peu de beurre qui sont pl rend la cire plus amiable Et est<lb/>

plus propre que le suif que les Italiens y mectent a cause quil<lb/>

fault souvent mectre les houtils en la bouche qui sont meilleurs<lb/>

de buys ou dos de cerf</ab>

Translation [from tl_p109r]

<title id="p109r_a1">Working in rough with wax</title>

<ab id="p109r_b1">When the wax is too hard, one mixes in some turpentine or a bit of butter, which renders the wax malleable, and cleaner than tallow, which the Italians mix in, because oftentimes, it is necessary to put the tools into the mouth, [tools] which are better when made from box wood or antler. </ab>

AnnotationFall2014_CataldoVisco_109r

Wax and Tallow: A Material Investigation

"The light is God, the wax is man, Christ is both."[1]

C. Musso (1579)

"It is as precious as it is ambiguous in its duality, for wax—poised between a solid and liquid state—fluctuates between presence and absence, strength and weakness, will and obedience, virtue and vice, memory and oblivion, death and resurrection."[2]

G.A. Guerzoni (2012)

Wax and tallow are mentioned throughout BnF Ms.. Fr 640, but a few recipes focus on changing the qualities of the material itself, particularly to alter its hardness or softness. On folio 109r, the author recounts a recipe for "working rough in wax." He writes: "When the wax is too hard, one mixes in some turpentine or a bit of butter, which renders the wax malleable, and leaner than tallow, which the *Italians* mix in…" Given the frequency of wax[3] and tallow[4] in the manuscript, how can we understand the material properties of each substance, and how do they work together? How do the suggested additives perform comparatively? How do these mixtures relate more broadly to themes of material transformation in BnF Ms Fr 640 and other early modern sources?

In the early modern period, wax was a commonly purchased commodity that had a variety of uses in workshops, apothecaries, and ecclesiastical spaces, as well as, of course, in the household.[5] It could also be used as a device of imitation or trickery, as wax could easily imitate other materials.[6] Tallow, or rendered animal fat, was less expensive, and could be sourced more easily. It shared many of the material properties and uses of wax, although was considered to be a material of lower quality.[7] Both wax and tallow were used regularly by the early modern craftsman: both could be used to carve and model patterns for sculptures,[8] or could be used in other processes like copper etching, bronze casting, and gilding.[9] Both materials were used in candles for illumination – though the expense of wax made it more likely to be used to illuminate sacred spaces. Wax was also a key ingredient for many medicinal remedies, creams, ointments, and cosmetics.[10] These materials, which could readily change from one state to another, from solid to liquid, evoke the trope of transformation and mimic the material properties of metals that could be melted down and reconstituted into new objects. For wax, the duality of the material also had a spiritual dimension, both in alchemical and devotional[11] practices.

Wax and tallow share many properties and material characteristics. Both substances ideally undergo a purification process before they can be utilized by a craftsperson. In the early modern period, wax was purified and bleached in earthenware pots, boiled in a mixture of "fresh seawater, alum, and saltpetre several times, until no traces of impurities remain[ed]."[12] Tallow also undergoes a purification process before being used. Early modern sources on rendering tallow are scarce, perhaps because this process was considered common knowledge and thus unimportant to record, like recipes for baking bread.[13] Modern recipes that describe tallow rendering techniques, however, are plentiful[14] and easily available on the internet.[15] We rendered our beef fat and pork fat in a modern slow cooker

internet.[15] We rendered our beef fat and pork fat in a modern slow cooker, but this could have also been done over many hours in an oven or on a stove. It is essential in the rendering process to apply heat to the fat for many hours without burning it, then strain the rendered fat through cheesecloth to remove the impurities. This straining process could be repeated multiple times to achieve an ever more purified and perhaps firmer substance.

Both wax and tallow can be found in different qualities and types. In the manuscript, the author refers to “white wax” in many recipes.[16] In his article on “The Use and Abuse of Beeswax,” Guerzoni writes that in order to assess the quality of wax, “one must carefully examine the color. The finest is yellow: the lighter it is, the better, and the darker, the worse.”[17] Scent could also play a role in determining the quality of the wax, as a “rotten or mouldy” scent could indicate that tallow had been added to the wax in order to make the expensive material go further.[18] While tallow was much easier and cheaper to procure than beeswax, the fat of different animals could be used, and each of these fats possessed different material properties. Lamb tallow is also mentioned in the manuscript, and Biringuccio notes goat tallow as an ingredient in a wax mixture.[19] Once cooled, the tallows became soft solids. In our experiments, we rendered both beef and pork tallow, experimenting with multiple renderings. We rendered both beef and pork fat, cooking each for five hours. The pork tallow had a much smoother texture[20] than the beef tallow; the consistency of the once-rendered beef tallow was reminiscent of mashed potatoes, while the consistency of the once-rendered pork was similar to thick yogurt. Then we rendered the fats again, cooking each for an additional 5 hours. The twice-rendered pork fat was even creamier in texture, but the twice-rendered beef fat had a particulate consistency that could be compared to hard rice pudding. [fig. 1]

On fol.109r of BnF Ms Fr 640, turpentine and butter are listed as softening agents for wax, though it is not clear how much should be added to achieve the desired texture. This led us to conclude that tallow is also a softening agent, though one that, it seems, the author would prefer not to use.[21] In our experiments with wax, a 1:1 mixture of wax and beef tallow yielded a mixture that was soft and released easily from the molds, but was prone to breaking and cracking after it hardened. We therefore opted for mixtures that contained smaller amounts of the softening agent than of wax. We made mixtures of wax and turpentine, wax and butter, wax and beef tallow, and finally, wax and pork tallow. [fig. 2] Adding two teaspoons of Venice Turpentine to a quarter cup of wax produced a gummy, sticky result that could be carved easily with a stylus. The butter, however, when mixed with the wax, was difficult to carve; the carving tool got stuck in the material, making it difficult to control.[22] Despite the misgivings of the manuscript

author, the tallow mixtures worked particularly well for carving. As mentioned above, a 1:1 mixture was too soft and fragile, but mixtures that included “a little” tallow (in our experiments, two or four teaspoons of tallow to a half cup of wax) resulted in a wax that was more malleable than both the pine rosin and butter mixtures.[23] The best mixtures were wax and pork tallow. Carving tools cut cleanly through the material, making it easy to manipulate and carve, while the overall structure remained solid enough to endure manual manipulation. [fig. 3]

The author of BnF Ms Fr 640 also writes about how wax can be hardened in fol.120r, in a recipe titled “Impress medals made from wax.” Here, he states that “You can mold your relief with wax mixed with a bit of resin to make it harder and firmer…” and he goes on to describe a process of striking medals.[24] A resin and wax mixture is also mentioned on fol.160v in the recipe for “Moulding a foot or a hand.”[25] Rosin and resin are mentioned in several instances in the manuscript, including the making of imitation coral, purpurine, adhering lead to glass, and using resin candles for smoking molds.[26] In this recipe, the French word *rousine* is used; while other recipes use the more common *résine* or *la gemme*, or gum. In modern usage, rosin, resin, and gum have some interchangeable meanings; the material we used to try the wax-resin mixture was sold as “pine gum rosin,” which is a refined form of resin. In our experiment, we were concerned about mixing the two substances due to the higher melting temperature of the pine gum rosin. Would the wax burn or smoke if poured into melted rosin? We melted the wax first and then dropped in pieces of the rosin. The rosin, like an ice cube in cool water, slowly dissolved and became more gelatinous. The resulting mixture once hardened was resistant to the impression of the stylus and thus more difficult to carve indeed more difficult to carve.

The softness and hardness of wax and its ability to take on different states and appearances was an oft-remarked subject for early modern craft writers. Cellini, for example, notes how the seasons affected the conditions of wax, and the temperature of the workshop could determine how the material responded to the craftsman’s hand and tools.[27] On fol. 151r, the author-practitioner of BnF Ms. Fr. 640 recommends mixing coal with white wax to make it strong,[28] and Hugh Platt also mentions this mixture (“Note also that you must first cast all your curious patternes in yellow wax tempered with the fine powder of smale cole”).[29] Platt also mentions red ochre as an additive to color the wax, which makes the pattern more visible.[30] Biringuccio mentions adding Grecian pitch or “ship’s tar” to wax,[31] while both Biringuccio and Cellini write about the benefits of mixing white lead with wax for softening it.[32] Indeed, the remarkable ability of both wax and tallow to easily transform and combine with other substances made

them useful as well as symbolically important in the early modern workshop, and in early modern culture more generally, which evinced a fascination with material transformation.

Emogene CataldoJulianna Van Visco

List of illustrations

Figure 1: Once-rendered pork tallow is smooth and creamy when it has solidified. When combined in small amounts to pure beeswax, it creates a soft, malleable carving material.

Figure 2: Chart showing the mixtures of beeswax and additives, hardness-to-softness, and comments about the consistencies of the mixtures.

Figure 3: Diagram of consistency of beeswax mixtures.

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Making Of The Modern World. Web. 19 Dec. 2014.

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1 "Il lume è Iddio, la cera è l'huomo, Christo è l'uno & l'altro." C. Musso, *Il quarto libro delle prediche del reverndissimo mons. Cornelio Musso, vescovo di Bitonto.* (Venice: Giovanni e Gio, 1579), p. 138. Quoted in Guerzoni, "Use and Abuse," p. 49.

2 Guido Antonio Guerzoni, "Use and Abuse of Beeswax in the Early Modern Age. Two Apologues and a taste," in A. Daninos, ed., *Waxing Eloquent: Italian Portraits in Wax* (Milano: Officina Libraria, 2012), 49.

3 A complete list of recipes that mention the word wax (French: *cire*) include the following: fol. 12v, "Moulding stucco promptly"; fol. 26, "Mortar"; fol. 42r "Wax for seals and stamps" and "Casting in plaster"; fol. 44v, "Stucco"; fol. 50r, "Molding"; fol. 59v "To mend holes painting"; fol. 94r, "Burnisher"; fol. 103r, "Something excellent against burns"; fol. 104v, "For casting"; fol. 109r, "Working in rough with wax," "Wax for molding," and "Molding wax"; fol. 112v; fol. 116r "Molding as a core" and "Molding snakes"; fol. 117r "A way to mold flowers and herbs"; fol. 120r "Stamped medals made from wax"; fol. 121r "Keeping fruit over a year"; fol. 122v, "Molding hollow"; fol. 122r "Fixing diverse animals"; fol. 124v, "Casting gold" and "Casting small lizards"; fol. 125r "Molding fruits and animals in sugar"; fol. 125r, "Plaster" and "Plaster to cast with wax"; fol. 126v, "Plaster"; fol. 127r, "Plaster mold for wax"; fol. 129v "Advice about casting"; fol. 130v, "For molding thinly"; fol. 130r, "Drying animals in an oven"; fol. 131r, "Molded wax"; fol. 133r, "Hard wax to imprinting seals" and "Casting the feet of small lizards in gold and silver"; fol. 133v, "Thing that cannot be stripped from the mold" and "Animals entwined"; fol. 134v "Secret for soldering small works made of gold and silver"; fol. 135r "Casting" and "Vine leaf and small frog"; fol. 137v, "Wetting sand to mold flat medals"; fol. 138v, "Imitation diamonds put into the work"; fol. 139v, "Casting wax to mold an animal that one has not got"; fol. 140v "To cast in sulfur"; fol. 141v; fol. 143v; fol. 145v, "Moulding herbs and flowers"; fol. 147r; fol. 149v, "Molding vases in several pieces" and "Bats"; fol. 150v, "Moulding hollow"; fol. 150r, "Very strong wax"; fol. 151r; fol. 152v, "Reworking cast things"; fol. 153r, "Moulding hollow seals or other things"; fol. 153r "Moulding hollow seals or other things"; fol. 155r "Moulding a rose"; fol. 155v, "Rose"; fol. 156v, "Moulding a fly", fol. 156r, "Quickly moulding hollow mould and relief"; fol. 157r, "The mode in which goldsmiths mold hollow molds" and "Flies"; fol. 159r, "Wax paintings"; fol. 160v, "Moulding a foot or a hand"; fol. 163v, "Crayfish"; fol. 165v, "Wings of fly"; fol. 165r, "Reworking snakes and lizards" and "Reworking"; fol. 166v, "Scented candle from Le Mans"; fol. 167v; fol. 169v "How to reduce a round form into a hollow one"; fol. 170r "How to clean

"How to reduce a round form into a hollow one", fol. 179r, "How to clean closed moulds".

4 A complete list of recipes that mention tallow (French: *suif*) include the following: fol. 6r, "To put and make hole some burnished gold and produce some red or green or blue"; fol. 13v, "Candles"; fol. 50r, "Molding"; fol. 69r; fol. 80v, "Casters of small tin work"; fol. 81, "Sand"; fol. 96r; fol. 109r, "Working in rough with wax," fol. 118v; fol. 120v, "Making silver runny"; fol. 122v, "Molding hollow"; fol. 150v; fol. 154r, "Metal file dust"; fol. 156v, "Moulding a fly".

5 For more on various uses of wax, see Marco Beretta, "Usi scientifici della cera nell'antichità," in *Quaderni Storici*, 2009 XLIV 1, 15-34; Reinhard Büll, *Das grosse Buch vom Wachs : Geschichte, Kultur, Technik* . (München: Callwey 1977); Wax Craft: T.W. Cowan, et al., *All About Beeswax. Its history, Production, Adulteration, and Commercial Value* (London: 1908).

6 Guerzoni, "Use and Abuse of Beeswax," 54-55.

7 For the economic considerations of wax and tallow, see Guido Antonio Guerzoni, "Use and Abuse," 47. In 1619, 100 pounds of Native Wax cost 79 guilders; 100 pounds of Baltic Tallow, on the other hand, cost 22.5 guilders. Early modern Dutch price data for three different kinds of wax (Baltic Dry Wax, Native Wax, and Riga Wax) and five tallow products (Baltic Tallow, Waits Tallow, and three categories of Native Tallow) can be found in the Prices (Posthumus) database, Medieval and Early Modern Data Bank, <http://www2.scc.rutgers.edu/memdb/index.html>.

8 Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio. The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. and ed. by Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), 221.

9 For gilding and etching processes, see Benvenuto Cellini, *The Treatises of Benvenuto Cellini On Goldsmithing and Scultpure,* trans. C.R. Ashbee, (New York: Dover Publications, 1967), 100-101 and 105.

10 Guerzoni, "Use and Abuse of Beeswax," 45.

11 For more on the materiality of sacramental objects in the Late Medieval Period see Caroline Walker Bynum, *Christian Materiality: An Essay on Religion in Late Medieval Europe*, (New York: Zone Books, 2011), 145-154. For more on the materiality of wax in art see George Didi-Huberman, "Viscosities and Survivals. Art History Put to the Test by the Material," *Ephemeral bodies: Wax*

Sculpture and The Human Figure, ed. Roberta Panzanelli (Los Angeles: Getty Research Institute, 2008); and *Oxford Journal of Art*, Volume 36, Issue 1 March 2013) [Special Issue Theorizing Wax: On the Meaning of a Disappearing Medium].

12 Guerzoni, "Use and Abuse of Beeswax," 46.

13 Bread is mentioned as a molding material in Bnf. Ms. Fr. 640, but a recipe is not provided. On folio 156r in the recipe "Quickly moulding hollow mould and relief," the author instructs the reader to use a bread loaf, "prepared as you know [preparée co{mm}e tu sçais]."

14 Many back-to-basics blogs and affordable lifestyle websites feature content on the reintegration of traditional methods such as fat rendering into the modern home. For examples, see The Prairie Homestead (www.theprairiehomestead.com), The Browning Homestead (www.thebrowninghomestead), or The Paleo Leap (www.paleoleap.com).

15 Here, we use the word "render" to describe the purification process of applying heat to animal fat over a long period of time. This process is not described in Bnf. Ms. Fr. 640, and the French word "rendre" used in the manuscript carries a more distinctive meaning related to making and transformation.

16 For more recipes that mention "white wax," see Bnf. Ms. Fr. 640, 59v "To mend holes [in] painting," 131r "Molded Wax," 133r "Hard wax to imprinting seals," 139v "Casting wax to mold an animal that one has not got," 151r "Moulding hollow," 153r "Molding hollow seals or other things," 155v "Rose," 156v "Moulding a fly," and 159r "Wax paintings."

17 Guerzoni, "Use and Abuse of Beeswax," 47.

18 Guerzoni, "Use and Abuse of Beeswax," 47.

19 See Bnf. Ms. Fr. 640, 6r, and Biringuccio, *Pyrotechnia*, 330.

20 This property is rooted in the saturated fat content. Saturated fats present as more solid at room temperature.

21 The author does mention the mixing of wax and tallow on page 122v, "Molding hollow": "But tallow alone is not good and that is why you have to mix wax and tallow together."

22 We used all-natural, organic butter, but might have had a different result had we made our own butter or clarified the store-bought butter. See Cataldo and Visco Field Notes, 16 November 2014, “Wax and tallow and elm infusion.”

23 Biringuccio says to mix “a little” tallow into the wax. See Biringuccio, *Pirotechnia*, 330.

24 Rosin-wax mixtures are also mentioned in Hugh Plat, *The Jewell House of Art and Nature*, on p. 60.

25 Bnf. Ms. Fr. 640, 160v, “Moulding a foot or a hand.”

26 Bnf Ms Fr 640, 3r “Imitation coral,” 43r “Purpurine,” 49r “Lead Casting” and “Pewterers.”

27 Benvenuto Cellini, *Treatises,* 118.

28 Bnf Ms Fr 640, 151r, “Very strong wax.”

29 Plat, *The Jewell House*, 59.

30 Plat, *The Jewell House*, 59.

31 Biringuccio, *Pyrotechnia,* 330.

32 Cellini, *Treatises*, 100-101 and Biringuccio, *Pyrotechnia*, 330.

Sulfur and Additives_140v_12r

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Transcription [from tc_p140v, 20 December 2014]

<title id=”p140v_a1 >Pour gecter en soufre </title>

<ab id="p140v_b1 >

Pour gecter nettement en soufre, acoustre la miette de </lb>

pain soubs le brasier comme tu sçais. Moules en ce que </lb>

tu veux & laisse seicher & tu auras ton ouvrage fort net. </ab>

<note id="p140v_c1 >Essaye le soufre, </lb>

passe par la cire </lb>

fondue pource qu'il </lb>

ne s'enflamme plus </lb>

& ne faict plus d'oiellets. </note>

Translation [from tl_p140v, 20 December 2014]

<title id="p140v_a1">To cast in sulfur</title>

<ab id="p140v_b1">To make a clean cast in sulfur, arrange the pith of some bread under the brazier, as you know how to do. Mold whatever you want & leave it to dry & you will have a very clean work.</ab>

<note id="p140v_c1"> Try sulfur passed through melted wax, since it won't catch fire & won't make more little eyes.</note>

Transcription [from tc_p012r, 20 December 2014]

<title id="p012r_a1">Pour mouler de soufre</title>

<ab id="p012r_b1">Le soufre se faict beau avecq le noir à noirci meslé ou<lb/>

avecq sanguine pulverisée, qui le rend plus dur et plus fort,<lb/>

l'ayant bien laissé fondre jusques à ce qu'il soict liquide<lb/>

comme huile. Y meslant du verdegris, tu en gecteras dans<lb/>

le plastre un lesard ou aultre chose fort nette.</ab>

<note id="p012r_c1">Il ne le fault pas gecter<lb/>

qu'il ne soict bien refroidi<lb/>

& qu'il n'aye perdu toutes<lb/>

ses pustules & bouillons,<lb/>

et ne soict bien<lb/>

abaissé & rendu<lb/>

uny co{m}me [illegible] eau.<lb/>

Le noir à noircir<lb/>

luy donne un beau<lb/>

vernis & le rend<lb/>

plus necte. Il fault<lb/>

employer le soufre<lb/>

jaulne du plus beau,<lb/>

car le grisastre & vif<lb/>

n'est pas bon. Ne gecte pas<lb/>

au vent & au froict<lb/>

car il soufleroit.</note>

Translation [from tl_p012r, 20 December 2014]

<title id="p012r_a1">Molding sulfur</title>

<ab id="p012r_b1">Sulfur is improved by mixing in soot black or powdered sanguine, which makes it harder and more resistant, after letting it melt entirely until it becomes liquid and similar to oil. Mixing it with verdigris, you

can use it for casting a lizard or something else in plaster, very cleanly.</ab>

<note id="p012r_c1">You must not cast it until it has quite down and lost all its bubbles and eyes, and its surface has fallen and become flat as water. Soot black gives it a fine luster and makes it neater. Use yellow sulfur of the best kind, as the greyish natural sulfur is no good. Don't cast it in the wind and cold for it would fill with bubbles.</note>

Annotation: Concerning the Uses of Sulfur for Casting

Rozemarijn Landsman & Jonah Rowen

[All figure file names have been abbreviated for readability, and are preceded by "AnnotationFall2014_LandsmanRowen_Sulfur_ ..."; e.g., "AnnotationFall2014_LandsmanRowen_Sulfur_Fig1_BreadMold.jpg" is here shortened to "Fig1_BreadMold.jpg"]

From the number of references in BnF Ms. Fr. 640 and contemporary sources, sulfur appears to have been a versatile material in early modern fabrication processes. The manuscript refers several times to sulfur as a material for casting, and this annotation will focus on these recipes. Our primary question is why, and under what circumstances, sulfur would be an advantageous material to use for pouring and molding. Our method of inquiry in addressing this question is to examine the material properties of sulfur itself when melted and poured into molds, as well as to follow the manuscript's directions for additives to sulfur in order to test the effects that other materials have in the casting process. In addition to our questions regarding why and when sulfur would have been used for casting, and what sulfur would be mixed with and why, these experiments and this research aims secondarily to address whether the material of sulfur itself carried any semiotic meaning for the author of BnF Ms. Fr. 640, and whether the material properties of sulfur (e.g., flammability and brittleness) are significant in the author's descriptions or directions. This annotation begins by reading closely some of the directions that the manuscript gives for casting in sulfur closely. It then proceeds to describe the series of experiments performed, discusses the textual sources in combination with experimental findings, and concludes with suggestions for further research. To answer our questions, we will focus on two recipes that explicitly discuss casting in sulfur: folio 140v, "To cast in sulfur"; and folio 12r, "Molding sulfur".[1]

Text of the Recipes

The recipe "To cast in sulfur" [*Pour gecter en soufre*] on fol. 140v explains

The recipe "To cast in sulfur" [*Pour gecter en soufre*] on fol. 140v explains, "To make a clean cast in sulfur [*Pour gecter nettement en soufre*], arrange the pith of some bread under the brazier, as you know how to do. Mold whatever you want & leave it to dry & you will have a very clean work [*tu auras ton ouvrage fort net*]." The word *nettement* is an adverb translated as "clean" here, but Randle Cotgrave provides the alternative translations "neatly, cleanely, purely, cleerely, smoothly, smug"; and *net* or *nette* ("you will have a very clean work") as "Neate, cleane, pure, cleere; spotlesse, unspotted; polished, smooth; briske, smug; faire."[2] The word *fort* or *forte*, which as an adjective means "strong" or "tough," is in this case also used as an adverb, for which Cotgrave gives the definition "verie, most, verie much, mainely, exceedingly, excessively, extremely, vehemently."[3] The aspect of achieving a smooth surface in molding and casting is a significant criterion of success in the description of this type of process. This is further illustrated by the lines in the left margin, next to the passage from fol. 140v quoted above, "Try sulfur passed through melted wax [*Essaye le soufre passe par la cire fondue*], since it won't catch fire & won't make more little eyes [*doeillets*, or *d'oeillets*]." The phrase "passed through" is unclear, but could mean melting the wax first and adding the solid sulfur subsequently, since the recipe seems to emphasize that the wax is already melted. The "little eyes" or "eyelets" mentioned here may refer to air bubbles that form within the heated material, which can damage the results of an otherwise well-poured cast, hence affecting its smooth surface.[4] Another criterion is that the cast object may be easily removed from the mold, which may also be one of the connotations of the author's use of the word *net*.[5]

"Molding sulfur" [*Pour mouler de soufre*] on fol. 12r includes apparently similar references to strength, hardness, air bubbles, and the quality of sulfur.

Sulfur is improved by mixing in soot black [*noir à noirci*] or powdered sanguine [*sanguine pulverisée*], which makes it harder and more resistant [*plus dur et plus fort*], after letting it melt entirely until it becomes liquid and similar to oil. Mixing it with verdigris, you can use it for casting a lizard or something else in plaster, very cleanly [*fort nette*].

And in the margin next to these directions:

You must not cast it until it has quite cooled down again and lost all its bubbles and eyes [*qu'il n'aye perdu toutes ses pustules & bouillons*], and its surface has fallen and become flat as water [*et ne soict bien abaissé & rendu uny co{m}me* (illegible word) *eau*]. Soot black gives it a fine luster and makes it neater [*Le noir à noircir luy donne un beau vernis & le rend plus necte*]. Use yellow sulfur of the best kind, as the greyish natural sulfur is no good. Don't

cast it in the wind and cold for it would fill with bubbles [*Ne gecte pas au vent & au froict car il soufleroit*].

This recipe, like that on fol. 140v, recommends casting in sulfur because it makes a "very clean" cast.

As described in Cennino Cennini's *The Craftsman's Handbook*, "soot black" is the soot collected from a lamp burning linseed oil.[6] Cennini also provides an explanation of "sanguine": "... mark out all the outlines with dark sinoper and a little black, tempered; and this will be called 'sanguine.'"[7] What Cennini means by "dark sinoper" is not entirely clear; in fact, Cennini's translator uses the term as an example of a word with a diffuse meaning, and is therefore difficult to translate: "In other cases, such as his [Cennini's term] *sinopia*, the meaning is too general to be reduced to any single commercial term."[8] Vannoccio Biringuccio mentions a similar mixture of sulfur and red powder: "When I did not have plaster of Paris, I have used sulfur and brick dust...."[9] Cennini also recommends casting with sulfur, using clay or plaster molds: "If you wish to cast medals..., melt some sulfur; get it cast in these molds, and it will be done."[10] The suggestion that mixing sulfur with these pigments would be "harder and more resistant" or "tougher and stronger" implies that, since sulfur itself is quite brittle and chips or cracks easily, hardening the material might have enhanced its durability, and thus its usefulness.

The note to the first paragraph cited on fol. 12r, again written in the left margin of the page, contains several interesting modifications to the main recipe. In particular, two other sets of terms, besides the *oeillets* from fol. 140v, are used again to caution against the possibility of air bubbles: "bubbles and eyes" (or maybe more accurately, "boils & bubbles," with connotations of boiling or broth [*pustules & bouillons*]), and the verb *souffler*, for which Cotgrave gives: "To blow, breath (strongly,) puffe out, send forth blasts; to sound, or wind, as a Corne[t], horne, &c.; also, to kisse behind."[11] Incidentally, further down on fol. 12r, under the heading "Plaster" and in the marginalia to the left of that recipe, the term *pustulles* is again used.[12] Thus, the author gives three different terms for "bubbles" in these two recipes, each with different connotations: "eyelets," "pustules & bubbles," and *souffler* (something like "blown bubbles"). While the last is the least mysterious, since it is a word for a turbulent surface caused by wind and is used in precisely this context, the meaning of "eyelets" and "pustules" was not clear to us.

Experiments

In order to test some of our hypotheses and to decipher some of the more cryptic language in the two recipes from BnF Ms. Fr. 640, we first focused our experiments on casting pure sulfur into bread, as suggested on fol. 140v, and, later in order to save time, into a standardized silicone baking mold. Then we moved on to casting sulfur with some of the pigments added, as suggested on fol. 12r, and sulfur cast in combination with wax, as in fol. 140v. For our first experiment, using bread as a molding material, we patiently grew a rye yeast starter, which eventually yielded a dark and dense rye bread.[13] After removing the bread from the oven, we scooped the "pith" of the bread out from the crust with a spoon, while the bread was still hot, and pressed it in two big pieces around the sides (front and back) of a small Buddha figurine. When dry, this was our pattern for molding.[14] [Fig. 1: Fig1_BreadMold.jpg] We pierced the bread with two wooden lead pencils as indications of how to register the two sides of the mold with respect to one another, and we cut a gate into which the molten casting material could be poured. The 99.9% pure sulfur that we used came as a bright yellow powder. The material's melting point is about 240°F and it took around thirty minutes to solidify inside our bread mold. [Fig. 2: Fig2_BreadMoldPouring.jpg] The result of our pour was a highly detailed three-dimensional reproduction of the figurine, reproducing more of the surface detail of the original than the bread mold appeared to have captured, as detail in the uniformly dark color of the bread is difficult to see. [Fig. 3: Fig3_BuddhaFigurine.jpg] The success of this experiment would inform our subsequent trials. Because this was a two-sided mold, no surface of the sulfur was exposed to air, which seems to have guaranteed the relatively smooth surface; in the one-sided bread molds created by other members of our group the crystals of the sulfur became quite visible as the sulfur cooled.[15]

The cast of the Buddha figurine demonstrated that pure sulfur melts easily, pours well, and picks up very detailed impressions of molds. Other pours of pure sulfur executed by the rest of the group corroborated the results of that experiment. Our next trials involved mixing sulfur with soot black (obtained from Kremer Pigments, a company advertising a specialization in historical pigments, that sells it as "furnace black" or "lamp black") in varying amounts. Few of the recipes that we considered included amounts or proportions, which left the measurements of our experiments open to question.[16] We also experimented with the order of steps in the process: melting the sulfur and adding the pigment afterward, mixing them as powders and melting them together, and melting them separately and mixing them afterward.[17] [Fig. 4a: Fig4a_PowderedSulfurandSootBlackinPot1.jpg; Fig. 4b: Fig4b_PowderedSulfurandSootBlackinPot2] The pigment was quite potent, and two very small spoonfuls (less than 2g) added to 11.5g of sulfur turned

and the very small spoonfuls (less than 1g) added to 1 kilog of sulfur turned the mixture a rich, dark black color. [Fig. 5: Fig5_PowderedSulfurandSootBlack.jpg; Fig. 6: Fig6_MoltenSulfurandSootBlack.jpg; Fig. 7: Fig7_SolidifiedSulfurandSootBlack.jpg; Fig. 8: Fig8_CrystallizedSulfurandSootBlack.jpg] A smaller amount of soot black added to the same amount of sulfur still gave the melted mixture a dark black color, but when it hardened the difference became apparent: the first mixture with the larger amount of black turned dark gray, whereas smaller amounts made the casts turn a greenish color. [Fig. 9: Fig9_SulfurandSmallAmountsofSootBlack.jpg] The color of all mixtures lightened over time. When we first poured, they all looked much darker than they turned out to be after they completely solidified. [Fig. 10: Fig10_SulfurandSootBlackTimeLapse.mp4]

Our other experiments with pigments were much less successful. For "sanguine" we mixed a Venetian Red pigment (also from Kremer Pigments, as our "sinoper") with a very small amount of lamp black, as per Cennini's instructions. [Fig. 11a: Fig11a_PowderedSulfurwithSanguine.jpg; Fig. 11b: Fig11b_MixedPowderedSulfurwithSanguine.jpg] When combined with the sulfur, the powders appeared to form a homogeneous mix, but after we poured the mixture the materials visibly separated from one another, so that the poured cast was dappled yellow and red. [Fig. 12: Fig12_SulfurwithSanguine.jpg; Fig. 13: Fig13_SulfurwithDarkerSanguine.jpg]

We began our experiments with sulfur and wax with similar doubts about how well the materials would mix, based on earlier trials with our group members' bread molding when the ingredients appeared not to combine well. The line from fol. 140v, "*Essaye le soufre passe par la cire fondue*," could, once again, imply a number of procedures, and we attempted several: melting wax then adding powdered sulfur; melting wax then adding solid sulfur (in chunks); and melting each separately and combining them. The different forms of the sulfur appeared not to affect the results of these experiments. When sulfur, in either a solid or molten liquid state, was combined with wax, the two materials remained visibly separate, reminiscent of oil added to water. [Fig. 14: Fig14_MoltenSulfurwithWax.jpg]

For carrying out these experiments another recipe from the manuscript was useful, "Wax for molding," from fol. 109r:

Since the wax is molten, they have some sulfur in a spoon or crucible and pour it in the molten wax. And with the sulfur going to the bottom or staying on top, it stays where it is and mixes only its substance [*substance*] in the

wax, and renders it more meltable [*fusible*; fusible/mixable/combinable[18]] when warming it, in such a way that having molded it, [the wax] gently melts in the mold like butter, without leaving any blister or boil [*pustule ou bouillon*]. Also be warned to not give it too much heat.[19]

The significant part of this recipe for our experiments is the second sentence, "And with the sulfur going to the bottom...," since this implies precisely that the sulfur and the wax do *not* mix or fuse. Instead, the sulfur turned a reddish color at the bottom of the liquid wax. We now felt that we understood that this is what the author meant in reporting that the sulfur should be "passed through" the wax. The results of these pours in which we passed the sulfur through the wax were very smooth, milky, homogeneous surfaces, with a large amount of detail. They had all of the definition of sulfur casts, but appeared less brittle, while also containing all of the malleability of wax, without its translucency (which makes it difficult to see detail on wax impressions and therefore they are more challenging to work with). [Fig. 15: Fig15_SpectrumfromPureSulfurtoPureWax.jpg] Furthermore, the back sides of these sulfur-wax casts did not crystallize visibly in the way that pure sulfur or sulfur mixed with pigments did; instead, the back surface that was exposed to the air was as smooth as the front. [Fig. 16: Fig16_SulfurwithWax_Backs.jpg] Our final experiment with sulfur and wax was to melt one of these mixtures back to a liquid state. As predicted, they gradually re-separated. [Fig. 17a: Fig17a_SulfurwithWaxReseparating1.jpg; Fig. 17b: Fig17b_SulfurwithWaxReseparating2.jpg]

Open Questions and Conclusion

Further experiments involving sulfur and its additives would include a study of and experiments with all of the recipes that mention sulfur in the manuscript,[20] although that may be difficult to achieve. The most common combinations, aside from sulfur with wax, include the additions of metal filings (copper and iron), tin, ammonia salt, resin, and verdigris. Additionally, further trials with other pigments for "sanguine" besides the Venetian Red pigment that we used would help to determine the author's meaning in that suggestion. Along similar lines, the proportions of the various materials could be explored in more depth, since we only had time to test proportions within a relatively small range. Further philological or hermeneutic research into the author's use of language might also help to determine the actual ends of casting in sulfur, and why making the material *plus dur et plus fort* was a valuable goal. Additionally, while empirical observations seemed to corroborate the author's comments about the hardness and brittleness of the various mixtures, more accurate testing with instruments appropriate to that measuring these properties would provide interesting insight.

provide interesting insight.

While very few positive conclusions can be drawn from either these experiments or the text of the recipes, one can say with certainty that sulfur was used as a casting material for good reason, since its capacity for accepting detail proved excellent in almost all experiments. Whatever alchemical associations the material carried for others—Biringuccio mentions these properties and practitioners skeptically[21]—few traces of those ideas are visibly evident in the recipes from BnF Ms. Fr. 640 that we studied. Instead, sulfur is used quite practically, and when its deficiencies as a material (its color, luster, or brittleness) make it inappropriate for certain tasks, the author suggests augmenting it with other materials. That sulfur is also used in so many other ways, including as an ingredient in pigments and in a variety of other recipes, attests not only to the material's availability and versatility, but perhaps more significantly, its *perceived* versatility.[22] For all of the different uses documented, one can infer that others were tried but did not produce a desired result. Therefore it may not be too speculative to suggest that sulfur metonymically represents the process of trying and assaying, or in other words, "experimenting" itself. The prevalence of sulfur in recipes ranging from coloring to casting to "boil[ing] an egg in cold water without fire"[23] provides evidence that the material was both commonly used and tried in a breadth of applications. Even in its uses in processes of casting explored here, one of its purposes was likely to experiment with the level of detail one can achieve with a carved pattern or mold.[24] It would seem that, in its ubiquity in trying and testing in this manuscript, sulfur both connoted the idea of experimentation and, as a versatile material, invited further actual trials.

Although sulfur, along with mercury and sometimes salt, was considered by alchemical writers to be one of the "principles" of all metals, and is therefore ubiquitous in discussions of that subject, BnF Ms. Fr. 640 is not an alchemical treatise.[25] Lawrence M. Principe criticizes Steven Shapin and Simon Schaffer for claiming that alchemical experiments were not rigorous and repeatable.[26] Our research and experimentation has demonstrated that the claims made in regard to casting sulfur in BnF Ms. Fr. 640 *are* repeatable. Addressing the reproducibility of alchemical practices would be beyond the scope of the present annotation, but we have been able to conclude that the author-practitioner provides practical—and practicable—advice on procedures for casting using sulfur.

Our research has only been able to raise the question as to whether the author-practitioner responsible for BnF Ms. Fr. 640 omitted mentioning sulfur's applications to alchemical processes simply because those uses were so widespread as to be commonplace knowledge, or that these

omissions constitute evidence of a more deliberate disinterest in chrysopoetic alchemy (as displayed by Biringuccio). Further research would be necessary to determine what traces of allusions to alchemy exist in the manuscript. Nonetheless, based on the number and variety of recipes that suggest using sulfur (and, presumably, others that were not included) our work with sulfur allows us to conclude that the author-practitioner's methods were not only predicated on experimentation, but that for him sulfur seemed metonymically to stand for the process of experimentation.

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1 A complete list of recipes that mention the word *soufre* are the following (* denotes relevance to casting in sulfur; † denotes a pigment): fol. 3r,

"Imitation coral"; fol. 12r,* "Molding sulfur"; fol. 12r, "Paper"; fol. 12r, "Plaster"; fol. 13r (irrelevant; "sulfur steam"); fol. 35r, "To boil an egg in cold water without fire"; fol. 43r, "Purpurine"; fol. 44v, "Stucco"; fols. 46r & 46v (irrelevant; "sulfur oil," or oil of vitriol); fol. 50r,* "Molding"; fol. 68v (irrelevant; "smoke of sulfur"); fol. 73r,† "Making grey wood"; fol. 73v,† "Brown copper color"; fol. 74r, "Vermilion"; fols. 75v-76r,† "Recipe for coloring all wood"; fol. 76v,† "Making cheap and very beautiful gold color"; fol. 79r,† "Making bronze and gold coloring"; fol. 81r, "Earth for molding"; fol. 99r (apparently irrelevant); fol. 104r,† "Good mixture to color gold"; fol. 109r,* "Wax for molding"; fol. 117v (irrelevant; "sulfur oil"); fol. 118r (irrelevant; "sulfurous marcasites"); fol. 120r, "Sand for casting gold"; fols. 126v-127r, "Plants that are burned in the core with difficulty"; fol. 129r, "Viperine snake"; fol. 129v, "Casting a spider on a leaf"; fol. 131v,* "Molded wax"; fol. 138r, "Wetting sand to mold flat medals"; fol. 139v, "Casting wax to mold an animal that one has not got"; fol. 140r,* (untitled); fol. 140v,* "To cast in sulfur"; fols. 169v-170r, "How to reduce a round form into a hollow one."

2 Randle Cotgrave, "*Nettement*," "*Net: m. nette: f.*," in *A Dictionarie of the French and English Tongues* (1611), http://www.pbm.com/~lindahl/cotgrave/658.html.

3 Cotgrave, "*Fort. (Adverb)*," http://www.pbm.com/~lindahl/cotgrave/457.html.

4 This was a concern of Benvenuto Cellini's as well; in his instructions "On the Art of Niello" (that is, on a slightly different subject, although his recipe for niello contains sulfur) he writes, "The only object of this burnishing is to stop up certain bubble-holes that sometimes come during the process." See Benvenuto Cellini, *The Treatises of Benvenuto Cellini on Goldsmithing and Sculpture*, trans. C.R. Ashbee (Whitefish, MT: Kessinger Publishing, 2006), 9. For *oeillets*, Cotgrave gives, "A little eye; also, an oylet-hole...," http://www.pbm.com/~lindahl/cotgrave/670.html.

5 Biringuccio writes on the uses of sulfur for casting and more broadly: "As I told you, sulfur melts and by means of its fusion one can mold any desired object from it as if it were plaster of Paris, wax, or melted metal. It serves human needs in medicine, in the purifying and bleaching of wool, and in divers other things. But the greatest quantity today is consumed in making gunpowder." See Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), 90.

6 “There is another black which is made in this manner: take a lamp full of linseed oil, and fill the lamp with this oil, and light the lamp. Then put it, so lighted, underneath a good clean baking dish, and have the little flame of the lamp come about to the bottom of the dish, two or three fingers away, and the smoke which comes out of the flame will strike on the bottom of the dish, and condense in as mass. Wait a while; take the baking dish, and with some implement sweep this color, that is, soot, off on to a paper, or into some dish; and it does not have to be worked up or ground, for it is a very fine color.” Cennino d’Andrea Cennini, *The Craftsman’s Handbook: “Il Libro dell’Arte”*, trans. Daniel V. Thompson, Jr. (New York: Dover Publications, 1960), 22-23. Also peripherally relevant is the “black sulfured wax” recommended on fol. 139v. Cellini also mentions using “black wax”: “To see better how you are getting on, you may occasionally press in a little black wax, or whatever colour pleases you better, to gauge the projections”; see *The Treatises*, 65. Cellini does not describe how to make “black wax,” but the recipe “Casting Wax to mold an animal that one has not got,” on BnF Ms. Fr. 640 fol. 139v includes a definition of black wax that contains charcoal.

7 Cennini, *The Craftsman’s Handbook*, 95.

8 Daniel V. Thompson, Preface to *The Craftsman’s Handbook*, xiv. He continues: “To translate *sinopia*, “Venetian red,” would be to fix arbitrarily upon one of many perfectly good reds, all of which Cennini would unhesitatingly have called *sinopia*; and that to no good purpose, for there are almost as many shades of Venetian red in modern trade as there are colormen who sell that universal pigment.” *The Craftsman’s Handbook*, xiv-xv. Cennini mentions dark sinoper several other times, but without specifying in any further detail how one would make the pigment.

9 Biringuccio, *The Pirotechnia*, 331.

10 Cennini, “How to Cast Medals,” *The Craftman’s Handbook*, 130. Interestingly but incidentally, under the same heading, Cennini also suggests hardening plaster using a red additive, “red lead”: “And if you wish to do them just with plaster, mix ground red lead with it; that is, mix the dry powder with the plaster. And make it as stiff as you think best, to suit yourself.”

11 Cotgrave, http://www.pbm.com/~lindahl/cotgrave/877.html.

12 Fol. 12r, “Plaster”: “rub it well with your finger, and if it makes bubbles, throw on more powder of the said plaster and crush it with your finger…”

and in the margin, "It makes no more bubbles." Then once more throw and sprinkle plaster powder on top and leave to set well, then scrape the powder off."

13 In none of its breadmolding recipes does BnF Ms. Fr. 640 specify the type of grain or bread that should be used for making bread molds.

14 On fol. 140v, below "To cast in sulfur," what follows is a recipe titled, "Molding and reducing a big piece," which gives the instructions, "Mold it with the pith of the bread just out of the oven, or like that aforementioned...."

15 See the cast of the dinosaur figurine from Jenny Boulboulle's bread mold. Jenny Boulboulle "Class Notes 3 October 2014," Dinosaur cast.

16 When they did, there was a varying level of specificity; the recipes "Brown copper color" and "Vermilion" on fols. 73v and 74r include measurements in ounces and pounds, respectively; more frequently, measurements are given in relative quantities. Measurements are often given for one ingredient but not for others.

17 Because soot black consist almost entirely of Carbon, the melting point of which is 3550°F, this last one was not successful.

18 Cotgrave definition is: "*Fusible*: fusible; meltable, which may be melted." http://www.pbm.com/~lindahl/cotgrave/473.html

19 On fol. 131r the recipe "Molded wax" repeats a similar instruction: "Do not add to your wax all the drugs you are preparing, but only melted sulfur, as the candle melts, and also candle smoke. Melted sulfur falls down to the bottom of your mold, but lets the wax keeps some of its quality, melting it but leaving it a little firm."

20 See n. 1.

21 On pp. 86-87 of *The Pirotechnia*, Biringuccio doubts that sulfur is a "principle" for metals, as the alchemists argued, "because I do not believe that either of these [mercury or sulfur] really occurs except in similar elemental substances. I say this because I have never seen sulfur found in any metal mine, or metal near any sulfur or mercury ore," yet he proceeds, "The alchemists hold sulfur in great reverence as a material agent in all their operations because of its heat and dryness and because of its yellow color." He continues to describe silk workers' use of the material for bleaching and women's use of it as hair dye. See *The Pirotechnia*, 90.

women's use of it as hair dye. See *The Pirotechnia*, 90.

22 Sulfurt was also a readily available material, as evidenced in numerous inventories from sixteenth-cetury Europe, where it is referenced in different colors and forms, including yellow and grey, in cakes or as a paste, gathered from volcanic regions. See inventories in Jo Kirby, Susie Nash and Joanna Cannon, eds., *Trade in Artists' Materials: Markets and Commerce in Europe to 1700* (London: Archetype Publications, 2010), pp. 258 (inventory of Venetian color seller Jacopo d' Benedetti), 351 (in the stock of the English storekeeper William Watkyns), and passim (in the large scale vermillion making carried out in several European centers).

23 Fol. 35r, "To boil an egg in cold water without fire."

24 Cellini recommends that "you will do well to make wax impressions from time to time, while you are cutting, to see how you are getting on." *The Treatises*, 73-74.

25 William R. Newman, "What Have We Learned from the Recent Historiography of Alchemy?" *Isis* 102, No. 2 (June 2011): 313-321.

26 Shapin and Schaffer characterize the difference between "The experimental 'laboratory'" and "the alchemist's closet in that the former was said to be a public and the latter a private space." Shapin and Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985), 57. Principe does not appear to object to their argument regarding public, as opposed to private, experimentation. See Principe, "Apparatus and Reproducibility in Alchemy," in *Instruments and Experimentation in the History of Chemistry*, ed. Frederic L. Holmes and Trevor H. Levere, (Cambridge, MA: The MIT Press, 2000), 56. Whether the author of BnF Ms. Fr. 640 practiced his experiments in public or private settings is not an answerable question at this stage of research, but the fact that the manuscript exists is at least one form of making the author's work available outside of his workshop, whatever it may have been.

Sands and Binders

July 1, 2015 mkp-admin 2014_Fall, Annotation

Leave a comment

Transcription [from tc_p084v]

<title id="p084v_a2">Eau magistra</title>

<ab id="p084v_b2a">Aulcuns trouvent que leau sel nest pas bonne pourceque<lb/>

le sel pette au foeu & par consequent doibt faire soufler<lb/>

Il ny a que le vin bouilly avecq racine dorme</ab>

<ab id="p084v_b1d">Le charbon pour poncer faict bien despouiller mays<lb/>

on trouve que celuy de saule faict soufler celuy de chaisne<lb/>

ou fayan faict soufler bien sans soufler</ab>

<note id="p084v_c1">Essaye huitres bruslees</note>.[1]

Translation [from tl p084v]

<title id="p084v_a2">Eau Magistra</title>

<ab id="p084v_b2a">Some people think that salt water is not good, because the salt releases gas when heated and as a result causes bubbles. [In this case], there is only wine boiled with elm root.</ab>

<ab id="p084v_b2b">Sanding charcoal makes [things] come off well. But one finds that willow charcoal creates bubbles, but oak or beech charcoal does the job without making bubbles.</ab>

<note id="p084v_c2">Try burnt oysters.</note>.[2]

Transcription [from tc 082r]

<title id="p082r_a3">Glaire doeufs</title>

<ab id="p082r_b3">La glaire doeufs donne force au sable pour en faire<lb/>

plusieurs gects</ab>

Translation [from tl p082r]

<title id="p082r_a3">Egg white</title>

<ab id="p082r_b3">Egg white gives strength to sand so that many casts [can be] made from it</ab>

"Eau Magistra:" Investigating Binders for Sandcasting

BnF Ms. Fr. 640 contains many recipes that describe sand-casting processes. To make a successful mold, often a dry sand and a wet binding agent are combined to create a mixture that is able to take and hold an impression as well as withstand the heat or pressure of a molten material.

A "sand" might consist of many materials. Indeed, the author of the manuscript mentions, among many options, calcined ox hooves, pulverized sand, and burned felt as potential materials for sand.[3] Similarly, BnF Ms. Fr. 640 cites diverse materials that may be used as "wet" binding agents, which are also called "Magistry" or *magistra* in early modern craft recipes. Biringuccio writes about making a magistry of salt and water in his *Pirotechnia*. saying, "Because it is necessary that the powders made for casting have a magistery of salt water, I wish now to teach you to prepare the salt that must form this magistery, for without it these powders would not have the toughness to hold themselves together when they dry."[4] Hugh Plat also uses this term within the context of a recipe, but one that does not describe a sand casting process. The very term "Magistry" itself is enigmatic; how does this word connect to the binding agents described in the manuscript? What properties are exhibited in these binding agents? What do they have in common? Do they operate in similar ways, or do certain binders perform better than others? By thinking more broadly about the materials used in the manuscript's mold-making recipes and investigating the materials themselves, it is possible to understand why an early modern craftsman might have preferred one binding agent to another: in the examples of egg whites and wine-elm-root decoctions, egg whites may have been used for their strength, and an elm root decoction for similar reasons, as well as the ease of making it in larger quantities.

Before considering the specifics of each material, it is helpful to briefly consider the term "*magistra*" and what it might have meant to the author and potential readers of BnF Ms. Fr. 640. The French term *magistra* seems to have been derived from the Latin word *magisterium*, used in Classical Latin to refer to the office of a magistrate, and used later in medieval Latin to refer

to the philosophers' stone.[5] The term *magistra* does not appear in Randle Cotgrave's 1611 French-English dictionary, though a related word *magistère* is defined as "Maistership, authoritie, sway, cheefe rule, also, maisterie, a maisters part, or maisterpeece."[6] This entry is followed by several words that may relate to the author's use of *magistra*: the adjective *magistral* implies both mastery and trickery in its description: "Magistrall; of a maister, or magistrate, or maister; also, maister-like; artificiall, skilfull, cunning."[7] Similarly, the adverb *Magistralement* suggests a similar dual meaning of skill and trickery: "Maister-like, expertly, artificially, cunningly."[8] Turning to English usage, the *Oxford English Dictionary* defines "Magistry" as having chymical import, with most usage of the word appearing in seventeenth century texts.[9] Magistry might refer to a "master principle of nature, free of impurities…a substance, such as the philosopher's stone, capable of transmuting or changing the nature of other substances," but can also refer to the "residuum obtained by an acid solution; a precipitate; a resinous extract."[10] In alchemical texts, the magistery or *magisterium* could refer to the great work, the *opus magnum*, or the attainment of the philosopher's stone by which the corruptions of both humans and metals could be rectified and brought to a higher state of health. In *Archidoxis*, Paracelsus wrote, "This therefore is a *Magistery*, viz that which can be Extracted out of things without any separation or Preparation of the Elements, and yet notwithstanding, the Powers and virtues of things, are by the addition of some thing, attracted into that matter and conserved there."[11] While *magistra* or magistery carries many meanings, the key to understanding it for our study seems to be that *magistra* was capable of enacting material transformation; it could make a dry substance wet, a lean substance fat. As the French entries suggest, this material transformation was shrouded in mystery: perhaps only those skilled in the making of *eau magistra* could access its transformative powers.

Binding agents in sand-casting seem to have been one of the many sub-categories of *magistra*. BnF Ms. Fr. 640 mentions *magistra* on folio 68r in a recipe for casting: "It releases very cleanly, and needs not to be dampened with magistra or anything else…"[12] Here, *magistra* seems to indicate a mixture: both wine and egg white are mentioned in the manuscript in cases where a binder is needed to moisten the sand.[13] Interestingly, the author specifies different kinds of magistries: "wine *or magistra*", and "*magistra or* egg white."[14] The author seems to differentiate here between *magistra* and substances that do not require additional ingredients to act as binding agents. That said, other recipes for *magistra* in BnF Ms. Fr. 640 call for mixtures of more than one substance: salt and water[15], for example, or wine and elm root.[16] The recipe for "Eau Magistra" on folio 84v is one of these. It recommends boiling elm root in wine in order to make a mixed *magistra*. This mixture, the author-practitioner implies, is a better alternative to salt water

mixture, the author-practitioner implies, is a better alternative to salt water, which "some people" say is "not good."[17] This elm root binding agent is mentioned in a number of recipes for sand-casting,[18] including "Sand" on folio 69v: "Lean sand needs to be more moistened than others, that's to say with...wine boiled with elm tree roots or something similar."[19] The elm root-wine decoction is mentioned on folio 72r in the recipe for "Copper casting" where the author-practitioner advises to "Moisten your sand with wine boiled with elm root".[20] Another recipe on fol. 86r, "Sand Experiments" provides the following directions: "Then I molded burned bull's foot bone, pulverized & strained through a double sieve and wet with egg white or wine boiled with the root of an elm."[21]

Like "Eau Magistry" on folio 84v, the recipe "Magistry" on folio 87v also describes how the decoction should be made: "Founders harvest the roots of a young elm when it is sappy, and boil it in wine, or better yet vinegar. They prepare a year's worth of it and store it in a cask."[22] It is interesting to note the lack of distinction between wine and vinegar in this recipe; the author implies that the qualities of both are sufficient for the needs of the binder. The description of the elm root harvest is also notable; notice that the author writes that "Founders" do this, implying that he himself (or whoever wrote the recipe) is not a founder. Also noteworthy is the author-practitioner's understanding that the elm root mixture could be made and stored in large quantities; perhaps this was useful when casting objects from a large box mold.

In our experiments to reconstruct different *magistras*, we were able to make a substance that performed well in sand-casting and behaved similarly in its material properties to egg white. We set out to follow the recipe, a seemingly straightforward process, as the manuscript simply instructs to boil wine with elm root. Nevertheless, we encountered various obstacles in its recreation. To begin with, we chose an inexpensive Cabernet Sauvignon, remembering that the manuscript did not discriminate between wine and vinegar.[23] While we were unable to harvest sappy elm root as described in the manuscript, we did find slippery elm inner bark powder, which is still used in CAM (Complementary and Alternative Medicine) recipes.[24] We substituted this substance for the freshly harvested elm root. The recipe did not specify the quantity of elm root, and it remains an open question, how much is needed to make the *magistra*. With a scarcity of early modern sources on this point,[25] we consulted modern medicinal recipes to determine the quantity. Boiling one cup of wine with two teaspoons of powdered slippery elm bark resulted in a viscous liquid that smelled of fruit and had the thick, mucilaginous texture of egg whites. The substance coheres to itself, forming globules, much like the mucous-like character of the mucus of egg whites, but with a more uneven texture.[26] [fig. 1]

As discussed above, egg whites were also used as a binding agent and are mentioned in several recipes in BnF Ms. Fr. 640;[27] however it is unclear if the author considered egg whites to be *magistra*, or (as the aforementioned "Sand experiments" recipe implies), if it was an alternative to using *magistra*.[28] In the recipe "Egg white," the author suggests that the particular advantage of the substance as a binding agent is its strength: "Egg white gives strength to sand so that many casts [can be] made from it."[29] Egg white also appears in the recipe "Other sand," which recommends mixing well-beaten egg white with clay earth mixed with charcoal.[30] In the recipe "Sand, for the most excellent lead of all..." egg whites are suggested to moisten crushed white lead.[31] On folio 85v in the recipe "Casters," the author writes that beaten egg white should be mixed with earth: "They mix beaten egg white with earth of which they make the first layer of the crown [of a bell] in pieces."[32] The recipe "Excellent sand for lead, tin and copper" on folio 86v, which mentions many materials for sand such as burned bone and burned felt, also mentions egg white as a binder in sand casting.[33] In this recipe, the author writes that he was able to do multiple casts in this particular mold: "Two times, I cast copper..."[34]

We tested both egg whites and the elm-root wine decoction as binders in sand casting, using box molds and sand made from crushed "sand" of molds that had been used previously.[35] While they have their differences, the sand mixture with egg white and sand mixture with elm root decoction were more similar to one another in tactile handfeel properties. When mixed with the sand, the consistency was almost more oily than wet, and the sand clumped like moist brown sugar rather than a soft, wet clay. It was easy to tell when the sand was ready for the molds, using a squeeze-test described in the manuscript on folio 118v: the sand should give "a nice hold," but still come apart easily.[36] The importance of this brief note about how to determine the correct liquid content of molding sand became clear to us as we worked. In order to make this test, we took a handful of the sand mixture and squeezed it into the palm. If it held together, but could also be easily dissolved by applying pressure to it with a fingertip, it was ready for molding. [fig. 2, fig. 3, fig. 4] Both sands packed exceptionally well when building the molds; the sand mixtures did not seem too moist or too dry, and both produced detailed impressions.[37] [fig. 5, fig. 6] Just as the recipes in the manuscript indicate, the mold made with egg white was strong enough to endure two castings of molten tin.[38] [fig. 7] The mold made with the elm root *eau magistra* produced a fine product, but the mold did not hold up well enough to produce two castings.[39] [fig. 8]

In conclusion, our research shows the author-practitioner's interest in experimenting with different types of binders, including what he called

experimenting with different types of binders, including what he called *magistra*. While it is not clear whether this term denotes a particular type of binder, all recipes for *magistra* in BnF Ms. Fr. 640 played an important role in transforming substances from one material state to another, and in the case of sand casting, *magistra* moistened the wet sand and made it strong enough to withstand casting molten metal. In our experiments, the mold made with the egg whites was strong enough to cast two objects in molten tin and could have possibly cast a third. The durability of molds made with egg white is also reflected in several recipes in BnF Ms. Fr. 640. The *magistra* made with elm root also performed well, and might have had the added benefit of being able to be made in large quantities and stored for long periods of time. These different ingredients might have been used in a workshop to make molds with different characteristics, and depending on what materials were available and potentially the size of the mold, the craftsman could have worked with either substance.

Emogene CataldoJulianna Van Visco

List of illustrations

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1 Marc Smith, Professor of Paleography, École des chartes, has noted that this marginal note does not necessarily belong to the "Eau Magistra" entry, but rather part of the preceding entry titled "Sand" [*"Sable"*].

2 See note 1.

3 See BnF Ms. Fr. 640, folios 84v, 68r, and 83r, respectively.

4 Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio. The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. and ed. by Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), p. 325.

5 *Oxford English Dictionary Online*, s.v. "magistry."

6 Randle Cotgrave, *A Dictionary of the French and English Tongues* (London: Adam Islip, 1611), s.v. "magistère."

7 Cotgrave, *Dictionarie*, s.v. "magistral."

8 Cotgrave, *Dictionarie,* s.v. “magistralement.”

9 According to the OED, the earliest English usage of the term “Magistry” as it is defined in alchemy and chemistry is by Hugh Plat, “Howe to keepe the juice of Oranges, and Lemons all the yeare, for sauce, julepps, and other purposes” in *Jewell House of art and nature*, (1594), 37: “But because such secrets are fitter for a philosophers laboratory, then a gentlewomans closet, I wil not...discover any magistery upon so base an occasion.” Of course, the OED may not have captured craft usages of Magistery before Platt’s writing.

10 OED, s.v. “Magistry.”

11 *Paracelsus his Archidoxis: comprised in ten books*, trans. by J. H. Oxon (London: printed for W.S., 1661), p. 78, quoted in Lyndy Abraham, *A Dictionary of Alchemical Imagery* (Cambridge: Cambridge University Press, 1998), p. 121.

12 BnF Ms. Fr. 640, fol. 68r: “Elle despouille fort net, ne veult poinct estre humectée de magistra ne d’aulcune chose...”

13 “Eau Magistra.” BnF Ms. Fr. 640, fol. 84v.

14 “magistra ou glaire d’oeuf...du vin ou magistra...” BnF Ms. Fr. 640, fol. 69r.

15 “Eau Magistra.” BnF Ms. Fr. 640, fol. 84v.

16 “Eau Magistra.” BnF Ms. Fr. 640, fol. 84v.

17 “Eau Magistra.” BnF Ms. Fr. 640, fol. 84v.

18 For recipes containing wine boiled with elm root, see BnF Ms. Fr. 640, folios 69r, 72r, 84v, 85v, and 87v.

19 “Il fault que les sables maigres soient plus humectés que les aultres, sçavoir de magistra ou de bon vin pur ou de vin bouilly avecq de la racine d’orme & semblable.” BnF Ms. Fr. 640, fol. 69v.

20 “Humecte ton sable avecq vin bouilly avecq racine d’orme, et gecte letton qui vient bien...” BnF Ms. Fr. 640, fol. 72r.

21 “Despuys j’ay moulé d’os de pied de bœuf bruslé, pulverisé & tamisé par un double tamys, & humecté avecq glaire d’oeuf ou vin bouilly avecq racine d’orme.” BnF Ms. Fr. 640, fol. 86r.

22 “Les fondeurs prenent de la racine de jeune orme quand il est en sabe, & le font bouillir en vin ou pour mieulx vinaigre, et en font provision pour tout l’an dans un barriquet.” BnF Ms. Fr. 640, fol. 87v.

23 See BnF Ms. Fr. 640, fol. 87v, “Magistry.”

24 Slippery Elm is a North American tree (*ulmus rubra*), but the elm root mentioned in the manuscript likely came from the European White Elm, *ulmus laevis*.

25 Inner bark of elm root is mentioned as an ingredient for a recipe “to make hair grow long” in Caterina Sforza’s late fifteenth century collection of recipes *Gli Experimenti*: “*Piglia el scorzo interior della Radice Delolmo et pesta et falla Bollir longamente in acqua...*” Making Up the Renaissance Project, Accessed 18 December 2014. <https://sites.eca.ed.ac.uk/renaissancecosmetics/>.

26 Egg white contains several types of proteins – albumin, globulins, and mucoproteins – which give it a mucous-like substance and texture.

27 Eggs have many uses in BnF Ms. Fr. 640and are mentioned often, but for recipes that mention egg white in sand casting processes, see folios 49r, 68r, 69r, 82r, 83r, 84v, 85v, 86v, and 87v.

28 See BnF Ms. Fr. 640, fol 85v, “Sand experiments.” Other evidence in the manuscript and in Biringuccio’s discussion of magistery, suggests that a “magistery” differs from other binders in its inclusion of material perceived as salts. In Biringuccio and other metalworkers’ material imaginary, salt seemed to provide “fat,” or unctuosity, to the lean sand. Like the healthy human body, a good mold must also be in balance; in the case of the mold, the balance is between fat and lean. The mix of these qualities provided for a mold that took an impression well, and was very robust, not too brittle on being heated and in pouring the metal but still friable enough to release the metal after casting. A good mold could also be tempered appropriately to balance the fatness or leanness of the metal going into it.

29 “La glaire d’oeufs donne force au sable pour en faire plusieurs gects.” BnF Ms. Fr. 640, fol. 82r.

30 BnF Ms. Fr. 640, fol. 83r.

31 BnF Ms. Fr. 640, fol. 84v.

32 “Ils meslent de la glaire d’oeufs battue avecq la terre de quoy ilz font la premiere couche de la chappe de pieces & cloches & toutes aultres pieces, disant que ladicte glaire faict venir nect & faict poser & asseoir la matiere. En noyau pour petit ouvraige, la glaire est bonne aussy.” BnF Ms. Fr. 640, fol. 85v.

33 See “Excellent sand for lead, tin, and copper,” BnF Ms. Fr. 640, fol. 86v.

34 “Je y gectay deulx foys...” BnF Ms. Fr. 640, fol. 86v.

35 We are grateful for the expertise of Tonny Beentjes, [Official Title], who guided us as we reconstructed sand casting techniques from BnF Ms. Fr. 640fol. 118v, “Casting in a box mold.” Our sand was made from re-used, crushed molds made of 1:1 brick dust and plaster. We used ammonium chloride and brandy as binding agents. The sand mixture took on moisture in a different way than it did with the egg white and elm root binders; our resulting sand was muddy and full of moisture. See Cataldo and Visco Field Notes, 14-15 October 2014.

36 BnF Ms. Fr. 640: “Casting in a box mold.”

37 The elm root decoction underwent significant shrinkage, whereas the mold made with the egg binder had only changed slightly in size. See Cataldo and Visco Field Notes, 2 December 2014.

38 Interestingly, the addition to egg whites in bread molding also makes for successful casts with great detail. See Cataldo and Visco Field Notes, 29 September 2014.

39 For more on the sand casting process, see Cataldo and Visco Field Notes, 25 November 2014.

Ox Bone and Rock Salt_89r

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Transcription [from tc p089r, Jan. 1st, 2015]

<title id="p089r_a1">Sable dos de bœuf brusle<lb/>

et sal gemme</title>

<ab id="p089r_b1">Je les ay pulverises separem{ent} & subtilies sur le porphire le plus<lb/>

que jay peu Puys jay mesle aultant dun que daultre & repasse<lb/>

sur le porphire Je lay apres humecte dans un papier replie dans<lb/>

une serviette mouillee qui est plus tost faict quau serain de la nuit<lb/>

ou a lhumeur de la cave Et nen ay point trouve qui despouille plus<lb/>

net que cestuy cy Il veult estre asses humide Et si tu le veulx gecter<lb/>

fort tanvre fais quil soict plus chault Il est venu en estain doulx fort net<lb/>

co{mm}e le principal Et ha soubstenu plusieurs gects Pour lestaim je<lb/>

croy quil nen fault point chercher de meilleur Ne pour le plomb fin<lb/>

aussy qui vient quasi plus net que lestaim Tou Los de pied de<lb/>

bœuf est tousjours si aride tout seul que sans estre mesle<lb/>

dune part ou deulx de quelque sable gras & ayant liaison co{mm}e<lb/>

le tripoly les sels le foeultre les cendres & choses semblables<lb/>

il ne despouilleroit pas & ne mouleroit pas net aussy car il sesmie</ab>

Translation [from tl p089r, Jan. 1st, 2015]

<title id="p089r_a1">Powder of ox bone and rock salt</title>

<ab id="p089r_b1">I pulverised them separately and ground them finely on

<ab id="p089r_b1">I pulverised them separately and ground them finely on the porphyry as much as I could. Then I mixed all of one with the other and re-ground it on the porphyry. Afterwards I moistened it in [a sheet of] paper folded in a moist napkin which is made wet more quickly from the moisture of the night, or the [moisture of] the cellar. I have never found [one] which can be removed more cleanly from the mold than this, though it needs to be quite moist. And if you want to cast small works, make it very hot. For tin, I believe that you cannot find a material that takes to powder better, and even for use with fine lead which has almost better results than tin. The bone of an ox hoof is always dry, that is why you must mix it with fatty sand, so it will bind like tripoli, salts, felt, ashes and similar materials. [If you do not mix ox-hoof bone,] it will not turn out from the mold and will not mold cleanly because it crumbles.</ab>

Powder of Ox Bone and Rock Salt

BnF Ms. Fr. 640, fol.89r

Annotation

This recipe in fol. 89r outlines a material called “sand” to be used for sand casting. Here, the author of BnF Ms. Fr. 640 uses “sand” to designate a mixture of the powder of ox bone and rock salt. The author-practitioner suggests pulverizing and mixing the two ingredients, and then moistening them with “the moisture of the night, or the [moisture of] the cellar.” This kind of sand, according to the author, is good for casting tin or lead. Several recipes in BnF Ms. Fr. 640 are devoted to sand casting. Most of these recipes contain a dry component and a wet component. The dry component is the “sand,” and the wet component is the binder that holds the sand together. For example, in fol.84v, the recipe includes burnt bone of ox hoof and a thick broth of elm root. And in fol.118v, the sand is the powder of plaster, brick, and feather alum, and the wet binder is sal ammoniac, water, and wine.

Other contemporary authors also point to various materials used as sand. According to Biringuccio, sand is usually composed of powders “made of crushed brick, tripoli, vine ashes, tiles, and glazed drainpipes, or burned emerey, calcined tin, straw, and of burned paper and horse dung as well as of young ram’s-horn ashes and many other things,” and the binder is usually a “magistry of salt.”[1] Good sand should be fine and take the metal well, and the binder should make the sand strong and hold together when the sand is dry.[2] Based on comparison of the recipe in fol. 89r with other recipes from the same manuscript, as well as descriptions from Biringuccio, the sand detailed in fol. 89r seems unusual because of the absence of an obvious wet

detailed in fol. 89r seems unusual because of the absence of an obvious wet binder other than the mention of moisture. What is powder of ox bone, and how does one make it? Can powder of ox bone and rock salt bind together without a liquid binder? If not, what serves as the binder? How fine must the powder be, and is (re)grinding necessary? Additionally, the author-practitioner refers to "fatty sand." What is the meaning of this?

This annotation first introduces the two components in this recipe and the preparation methods for these two components, then it turns to analyze what serves as the binder in this recipe. It concludes with an analysis of the concept of fat and lean/dry. As will become clear, our reconstruction process gave answers to the questions raised by this seemingly implausible "sand."

The Making of Powder of Ox Bone

Fol. 89r does not give any information about the composition of powder of ox bone, but clues appear in other recipes in BnF Ms. Fr. 640, for example, on fol.67v, which mentions the bone should be "well burnt two times and pulverized."[3] This informed our assumption that the powder of ox bone should be calcined and ground into bone ash.

Bone ash seems to have been a common material for sandcasting. In addition to the recipe in fol.89r, the author-practitioner also mentions the use of bone ash in fol. 67v ("Ox hooves for sand"), fol. 69r ("sand"), and fol. 84v ("Sand, for the most excellent lead of all, for large and small reliefs"). The author-practitioner seems to regard bone ash as an ideal material for casting because he claims that it enables easy removal of the cast objects from the mold. Fol. 67v states that bone ash "is the cleanest sand one can find for firing", and in the recipe in fol. 89r, the author claimed that bone ash is an ideal sand for casting since he had "*Et nen ay point trouve qui despouille plus net que cestuy cy Il veult estre asses humide* (never found [one] which can be removed more cleanly from the mold)", further noting that the bone ash takes fine lead and tin better than any other materials. Our experiment, as detailed in this annotation, shows that bone ash and rock salt take tin well and can be removed cleanly, while, in contrast, cast sulfur objects cannot be removed cleanly from molds made according to fol. 89r.

The source of bone ash, according to fol. 89r, should be ox hoof bone. This refers to the digital bones including proximal phalax, middle phalanx, distal phalanx (coffin bone), proximal sesamoid bones, and distal sesamoid (navicular) bone (fig. 1). Similarly, in the recipe given on fol. 67v, the author-practitioner also chose the bone of ox hoof to make bone ash. Contemporary sources point to other kinds of bone used for bone ash.

Cennini mentions that bones from the second joints and the wings of fowls are good for using on panels.[4] Biringuccio mentions ash made of young ram's-horn, leg bones of horses, donkeys, and mules.[5] Interestingly, the author of BnF Ms. Fr. 640 points out in fol. 69r that "[t]he human bones are the best for casting when they are calcined…[s]heep foot bones are even better than the ox foot bones." But since the author-practitioner of Ms. Fr. 640 particularly chose ox hoof bone in two recipes concerning casting, it seems that ox hoof bone is a commonly used material for bone ash. Since ox hoof proved hard for us to obtain, we chose to use bovine hoof bone and calf's leg bone for our experiment.[6] By comparing the bone at the hoof and the leg bone, we found that the hoof bone is much denser and harder than the leg bone, so we concluded that the hoof bone was a better source of bone ash (fig. 2 and fig. 3).

The process for calcination is not provided in the manuscript. In recipes in which calcination is mentioned, such as in fol. 67v, the author-practitioner does not give any information about such factors as the temperature and the time needed for this process. Other recipes from the same period are similarly opaque about the process. For example, Cennini describes the production of bone ash: "put them into the fire; and when you see that they have turned whiter than ashes, draw them out, and grind them well on the porphyry." [7] Biringuccio mentions using a furnace to calcine the bone and then pound and sift the bone ash, but does not provide any information about time or temperature. The absence or the simplicity of description of calcination may suggest that the knowledge about this process was common in the sixteenth and seventeenth centuries. For example, a 1678 publication of *The Royal Pharmacopœa* by Moyse Charas describes calcination as occurring with an "ordinary" fire.[8] The wide usage of bone ash in other kinds of craft and medicine also points to the process of calcination as a common practice among artisans. Cennini mentions using burnt and pulverized bone ash for treating the panels,[9] and Biringuccio mentions using bone ash to make crucibles, the vessels employed in the process of refining metals.[10] Charas' pharmacopoeia records a recipe of a styptic ointment that includes calcined bone ash as one of the ingredients.[11]

We found that the production process of bone ash in bone china industry served as a point of reference. Here, bones are calcined at up to 1250°C to produce commercial bone ash for bone china manufactory,[12] with the main component of the resulting bone ash being Tri-Calcium Phosphate in the form of Hydroxyapatite $Ca_5(OH)(PO_4)_3$.[13] According to the scientists Galeano and Gracia-Lorenzo, at over 650°C (1202°F), the organic components are completely removed. The bones turn black at 400°C (752°F) and then turned grey between 450°C (842°F) and 600°C (1112°F). At

(752 °F) and then turned grey between 450 °C (842 °F) and 600 °C (1112 °F). At 650°C (1202°F), the bones became white.[14] Based on Cennini's description about the color of bone ash, we consider 650°C as the lowest temperature for calcination.

We commenced experimentation by boiling the cow's hoof (fig. 4) purchased from a kosher butcher shop for 104 minutes. We removed the remaining skin, cartilage, and other soft tissues from the bone using knives and brushes. Then we put the cleaned bone in the oven to dry at 200°F (93 °C) for 1.5 hours and 300°F (149 °C) for five hours. For the sake of comparison, we also prepared the leg bones in the same manner. However, the heads of the leg bones became spongy and soft after boiling, and turned grey after being dried in the oven. The hoof bone turned white and hard after being dried in the oven, and its pieces rang like porcelain when tapped. Since the hoof bone was cleaner and denser than the leg bone, we consider hoof bone—as stipulated in the manuscript—to be a better source of bone ash.

We calcined the hoof bone in an electronic ceramic kiln (Paragon Dragon kiln) (fig. 5). We increased the temperature at a rate of 1100°F (593°C) per hour to 400°F (204 °C) then held the temperature at 400°F (204°C) for 30 minutes, after which we increased the temperature at a rate of 1100°F (593°C) per hour to 1500°F (816°C) and held it there for 60 minutes. At around 692 °F (367 °C), much smoke issued from the kiln, changing color from white to black, and then from black to grey and to white. At around 800°F (427°C) a gust of smoke again issued from the kiln, but by 834°F (427°C) the smoke had almost disappeared. This suggests that the organic components in the bone started to burn above 800°F. Upon opening the kiln, we found the bones had become extremely white, with only some grey parts remaining. These white bones were easy to grind in the mortar. When we ground the bone, we found some bones had a black layer inside of them, although their surface was completely white. This suggests that the bone was not completely calcined and still had some organic components. Overall, the ground bone ash felt like fine sand and was a greyish color. For comparison, we also purchased commercial bone ash. This kind of commercial bone ash is calcined using modern industrial methods; it is extremely white and fine and looks and feels like flour.

The physical characteristics of the bone ash that we made in the kiln—fine and powdery—correspond to the author-practitioner's description of the powder of ox bone. The author pointed out that the ash of ox hoof bones is dry and crumbles if you not mixed with fatty sand. On fol. 84v, the author mentions that ox hoof bone is very dry and lean and needs to be "well wet and humidified with a thick broth with elm root." Therefore, we can deduce that the ox hoof bone ash is too dry a substance to bind together by itself.

Rock Salt

Rock salt is the mineral form of sodium chloride (NaCl). It is mined from mountains (major salt mines in Europe include the Saltmine Berchtesgaden in Rheinberg, South Germany), and Biringuccio states that it is "made by Nature in the form of stone."[15] According to Biringuccio, Hungary was an abundant source of rock salt.[16] Although the color of rock salt varies in each mine, the main component, sodium chloride, is the same. Because it was easily available, we chose Himalayan salt from the Khewra Salt Mine in Pakistan for our experiment (fig 6). The chemical composition of Himalayan salt includes 95–96% sodium chloride and iron oxide, which gives the salt a pink color.

What is the Binder?

Folio 89r stands in contrast to other recipes for sandcasting as no liquid binder or magistry[17] is mentioned. Instead the author-practitioner instructs the reader to place the sand made from bone ash and rock salt in a sheet of paper folded in a moist napkin, and then allow the sand to dampen by means of the "moisture of the night" or "the moisture of the cellar." In fol.88v, the author uses a similar method to moisten sand containing rock salt. Here we can see that in recipes that use rock salt as the sand, the author-practitioner advises to moisten it in air or paper to impart moisture instead of directly adding liquid into the sand. Insight as to this technique appears in fol.88v, where the author states that "rock salt, like all other salts, dissolves in dampness." Our experiment sought to replicate the cool moisture of the night and/or cellar using a specially set up humidifier to both imitate and accelerate this process. We enveloped our "sand" in a damp piece of paper, laid it on a glazed ceramic plate, then wrapped it in a piece of linen, wet it with just enough water that it no longer dripped. (Fig. 7 and 8). Then we put the plate on an improvised open grill shelf system so that it could receive the steady stream of cool moist air from a cold vapor humidifier below (fig. 9).

The author did not specify the type of material from which the paper and napkin were made. In the early modern period, cotton was a luxury item from Asia, and household textiles were commonly made from hemp or linen, thus we used a 100% linen cloth for the napkin. Early modern paper was made from rags that contained raw flax and hemp fibers,[18] however current conservation of rare books has shown that "cotton and hemp blends provide us a paper that has the right color and is sympathetic to the original papers."[19] Therefore, we used paper made by the Center for the Book at the

University of Iowa that contained fifty/fifty cotton-linen blend.[20]

The ratio of the rock salt and the bone ash was not mentioned in the recipe on fol. 89r; rather, the author ambiguously advised to mix “all of one with the other.” In the recipe on fol. 88v, the author-practitioner mentioned that he used same quantity of rock salt and sand from a mine to make the molding material. From this, we concluded that his subsequent statement (i.e., to mix “all of one with the other”) might well indicate a mixture of equal proportions. Therefore we used equal quantities of bone ash and rock salt in our experiment.

We allowed the mixture (encased in paper and linen) to absorb the damp air from the humidifier for around one hour.[21] We experimented with two kinds of mixtures: one was a mixture of commercial bone ash and rock salt (“commercial sand”), and the other was a mixture of bone ash that we calcined in the lab and combined with rock salt (“homemade sand”) (fig. 10). The homemade sand turned grey when being moistened and felt like beach sand (fig. 11). It was also quite coarse compared to the commercial sand, which was likely due to incomplete calcination.[22]

We made five different molds in order to test the strength of the sand, the relationship between regrinding and the quality of casting, the separation agent used on the mold and the casting objects, and the proper material for pouring (chart 1). Our experiment showed that both the sands made from commercial sand and from homemade sand bound together well and formed a good impression. When the molds dried, both homemade and commercial sands hardened like cement, creating a solid mold. This result proved that sand made from bone ash and rock salt as described in fol. 89r binds with humidity from the air. The question then becomes which ingredient acts as the binder?

From the foregoing examination of bone ash, we know that the bone ash cannot be the binder since it is too dry and crumbly. And the rock salt? Interestingly, in BnF Ms. Fr. 640, rock salt is used both as sand and as a binder in casting. On fol. 88v, the author-practitioner also mentions sand composed only of pulverized rock salt. In a preceding recipe, fol. 84r, rock salt is employed as an ingredient for the “magistry,” or liquid binder. Indeed, here the author of BnF Ms. Fr. 640 notes that the rock salt solution can provide the sand “with a binding to enable several castings.” Furthermore, just as on fol. 89r, the recipe on fol.88v only mentions the dry components of the sand, i.e., rock salt and sand from a mine, which he then dampens with water. In the manuscript, then, our author-practitioner either used rock salt water as a wet binder, or used dampened rock salt as a sand that binds by itself. We therefore concluded that it is the combination of rock salt and

itself. We therefore concluded that it is the combination of rock salt and water that binds the sand. Without salt, water holds the sand together by its viscosity and H-bonding when the sand is damp. But when the water evaporates, the sand falls apart again into grains, because there is nothing to hold the grains together. But, by adding salt to the sand, as the water evaporates, the salt begins to crystallize. The main content of rock salt, sodium chloride (NaCl), forms hydrohalite ($NaCl \cdot 2H_2O$), possessing an elongated crystal structure, during the crystallization process.[23] The crystallized salt around the grains of sand hold the mold together.[24] And, indeed, our molds made from rock salt and bone ash became very hard and durable when they dried.

Is Regrinding Necessary?

In our experiment, we tested the effect of multiple grindings of the sand. Mold No. 1 with only once-ground sand left a rough surface on the cast, suggesting that regrinding is necessary (fig. 13). Because of the crystals it formed, the binder created by rock salt and moisture forced us to regrind the sand each time to get rid of coarse grains in the sand before using it. By regrinding, we mixed the bone ash and the rock salt more thoroughly. In comparison to the objects cast in Molds No. 2 and No. 6, we found the commercial sand left a sharper and more detailed cast (fig. 14). The feathers and the letters were cast more clearly in Mold No. 6 than in Mold No. 2 (fig. 15). This suggests that the finer the sand, the better and more detailed the resulting cast. Therefore we can say that the regrinding process has at least three effects: first, to mix the bone ash and rock salt well; secondly, to make the sand finer so that the cast will have more details; and third, to break down the clumps in the sand and enable the rock salt to crystalize more evenly.

Following the manuscript, we tried brandy and charcoal powder as separating agents to keep the pattern from adhering to the sand. Brandy had little effect, while, in contrast, charcoal powder was effective in separating the pattern, as well as separating the two halves of the double-sided mold. We then carried out trials in which we poured tin into this mold, and, in order to test the author's statement that this mold "took tin well," we also poured sulfur into the mold. The sand took tin well and molded cleanly, while in the case of sulfur, the sand stuck to the sulfur and could not be removed (fig. 16).

What is Fatty Sand? The Concept of Fat and Lean/Dry

As we have discussed above, it is the rock salt and its exposure to water in the form of mist that created the binding power in the sand. In the

manuscript, the author-practitioner attributes the binding power to "fatty sand:" "The bone of an ox hoof is always dry, that is why you must mix it with fatty sand, so it will bind, like tripoli, salts, felt, ashes and similar materials." In the recipe on fol. 89r examined above, the fatty sand refers to rock salt. Although the rock salt is crumbly when it is dry, when moistened with water, the salt binds together. On fol. 84r, the author mentioned using rock salt as one of the ingredients for magistry, which served as a binder for sand. It seems clear that in these two recipes, moistened rock salt serves as a binder.

The paradigm of fat and lean was used to describe many phenomena of nature in the early modern period. In agriculture, fat and lean were used to describe productive or poor soils respectively; in metalworking, fat and lean were used to describe degrees of fluidity in a metal (how well it "ran"); in casting, Biringuccio believed that lean sand received fatty metal well.[25] According to Pamela H. Smith, this paradigm "appears to have arisen not only in observation by and of farmers, but also from the practices of foundrymen in which it played a central part in the making of molds and crucibles, and in the alloying of metals."[26]

In BnF Ms. Fr. 640, fatty and lean/dry were used to describe the property of sand. In fols. 84r and 89r, fatty means the sand binds to itself and clumps together when moistened with simple water. In other recipes, fatty designates other qualities. For example, on fol. 143r, calcined slate is fatty so it "always retains its bumpiness and swells." Bumpiness here may refer to clumps in calcined slate powder. This suggests that fatty is used to describe materials that always stick together to form clumps. On fol. 69r, the author-practitioner points out that the crumbly sand should be mixed with something fatty that binds, and on fol. 84v he mentions that fat sand "sticks together neatly." On fol. 88v, he claims that fatty sand does not work for casting metal that is too hot. Moreover, on fol. 84v, fatty sand swells up and does not provide a subtle impression.

In contrast, dry or lean means the sand is crumbly and will not bind together well, like bone ash. For example, fol. 69r mentions that lean and arid sand does not bind at all, however, in fol. 84r, the author indicates that although lean sand is crumbly, it takes fat metal well. All told, the manuscript offers several ways to improve the lean/dry sand in various recipes. One way is to moisten the dry sand with magistry or good pure wine, where the dry sand needs more liquid binder than other sand (fol.69). Another way is to mix dry sand with fat sand and moisten them with water (fol.84v, fol.89r). Therefore, it seems that the moistened "fat" sand may be similar to magistry in terms of its binding action. Indeed, if we parse the contents of magistry, we can

find that many of its ingredients are common to fatty sand. For example, in fol. 89v, the author understood sal ammoniac (ammonium chloride) as fatty; in fol.118v, the author used sal ammoniac water as a binder. The rock salt recipe on fol. 89r is also used as binder as well as fatty sand. Indeed, we find in the manuscript that many types of salts fall into the category of fatty, such as sal ammoniac, rock salt, saltpeter, and sandever.[27] Interestingly, in the manuscript we can find many of these salts also belong to the ingredients of magistry. Therefore it appears that the choice of binder is related to the fattiness of the salts. Therefore we may deduce that the salt used for creating liquid binders may all belong to the category of "fatty."

The designations "lean" or "dry" and "fat" in sandcasting might be related to ways of "rectifying" soil through fertilization. For example, on fol. 69r, the author notes that "you will also find sand in lean soils...much better than those from fat and strong soils." As we have discussed above, lean sand is better than fatty sand in casting as long as it is moistened with binder, so we may assume that dry/lean soil produces dry/lean sand, while fat soil produced fat sand. While Aristotelian categories inform Biringuccio's definition of salt as of a hot and dry nature, the fattiness of rock salt and ammonia salt as defined in the manuscript is based in some other paradigm, which bears further investigation.[28] It seems clear, however, that the binary pair of fat and lean was employed by early modern metal workers both as an explanatory "theory," as well as a means by which metalworkers could make choices about the kinds of sands, binders, and metals they selected, and the manner in which they expected them to interact.

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Yijun Wang, with Pamela H. Smith

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1 Biringuccio, *The Pirotechnia of Vannoccio Biringuccio*, translated and edited by Cyril Stanley Smith and Martha Teach Gnudi, New York: Dover Publications, 1990, 324.

2 Biringuccio, *Pirotechnia*, 324.

3 Biringuccio, *Pirotechnia*, 137.

4 Cennino d'Adrea Cennini, *The Craftsman's Handbook*, 5.

5 Biringuccio, *Pirotechnia*, 137.

6 Ox means castrated male kept for draft purposes. Male oxen usually have denser bones than females, and the draft labor might make the bone even denser. It seems that denser bones were preferred by early modern craftsman for the production of bone ash.

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15 Biringuccio, *Pirotechnia*, 107.

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17 For the definition of magistry, see annotation on "p084r magistry."

18 http://paper.lib.uiowa.edu/european.php.

19 Tim Barrett, email to Diana Mellon on 11/11/14.

20 Our special thanks go to Professor Timothy Barrett, who offered great help to us in understanding early modern paper production. He also provided the paper used in this experiment.

21 This is an estimated time. After about one hour, water began to drip from the mixture. But in order to keep the moist, we kept the humidifier on. We did not observe further change after the bone ash was moistened.

22 Unfortunately we did photograph the dry rock salt and bone ash mixture for comparison.

23 See http://rruff.info/doclib/hom/hydrohalite.pdf, also http://www.mindat.org/min-1975.html. Our thanks go to Sonia Xin Gai, MSc, Stanford University for providing information about the crystallization process of salt.

24 Our thanks go to Prof. Lawrence Principe from Johns Hopkins University who helped us understand the reason why salt can bind the sand together.

25 Biringuccio, *Pirotechnia*, 324.

26 Pamela Smith, "The matter of ideas in the working of metals in early modern Europe," *The Matter of Art: Materials, Practices, Cultural Logics, c. 1250-1750,* Christy Anderson, Anne Dunlop, Pamela H. Smith, eds., Manchester University Press, 2014, 64.

27 See annotation on fol. 84r for Eau magistra.

28 Biringuccio, *Pirotechnia*, 108

Original Patterns

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DRAFT Annotation Concerning Original Patterns

Rozemarijn Landsman & Jonah Rowen

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Despite the great quantity of detail and breadth of topics relating to metalworking in BnF Ms. Fr. 640, most of the manuscript's instructions for casting are for processes involving the prior existence of an object to be cast, usually medals, animals, or plants. While the focus on practical advice given in the manuscript may suggest that it was written in the context of a

given in the manuscript may suggest that it was written in the context of a practicing artisan's workshop practitioner, the metalworking descriptions most often involve replication, and very rarely address the making of an original object. For casting medals in particular, reproducibility or serial production seems to have been an important part of the process,[1] but in the manuscript, whether the "original" was used for direct or indirect casting,[2] the actual procedure for making that first model is left mostly unmentioned. This entry investigates the few instances of textual sources from the manuscript for making patterns other than preexisting medals or casts from life. Among the questions that this annotation seeks to address are: what materials were used to make these patterns and what are the processes used for fabricating them? Were they carved, drawn, or modeled? How and with what tools? Our research into instructions for patterns in BnF Ms. Fr. 640 also attempts to gain insight into the identity of the author-practitioner.[3] That is, we ask what the lack of instructions about how to make patterns for casting allows us to conclude about the author's occupation or his areas of expertise. Were the techniques of carving or creating models so widely known that the author assumed readers would be familiar with those skills? Or were divisions of labor at work, in which case the artisan who made an original pattern would have practiced a different trade than the person who reproduced objects? What position would the author of BnF Ms. Fr. 640 have held within such a system of divided labor and divided knowledge?

Related Recipes from BnF Ms. Fr. 640

The recipe "Wax for seals and impressions" [*Cire a cachet et emprainсte*] on fol. 42r includes directions for making wax that is soft enough to take impressions, proposing that one is to keep wax in tepid water and knead [*pestrie*] it. He writes, "you can stamp [*empraindras*] whatever you want." Since this recipe is about making seals, the wax itself will not be cast but instead will only take an impression, so this is not quite a description of how to make a pattern for casting. However, the recipe also suggests carving: "You can carve figures [*tailler les figures*] and color them in gold, in silver, or paint them with *couleurs à vernis*…."[4] For *tailler*, Randle Cotgrave provides a contemporary definition, "*Tailler*: to cut, slit, slice, hew, hack, slash, gash; nicke, snip, notch, indent; carve, [en]grave; also, to gueld, or spey; also to tax, impose taxes on, levie tributes of."[5] The term is related to *intaglio* processes, which Benvenuto Cellini alludes to in passages on engraving.[6] Fol. 42r is the only recipe that we have been able to identify that uses the word *tailler* in the sense of carving a model; it seems more often used in the context of cut stone or other types of cutting.[7]

Although carving is not much discussed in the manuscript, "sketching" or

"(roughly) modeling" forms for other fabrication processes is. Under the heading "Adorning beds, mirrors and similar things" [*Pour orner des licts mirouers & semblabes*], a passage on fol. 131r reads, "Model any drawing in half relief on a flat slate [*Esbauche sur une ardoise bien unye quelque desseing a demy relief*] in order to set it on round or flat things. Cast with very fine tin, then you can gild it…." As a definition for the verb *esbaucher* Cotgrave writes, "To rough-hew; grossely to frame, forme, square, or cut out of the whole peece; to begin rudely, any peece of work; also, to pruine a tree; and, in painting, to tricke."[8]

On fol. 139v the recipe "Casting wax to mold an animal that one has not got" [*Gect en cire pour representer l'animal qu'on n'a point*] describes a procedure for making a stiff wax, sometimes called *esbaucher* wax. The title of the recipe appears promising for our research, since if "one has not got" the animal that one wishes to cast, then one's recourse would be to carve a model of it. But the focus of the recipe is on the production of a material that is "firm" [*ferme*], rather than on a discussion of the actual process of modeling or working with that material. Nonetheless, the author does make certain recommendations about casting that have to do with an ability to check one's work, such as adding charcoal "to give some color to your wax, that would otherwise be transparent and you will not be able to see your lines as clearly" [*donne couleur de corps à la cire qui aultrement seroit transparente & ne se verroit pas si bien le traict*]. The note to the left of this recipe also begins, "This black sulfured wax is for modeling round figures that do not come out of the mold" [*Ceste cire noire soufrée est pour esbaucher des figures rondes, qui ne sont poinct en despouille*]. The word *esbaucher*, which is also used on fol. 131r (discussed above), suggests a technique of fabrication that goes beyond replication.

The word *esbaucher* appears again on fol. 124v, under the heading "Casting gold," to refer to molds that have "taken much modeling" [*couste beaucoup a esbaucher*] to produce.[9] Similarly, fol. 109r contains a recipe titled "Modeling in wax" [*Esbaucher en cire*], which is about making hard wax "more malleable" or workable [*plus amiable*]. While none of these recipes explicitly uses the verb *tailler* again or describes the process of modeling in wax once it has been made workable, one might safely conclude that the reason for making wax malleable is to work it into a pattern for casting.

Another interesting passage to look at in regard to the topic of this annotation is a brief description of a procedure in the recipe entitled "Quickly molding and reducing a relief to a hollow [mold]" [*Mouler prompteme{n}t et reduire un cave en relief*] on fol. 156r. It begins with the instruction: "Make an impression in colored wax of the relief of your medal"

[*Tu peulx empraindre de cire coloree le relief d'une medaille*].[10] Again, the author already has a pattern (the medal) as his starting point. Interestingly, *empraindre* is also used in the recipe on fol. 42r, which we also discussed in relation to *tailler*. In that instance the author describes the preferred type of wax and a method for making such a negative imprint of a metal relief in the wax. On fol. 156r, this step is not explicitly explained but is either assumed as common knowledge or, perhaps, as sufficiently described earlier in the manuscript. That the recipe on fol. 42r further on suggests to carve [*tailler*] this wax impression may indicate alterations to the design being made, or flaws in the imprint being corrected.

"Molding," on fol. 50r, is similar to the recipes above in that it does not exactly discuss producing *original* patterns, so much as it explains how to translate an impression of an existing object onto paper for subsequent casting:

If you want to quickly mold in demi-relief [*demy relief*] anything you come upon, fold some paper five or six times over, and place it on the medal [*le poses sur la medaille*] and make sure the paper is folded around the edges of the medal so it is very secure. Next take a stick... and rub firmly on the paper, and retrace the lines with the point of the stick until you reckon that your impression is well done. Then... rub oil onto the paper [imprint] lightly with a brush, and cast some tallow or wax or sulfur into it. And the paper, without burning, will give you a neat design that you can then mold in plaster or tripoli and then in lead and other metals. [*Puys... frotte legerement d'huile avecq un pinceau l'empraincte du papier et gectes y suif ou cire ou soufre, & le papier, sans se brusler, te rendra ton pourtraict nect, que tu pourras aprés mouler en plastre ou tripoly, et puys en plomb & aultre metal.*]

Here the author, as on fol. 42r, describes a process of lifting an impression from a medal that already exists, including careful registration of the paper on the pattern ("so it is very secure"). Even more significantly, this recipe also provides the procedure—albeit in an abbreviated manner—for moving from a model impressed into paper used as a negative mold for a casting material (tallow, wax, or sulfur) that is poured into the paper as a positive, and then used to form a negative mold in plaster or tripoli, which results finally in a positive "in lead [or] other metals." The terse last two sentences of this recipe provide as clear a set of step-by-step instructions for casting from a model as almost any other recipe in the manuscript.[11] Furthermore, one can imagine that these steps would be applicable even without a medal used as a pattern, a peculiarity that prompts the series of questions raised in the introduction to this annotation.

The recipe "Copying off patterns" on fol. 51r similarly presumes an existing

The recipe "copying on patterns" on fol. 51r similarly presumes an existing model, but it also provides further insight into what might have constituted an original pattern, describing a similar method of rubbing paper. In this case, the paper takes the impression from an engraved stone [*la piece de taille doulce*] (note again the use of the word *tailler*), which resonates with one interpretation of a passage from Cellini's *Autobiography* that describes how he cuts a pattern: "During this man's illness the Duke sent for me, and bade me take his portrait; this I did upon [*innun*] a circular piece of black stone about the size of a little trencher."[12] The aspect of Cellini's account that requires interpretation, however, is whether the meaning of the conjunction *innun* is closer to "in" or to "on"; that is, whether the pattern that Cellini made was done *in* the black stone, as fol. 51r seems to suggest; or it was done *on* the black stone, as a working surface used to make a wax model for a seal [Fig. 1: John Flaxman, Jr. (attributed), *The Virtue Prudentia*, c. 1800 (Philadelphia Museum of Art, Accession Number 1944-63-11)].[13]

Related Recipes from Other Sources

Based on our research, BnF Ms. Fr. 640 does not appear to contain detailed information about creating original patterns, and what it does provide addresses the topic only glancingly. Whether this is because the author presumed that he did not need to provide instructions for this aspect of fabrication, or because those instructions would fall outside of the scope of either this manuscript or the author's expertise, is a question into which we hoped to gain insight. While we have found few overt descriptions of a procedure for creating a model in BnF Ms. Fr. 640, some contemporary authors' books of recipes are slightly less scant in providing information about this first step in the making process.

The most colorful and most informative of contemporary sources that sheds light on the question of original patterns is Cellini's *Treatises*. Cellini writes about a number of materials, and provides instructions for making patterns in several of them, including steel (for numismatic dies), black wax,[14] and white wax, in relation to which he describes the process of sand casting, as well as carving directly into silver.[15] Cellini advises softening steel for engraving under fire and by leaving it overnight covered in "a concoction made of earth, powdered glass, soot from the chimney, and bole of Armenia [with] a little horse-dung [and formed into] a paste with man's urine."[16] Into this steel, and using hard steel tools, one can engrave the ends of two tools, one for each side of the coin, using compasses to draw and measure the circumferential size of the coin.[17] Regarding patterns in white wax, Cellini writes,

The first thing to be done is to make a model in white wax of the head, the

reverse, and whatever there may be, to the exact size and relief of the final work, for we know this was how the ancients did it.

The white model in wax is made as follows: Take a little pure white wax, add it to half the quantity of well-ground white lead, & a little very clear turps.... [A negative] is made in the gesso just as the cardinals' seals were, of which I erewhile told you.[18] Then you take what are called the *taselli* [tools similar to those described above for steel dies].... After you have softened them [the *taselli*] in the fire in the same way as I showed you above with the coins, you smooth and polish them very carefully with soft stones and mark out the size of your medal, the beading, the place for the inscription & so forth, with just such immovable compasses as you used before.[19]

The description of making a model in white wax given here is unsurprising, but the fact that Cellini includes this step in his narrative of the process differentiates his text from BnF Ms. Fr. 640. The other peculiarity in this passage from Cellini, which is titled "About Medals," includes instructions for how to make tools, the *taselli*, evidently for reproducing the medals but also used for the fabrication of monetary coins, which prompts questions as to whether the distinction between coins [*monete*] and medals [*medaglie*] is mostly a functional one. He also recommends that "you will do well to make wax impressions from time to time, while you are cutting, to see how you are getting on," as he suggests in tin with steel dies, a statement that provides useful insight into the reasons for casting in materials other than metals.[20]

Vannoccio Biringuccio's comments on reproducing medals also provide information about workshop practices that go unmentioned in BnF Ms. Fr. 640 and Cellini's *Treatises*. In explaining the processes of sand casting, Biringuccio writes, "It [the sand and magistry discussed in the preceding text] also served me very well in that one, two, three, or four casts were made without having to mould it again, if the relief that was moulded was not very great."[21] Two significant implications are evident from this sentence: first, that in processes of sand casting, the same mold was indeed intended to produce several identical casts; and second, that for medals, the number of times a mold could be used was apparently related to the depth of its relief.

The pseudonymous Alessio Piemontese's recipe "To imprint medalles in hoste [haste?] with Dragagant," after explaining how to make a paste that would harden and could be used for casting, concludes with the suggestion, "And of this paste you maie make also other workes as you will, as Beades, stones, or other."[22] This suggests similar questions to those raised by BnF Ms. Fr. 640 on fol. 50r above, namely why, if the author suggests that other objects besides already-existing medals can be cast using this method, he

objects besides already-existing medals can be cast using this method, he chose not to expand his directions for making medals to carving one's own pattern and describing that technique.

What little information BnF Ms. Fr. 640 does provide on this subject, however, adds to the documented research on the patterns that may have been used for casting medals. John R. Spencer follows George F. Hill, who wrote a series of articles on early modern medals from 1907 to the mid-1920s, in assuming that medals of the Italian Renaissance were cast from wax.[23] Patricia Tuttle acknowledges that sulfur may have been used in the casting process, but suggests that its use was as a material for making negative molds rather than for the positive form of a pattern.[24] The addition of sulfur, especially, to the materials used for casting implies that a different set of tools for melting (since wax can be cast into sulfur but not vice versa) and almost certainly a different set of materials for molds might have been used. The melting point of beeswax, 144°F, is much lower than that of sulfur, at approximately 240°F (that of tallow is much lower, at around 113°F), which would make a sulfur mold suitable to use with molten wax or tallow. That pure wax was used as a pattern, and especially that medals were created using a lost-wax casting technique, appears to be an outdated conception of the process of making medals.[25]

Instead, scholarly opinion has shifted toward an understanding that sand-casting was the primary method of fabrication. Partly because of the pressure necessary for impressing a pattern into sand, and the relative melting points and temperatures achieved during the steps of the casting process, a workable material harder than wax would have been ideal. On this point, Biringuccio gives plaster as an example: "It is also customary to make a plaster capable of being worked easily by hand in making medallion portraits... in bas-relief so that they can be moulded for making them in bronze if you wish." He also gives several alternatives to plaster, including: white wax mixed with white lead and tallow; plasters with gums, wax, "Greek pitch or ship's tar"; soap; "sulphur and brick dust, or two parts of Grecian pitch and one of wax.[26] That all of these are viable materials for making a pattern that could produce, as Biringuccio describes, "multiple casts without having to mold it again" suggests that the scholarly assumption that medals began as carved wax models renders an incomplete image of not only the variety of substances marshaled toward the ends of fabrication, but also of the ingenuity of the fabricators.

Conclusion

In general, explanations of how to make patterns for casting are largely absent from BnF Ms. Fr. 640. How to interpret that conspicuous omission,

however, is not a readily answerable question. This is particularly important since the author does seem to presume a fair amount of implicit knowledge on the part of the reader, signaled by phrases such as “as you know” or “you know how to….” even when there are no recipes in the previous folios describing these processes.[27] The author of the manuscript may have simply not included instructions for fabricating a pattern because he assumed that that part of the making process was unnecessary to describe, since any artist could go about it in whichever way he or she chose. Furthermore, the recipes collected in BnF Ms. Fr. 640 mostly describe standardized procedures that can be replicated with some precision. The action of carving into materials is a particular learned skill that also depends on individual creativity, which the manuscript’s author may have realized falls outside of the scope of the type of knowledge that he aimed to, or that could be, transmitted in text.[28]

Finally, we return to the questions posed in the introduction to this annotation. The most challenging of these is the identity of the author of the manuscript. These notes will not attempt to solve this mystery. From the evidence gathered here, we can propose that the author’s focus was on *reproducing* medals and other objects, and not on how to create entirely new objects to be cast. We have been able to shed little light on the trade practiced by the author. In this context, however, it is instructive to compare other late sixteenth- and early seventeenth-century individuals whom we know produced, wrote about, or collected medals (or possessed knowledge about them). On one end of such a spectrum lies the practical knowledge of an artisan, such as a founder or, slightly removed, a goldsmith like Cellini, while on the other end we might place the more or less learned approach of the savant or *amateur*, for instance, a compiler of “secrets” or “recipes,” or, further still, a more “passive” collector and contemplator of medals.

The author’s interest in and detailed descriptions of many things in fields other than casting and metalworking indicates wide-ranging interests, but the manuscript entries about moldmaking and metalworking may still provide important clues. His interest in and description of all parts of the casting process that deal with making molds suggests that he was not merely a founder. We know that Cellini was a practitioner who related his practical experience through texts and could point to products of his craft. Yet we may also look to Hugh Plat as a counterexample, a compiler of instructions for various procedures in which he did not necessarily have any expertise himself.[29]

Another interesting example to consider is the Dutch polymath and nobleman Constantijn Huygens, who is known to not only have collected

medals, but to also have (re)produced them around 1628.[30] While Huygens' education and level in society remove him further from artisans than the socially less elite Hugh Plat, his hands-on experience blurs such divisions. As A.R.E de Heer notes, the benefit of Huygens' medal-making adventures, according to his autobiography, was threefold: first, it demonstrated his talent, and, as such, was cause for praise and respect among his peers; second, he demonstrated that he was skilled enough that, if ever necessary, he could earn a living through manual labor; and, third, his practical understanding and knowledge of medals provided the foundation for proper judgment of such objects.[31]

Significantly, Huygens possessed a brief handwritten treatise concerning metal casting containing a similar structure and style of written recipes to BnF Ms. Fr. 640 which explains the various processes of molding and casting medals.[32] In a letter dated 1629 from Huygens' friend Johan Brosterhuijsen, this treatise is mentioned as a gift to Huygens, describing it as "the art of casting; it is a handwritten book, drawn from the memories of a great founder…." [*… l'art de getter; c'est un livret escrit à la main, tiré des memoires d'un grand fondeur …*][33] In the same letter Brosterhuijsen recommends Huygens to learn the art of "casting herbs, etc. and gilding without gold" [*mouler sur des herbes, etc. et de dorer sans or*] from the "bag of secrets" [*son sac de secrets*] of the goldsmith Adriaen Rottermont – who does indeed appear to have been Huygens' instructor.[34]

Huygens, then, poses an interesting example of a learned man who not only practiced the art of casting medals himself, but also collected recipes of such (as well as many other) processes. A closer look at his "recipe books" is necessary, but it seems safe to assume that Huygens did not write these recipe books himself, nor did he comment upon them. Within the spectrum mentioned above, however, the author of BnF Ms. Fr. 640 appears to have been closer to the practitioner's side than Huygens, while closer to the learned scholar's end than Cellini.

Although this annotation cannot provide a definitive answer as to whether BnF Ms. Fr. 640 was written by an author who considered himself an artisan, or if in fact it is a collection gathered from disparate sources, our findings therefore place him somewhere in between. The designation as "author-practitioner" seems appropriate, since he did have the skills, time, and interest to write this broad and intriguing manuscript, while also experimenting, or practicing, with his own recipes, as is evident from his notes and illustrations in the margins.[35] Concerning medal casting, further research into founders' and artists' practices might indicate whether the tools and workshops that reproduced cast objects were the same ones that produced patterns and, thus, what the significance of the omission of

produced patterns and, thus, what the significance of the omission of certain types of knowledge in this manuscript might mean. Where do practical or experienced knowledge and theoretical or learned knowledge intersect? A deeper understanding of the various communities in society interested in, experimenting with, and writing about such practical knowledge would be constitute a valuable addition to this research. Questions regarding the frequency that the acquisition of practical skill in the arts was a part of the higher classes' education, as seen in Huygens, could shed more light onto the background and milieu of the author of BnF Ms. Fr. 640.

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1 Glenn Wharton begins his article on a technique for determining the facture of Renaissance medals (whether they were cast or struck) with the remark, “The Art of Medals is an art of multiples. From their origin in 1438 by Pisanello, Renaissance medals were usually produced in series, either cast in molds or struck from dies.” Arthur Beale writes, “there is ample documentation by Renaissance authors that using models, themselves made of metal, was an accepted procedure during that period.” The significant terms used for reproductions are the French *surmoulage* or “after-cast” in English. (These are not terms used by the author of the manuscript, only more recent authors.) See also Wharton, “Technical Examination of Renaissance Medals: The Use of Laue Back Reflection X-Ray Diffraction to Identify Electroformed Reproductions,” *The Journal of the American Institute for Conservation* 23, No. 2 (Spring 1984): 88. Beale, “Surface Characteristics of Renaissance Medals and Their Interpretation,” *Studies in the History of Art* 21, “Symposium Papers VIII: Italian Medals” (1987): 28. See also J. Graham Pollard, “The Italian Renaissance Medal: Collecting and Connoisseurship,” *Studies in the History of Art* 21, 161-169.

2 The distinction between these terms is made in, for instance, Francesca G. Bewer, “The Sculpture of Adriaen de Vries: A Technical Study,” *Studies in the History of Art* 62, “Symposium Papers XXXIX: Small Bronzes in the Renaissance” (2001): 158-193.

3 We follow Professor Pamela H. Smith and Tonny Beentjes in referring to the author of BnF Ms. Fr. 640 using singular masculine pronouns. See Smith and Beentjes, “Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques,” *Renaissance Quarterly* 63 (2010): 128-179.

4 Whether “carving” here refers to the stamp or the wax is ambiguous; most likely, it is the wax that the author suggests carving.

5 Randle Cotgrave, “*Tailler*,” in *A Dictionarie of the French and English Tongues* (1611) http://www.pbm.com/~lindahl/cotgrave/895.html.

6 Cf. fol. 39v, “Tracing a story on glass,” and “Chapter I. On the Art of Niello,” “Chapter III. Concerning the Art of Enamelling,” and maybe most relevantly here, “Chapter XIV. How to Make Steel Dies for Stamping Coins” in Cellini, *The Treatises of Benvenuto Cellini on Goldsmithing and Sculpture*, trans. C.R. Ashbee (Whitefish, MT: Kessinger Publishing, 2006), 7-9, 15-19, 67-74.

7 See, for instance, fol. 37v, “Yellow Amber,” and fol. 38r, “Sapphire” and “Amber.”

8 Cotgrave, “*Esbaucher*,” http://www.pbm.com/~lindahl/cotgrave/381.html. The close conceptual relation between *esbaucher* and *tailler* may be further indicated by the words’ connotations with vegetal pruning, as can be found in the instructions for “Grafting” on fol. 91r, which uses the word “cutting” [*tailler*] for branches.

9 *Esbaucher* is used in various other circumstances with similar connotations to “modeling.” See, for instance, fol. 109r, “Modeling in wax”; fol. 133r, “Casting the feet of small lizards in gold and silver”; fol. 138v, under “Imitation diamonds put into the work,” and fol. 157v, “Molding a bird.”

10 Incidentally, further down on fol. 156r (in the recipe “Chiseling”) the author provides directions for chasing, which in BnF Ms. Fr. 640 is another important but rarely addressed (in BnF Ms. Fr. 640) step in the process of metalworking.

11 Other recipes in BnF Ms. Fr. 640 that describe the molding process as such a series of positive and negative impressions in different materials are found on fol. 153r “Molding hollow seals or other things,” fol. 156r “Quickly molding and reducing a relief to a hollow [mold],” and fol. 169v “How to reduce a round form into a hollow.”

12 *In questo mezzo che lui stava ammalato, mi chiamò il ditto Duca a volse che io lo ritraessi, la qual cosa io feci innun tondo di pietra nera, grande quanto un taglieretto da tavola.* Benvenuto Cellini, *The Autobiography of Benvenuto Cellini*, trans. John Addington Symonds (New York: P.F. Collier and Sons Company, 1910), Part II, Section VI; available online at http://www.gutenberg.org/dirs/etext03/7clln10h.htm. Italian from http://www.letteraturaitaliana.net/pdf/Volume_5/t115.pdf, p. 284.

13 G.F. Hill writes that “The black stone about the size of a trencher was of course a disc of slate, or something similar, such as we know was used by wax modellers for a modelling board,” but he indicates only that Cellini used

this slate to carve into and does not acknowledge that in this case, the stone could have been used as a working surface for wax as well. In his *Treatises*, Cellini uses similar vocabulary: "The seals are made in the following manner. You take a smooth and polished black stone, and draw thereon the design you want to appear on the seal; and with black wax, a bit hardened, you fashion whatever relief you wish to impress." Cellini, *The Treatises*, 61. See Hill, "Notes on Italian Medals—X: Some Medals by Benvenuto Cellini," *The Burlington Magazine for Connoisseurs* 18, No. 91 (October 1910), 14.

14 See n.12. Cellini does not specify how to make "black wax," but he uses the term again on p. 65 ("To see better how you are getting on, you may occasionally press in a little black wax, or whatever colour pleases you better, to gauge the projections") and in an apparently unrelated way in "Chapter V. How to Set a Ruby," on p. 24. See also BnF Ms. Fr. 640 fol. 139v, "Casting Wax to mold an animal that one has not got," cited above, which includes a definition of black wax containing charcoal.

15 "Some artists have gone straight to work at their seals with merely cutting directly into their silver, and without casting at all, but pluckily doing their design straight on in the reverse with genuine knowledge of their art, and using the steel dies of which I told you, and they succeeded in it, too. I also have done this, but I have found the casting method more practicable; though both are good, and can lead to excellent results." Cellini, *The Treatises*, 66.

16 Cellini, "Chapter XIV. How to Make Steel Dies for Stamping Coins," *The Treatises*, 68.

17 Cellini, *The Treatises*, 69. He also advises intermittently pouring tin into the dies to check the quality of the coins.

18 For seals, this "volterrano gesso" is cast onto a black wax model, as described in n.12. The gesso "matrix" is then cleaned with a knife and impressed into sand-casting flasks. Because the seal is a negative for pressing into wax, the cast metal is a reverse (mirror) image, and therefore can be directly cast in sand from the gesso. Positive versions of these exist in lead, and some are illustrated in Ashbee's English translation of *The Treatises*. See *The Treatises*, 61-63, especially the note under the † symbol, p. 63. The illustrations are between pp. 66 and 67.

19 Cellini, "Chapter XV. About Medals," *The Treatises*, 72. This passage continues: "After this you begin to work with your chisels ever so carefully,

cutting away the steel in order to round off the form of the head in just such manner as you have it in your gesso model."

20 Cellini, *The Treatises*, 73-74. Cellini continues to a reiterate how these medals are cast and then chased from a first metal cast: "You do it in the usual way, taking the impression of it in caster's sand—you remember we spoke about it before—the same that all founders use for the trappings of horses, mules, and brass work generally. From this pattern medal you make your final casting which you carefully clean up, removing the rough edges with a file, and after that polishing off all the file marks." *The Treatises*, 75.

21 Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), 325.

22 In its entirety the text of the recipe reads, "Take five ounces of Dragagant, and steepe it in strong Vineger the space of three daies. Then stampe or beat it well, and ingrosse [?] it into a bodie or substance with plaister grounde very small, and if you will make them of other colours, put into it what pouder you will, be it white, or [illegible], so that the paste maie be somewhat hard, and all well incorporated together. Then take your hollowe formes or moulds, and annointe them a little, and fill them with the saied paste, and presse it well doune, and lette it drie in the Sunne, and you shall have the print of your moulde neate and fine. And of this paste you maie make also other workes as you will, as Beades, stones, or other." The following two recipes on the same page spread, "To make paste meete and good to make all manner of medalles, or pictures in moulde," and "To make medals and figures chaced and embossed with fishe glue," are also related. Girolamo Ruscelli, *The seconde part of the Secretes of Maister Alexis of Piemont: by hym collected out of diuerse excellent authors, and nevvly translated out of Frenche into Englishe. With a generall table of all matters contained in the saied booke*, trans. William Warde (1580), 31.

23 "In general, the letters are very sharp and only the C in the SC of the Nero reverse reveals the wax from which it was modeled." John R. Spencer, "Filarete, the Medallist of the Roman Emperors," *The Art Bulletin* 61, No. 4 (December 1979): 558. For Hill's short essays, see "Some Italian Medals in the British Museum," *The Burlington Magazine for Connoisseurs* 10, No. 48 (March 1907): 384-385, 387, to "Notes on Italian Medals—XXVII," *The Burlington Magazine for Connoisseurs* 42, No. 238 (January 1923): 38, 42-44, 47. While these articles have apparently been influential for those studying medals, they also evidently contain much misleading information, as many of the authors cited here have noted, including Spencer.

24 “Some [cast medals] seem to have been slushed into a mold, while in others the wax must have been in a semi-hard state in which it could be pressed into a mold, with bits and pieces added as reinforcement. Others must have had wax pressed into a mold using a piece of cloth, possibly as a separator, which left behind its fabric pattern in the metal surface. These molds were probably made of plaster, reinforced plaster, or sulfur, as the sand molds discussed above would be too delicate to withstand the pressure of pressing semi-hard wax against their surface.” Patricia Tuttle, “An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals,” *Studies in the History of Art* 21, “Symposium Papers VIII: Italian Medals” (1987): 211.

25 Lisha Deming Glinsman, “Renaissance Portrait Medals by Matteo de’ Pasti: A Study of Their Casting Materials,” *Studies in the History of Art* 57, “Monograph Series II: Conservation Research 1996/1997 (1997): 94-95. Cellini’s technique for making Cardinals’ seals on p. 64 of the *Treatises* does describe a lost wax process, but those objects are distinct from what would technically be described as medals (with notable differences in size and shape, but, perhaps most importantly, in that they are supposed to be unique).

26 Biringuccio, “The Methods for Moulding Various Kinds of Reliefs,” *The Pirotechnia*, 331.

27 See, for example, fol. 10r, “Imitation Jasper,” fol. 97v, “Mastic varnish dried in twelve hours,” and fol. 156r, “Quickly molding and reducing a relief to a hollow [mold].” The last, on bread molding, includes the sentence, “But to make this process go faster, if you are in a hurry, make the first impression and the first hollow out of the inside portion of the bread loaf, prepared as you know, and which will cast neatly.” In the bread molding experiments we undertook, this phrase “prepared as you know” was an issue, since we did *not* know how to prepare bread according to the standards of the author.

28 In comparison with Cellini, who overtly took as his task the mission of writing a didactic treatise (as well, of course, as proclaiming his skill), the author of BnF Ms. Fr. 640 was far less particular in his uses of proper names and he seems to be more casual in assuming that his reader already understood some aspects of the recipes that he presented. (Cellini’s didacticism is evident when he exclaims, on p. 19, “How careful you have to be with this cannot be told in words alone—you’ll have to learn that by experience!”) These two qualities may be linked to one another, if one reads Cellini through the lens of a teacher trying to impart specific information

about particular circumstances, as opposed to the text of BnF Ms. Fr. 640, which, from our research, can be characterized as providing instructions that do not rely on particular cases of their implementation. Although the manuscript at times does refer to specific places and situations, Cellini's anecdotes read as concrete proof of the validity of his directions and his successes, particularly in references to the Pope or Cardinals. (On a slightly different period and geographic region, but nonetheless relatedly, Francisco Alonso-Almeida writes, "the expression of efficacy and evaluation is gained by providing evidence of sources, such as mentioning authorities...." Alonso-Almeida, "Genre Conventions in English Recipes, 1600-1800," in *Reading and Writing Recipe Books, 1550-1800*, ed. Michelle DiMeo and Sara Pennell (Manchester: Manchester University Press, 2013), 74. Those references have the double function, however, of situating those recipes in their particularities, whereas those in BnF Ms. Fr. 640 may, on the whole, be described as less prescriptive.

29 See Deborah Harkness, "From the Jewel House to Salomon's House: Hugh Plat, Francis Bacon, and the Social Foundations of the Scientific Revolution," *The Jewel House: Elizabethan London and the Scientific Revolution* (New Haven: Yale University Press, 2007), 211-253.

30 According to his autobiography, Huygens occupied himself with medal making around 1628-1629, when he started with producing aftercasts of bronze and lead medals before moving on to making his own originals: "When I, finally, had enough of working with someone else's work, I moved on to make my own originals" [*Toen ik tenslotte genoeg gekregen had van dat ezig zijn met het werk van een ander, was ik ertoe overgegaan zelf originelen te maken*]; cited from A.R.E. de Heer, e genoeg gekregen had van dat ezig zijn me, "Constantijn Huygens en de Penningkunst," *Jaarboek voor munt- en penningkunde* 80 (1993): 271-288.

31 De Heer, "Constantijn Huygens en de Penningkunst," 275-276. The third point seems particularly relevant, since we experienced for ourselves in our laboratory experiences how much our understanding and appreciation of medals has been affected by hands-on knowledge about the process of making.

32 This treatise was bound together by Huygens with other treatises (one of which is a note regarding the preparation of wax, treatment of silver and gold, and the making of medals by the goldsmith Adriaen Rottermont). This collection was titled "Musica, medica, phijsica, chijmica, odofera, perfumatoria, fusoria, coquinaria, philosophiaca, mathematica, artificialia. Constantini Hugenii, Ars formandorum et poliendorum votorum ad usum

astronomicum" and is nowadays kept in the Royal Dutch Library (KB) in The Hague, inv.nr. KA XLVII. The manuscript concerning metalworking begins at fol. 220ff, see De Heer, "Constantijn Huygens en de penningkunst," 280, which also contains a transcription on pp. 282-288. The entire bound book would be interesting to compare to BnF Ms. Fr. 640, since the versatility of subjects touched upon may relate to that similar aspect of the manuscript. Moreover, it would be interesting to investigate what Rottermont's notes exactly looked like (found on fol. 185ff) in order to ask questions about whether he wrote them himself and what his focus, as a goldsmith, was in these recipes. The manuscript sent by Brosterhuijsen was apparently "drawn from the memories of a founder," which could also make for an interesting comparison with BnF Ms. Fr. 640.

33 Brosterhuijsen mentions that this treatise will be "communicated" to Huygens via Mr. Dedel "l'advocat" [... *en recompense je vous communiqueray, ou il vous sera communiqué de ma part par Mr Dedel, l'advocat* ...]. It is not entirely clear at this point who the author of this treatise is, or, in other words, what the role of this Mr. (Willem) Dedel was. Perhaps he transcribed treatises in the possession of Brosterhuijsen. De Heer mentions two more such treatises, sent by Mr. Dedel in Huygens' binding, one of them concerning life casting (fol. 227ff), the other for about making plaster to cast with (fol. 228ff): see De Heer, "Constantijn Huygens en de penningkunst," 280-281.

34 De Heer transcribed, and commented upon, part of this letter, "Constantijn Huygens en de penningkunst," 279-280. The entire letter can also be found as no. 420 in J. A. Worp, ed., *De Briefwisseling van Constantijn Huygens (1608-1687)*, 6 vols. (The Hague: Martinus Nijhoff, 1911-1917), vol. 1, 247.

35 For a discussion of the author of BnF Ms. Fr. 640 as a practitioner see also Smith and Beentjes, *Nature and Art, Making and Knowing*, 129-179.

One-Sided Hollow Cast Medals_92r

July 1, 2015 mkp-admin 2014_Fall, Annotation

Leave a comment

Transcription [from tc_p092r, 20 December 2014]

<title id="p092r_a2">Mouler cave dun coste et de relief<lb/>

de laultre</title>

<ab id="p092r_b2a">Et pour cet effect on gecte une medaille d**estain** fin qui est plus<lb/>

dur a fondre Et co{mm}e elle est nette on moule avecq icelle Et on<lb/>

la laisse en lune moictie du chassis & on ly presse un peu affin<lb/>

quelle y tienne mieulx Et apres tu gecteras dans ton chassis<lb/>

de la souldure cy dessus descripte ou aultre plus fondante<lb/>

que lestain fin Et ainsy la seconde medaille se fondra &<lb/>

moulera sur la premiere sans la gaster Mays pour faire<lb/>

plus seurement destrempe du **noir de lampe** avecq de **leau** & avecq<lb/>

un pinceau donnes en une couche legere sur la medaille qui<lb/>

demeure dans le chassis & laisse seicher Ainsy elle ne fondra<lb/>

poinct</ab>

<ab id="p092r_b2b">Mays si tu as une medaille de **cuivre** ou d**argent** tu la peulx<lb/>

bien laisser dans le gect si tu veulx gecter de **plomb** ou **estaim**<lb/>

mays il fault quelle soict un peu chaulde car la froideur feroit<lb/>

retirer **lestain**</ab>

<ab id="p092r_b2c">**Lestaim** veult estre gecte bien chault pour venir net</ab>

<ab id="p092r_b2d">**Lestain doulx** qui est le meilleur pour le gect est celuy

<ab id="p092r_b2d">Lestain doulx qui est le meilleur pour le geet est celuy qui estant<lb/>

gecte en grille est bruny & luisant & poly co{mm}e un mirouer & qui semble<lb/>

avoyr este bruny Et nha poinct de trous co{mm}e celuy qui est aigre & qui<lb/>

nest point luisant co{mm}e bruny</ab>

Translation [from tl_p092r, 20 December 2014] and suggested changes:

<title id="p092r_a2">Molding a hollow on one side and a relief on the other</title>

<ab id="p092r_b2a">And for this effect, one casts a **fine tin** medal, which is harder to melt. And since it is pure, we mold with it. And one leaves it in one half of the box mold and press it inside so that it holds. Then, thrown in the box mold soldering, the one described above, or something else that melts better than pure tin. In this way, the second medal will melt and mold itself on the first one without damaging it. But to make this is a better way, soak **noir de lampe** in **water**, and with a brush, apply a thin coat on the medal which is in the box mold, and leave to dry. In this way the medal will not melt at all. </ab>

<ab id="p092r_b2b">But if you have a **copper** or **silver** medal, you can leave it in the casting, if you want to cast in **lead** or **tin**; but the medal must be a bit warm, because otherwise, the **tin** will shrink.</ab>

<ab id="p092r_b2c">**Tin** must be cast very hot, to come clean.</ab>

<ab id="p092r_b2d">**Soft tin**, which is the best one for casting, is the one that, when cast en grille is shiny and polished like a mirror and almost looks as if it has been burnished. This **tin** has no holes like the one that is brittle, and is not shiny as if burnished.</ab>

Annotation: Concerning the Production of "One-sided Hollow" Cast Medals

Rozemarijn Landsman & Jonah Rowen

[All figure file names have been abbreviated for readability, and are preceded by "AnnotationFall2014_LandsmanRowen_One-SidedHollowCastMedals_ ": e.g.

SidedHollowCastMedals_ ... ", e.g.,
"AnnotationFall2014_LandsmanRowen_One-SidedHollowCastMedals_Fig1a_TuttleModel1.jpg" is here shortened to "Fig1a_TuttleModel1.jpg"]

The recipe "Molding a hollow on one side and a relief on the other" (BnF Ms. Fr. 640, folio 92r) gives advice on how to cast a thin medal with a relief on the obverse and with an exact negative of the image on the reverse. [PS: Add an image of this kind of medal here; many readers will not know what you are referring to.] In modern scholarship these single-sided medals are frequently referred to as "without reverse," "hollow cast," "incuse-reverse cast," or "uniface." In lieu of a universally accepted alternative, we have chosen to refer to these medals as "one-sided hollow cast," as it remains close to the original denomination in the manuscript. In this, "hollow" must be understood according to its meaning in this and other early modern casting recipes.[1] The large number and diverse places of origin of such medals suggests that the manufacture of these objects was a well-established practice throughout Europe by the late fifteenth century. However, little is known about their purpose, reception, and the methods of their production. They are currently held to be incomplete because they lack mottoes and emblems on the reverse, or they are thought to have had a more practical use rather than as decorative or as collector's items, whereby the reverse might possibly have been used as a matrix.[2] While BnF Ms. Fr. 640 offers little insight into the purpose or display of hollow cast medals, it provides a unique chance to explore the production methods of this type of object. Where the scarce early modern sources concerning medal casting seem barely to even mention these single-sided hollow cast variants—perhaps one of the reasons that such medals have often been approached as nineteenth-century electrotypes—the manuscript offers a number of recipes concerning their manufacture, illuminating some previously undocumented aspects of their processes of fabrication.[3]

The purpose of this annotation is twofold: first, to explain the method of hollow casting as it seems to be described on fol. 92r of BnF Ms. Fr. 640; and second, to try to place it into the context of both the rest of the manuscript, as well as what we know about this early modern practice from contemporary sources. The manuscript offers various recipes that can be linked to the recipe discussed here, either because of the process described, the outcome of the process described, or the terminology used.[4] That said, the terminology used in the manuscript to indicate or describe one-sided hollow cast medals and their manufacture is not consistent and overlaps with related processes such as mold-making and casting with a core. Our investigation of the broader context of the method described on fol. 92r included material evidence found in extant medals, as

well as a search for other early modern written accounts of this process. Although neither our experiments, nor our research concerning the context of this recipe have been exhaustive, there are some interesting findings and conclusions to be drawn.

Text of the recipe

As in so many recipes in BnF Ms. Fr. 640, the recipe on fol. 92r, "Molding a hollow on one side and a relief on the other" [*Mouler cave d'un costé et de relief de l'aultre*] goes into detail regarding certain aspects of the process it describes, without explaining the entire method from beginning to end. The focus in this recipe is on making sure that the original model, i.e., the medal that is to be reproduced, is suitable for the process. The author touches upon its material, use, and treatment, and suggests starting with a medal cast of pure tin [*d'estain fin*],[5] that is neat or clean enough to be reproduced and molded with.[6] The metal then used for casting is called "*souldure*": "the one described above [fol. 92r, "Mixture that is easy to melt"], or something that melts better than pure tin." As a second paragraph he[7] adds that "if you have a copper or silver medal, you can leave it in the casting [*laisser dans le gect*], if you want to cast in lead or tin."[8] The author's general point is this: not only does the original medal need to be capable of imprinting a sharp impression (i.e., "neat" enough), but also, to use this hollow casting method, the medal to be reproduced must be made of a metal with a (significantly) higher melting point than the metal used for casting.[9]

With regard to the method of casting this recipe provides the following clues: "And we leave it in one half of the box mold [*Et on la laisse en l'une moictie du chassis*] and press it a little so that it takes better. Then, you cast in your box mold (...). In this way, the second medal will melt and mold itself on the first one without damaging it [*la seconde medaille se fondra & moulera sur la premiere*]." Further on, in the second paragraph cited above, he again writes, "you can leave it in the casting." Thus, the original medal is not only used to imprint the mold, but it actually remains a part of the mold. This also explains the relevance of the difference in melting point between the material of the original medal and the metal used for casting.

Another important factor to the caster was the protection of the original medal. If the medal was deemed worth reproducing, it can be assumed that it would be preferable not to damage it during the reproduction process. Keeping it intact would also offer the possibility for continuous reproduction. The relatively high melting point of the metal used for the original prevents it from melting during the process. But the author offers more advice for further protection: "soak lamp black in water, and with a

brush, apply a thin coat on the medal which is in the box mold [*sur la medaille qui demeure dans le chassis*], and leave to dry. In this way the medal will not melt at all [*elle ne fondra poinct*]." Apparently, the layer of lamp black functioned not only as a separator, but also as a protective layer of the surface of the original medal which was left in the mold during the casting.

Experiments

After studying this recipe it is clear that the original medal was used as a part of the mold during the entire process, but it is not immediately clear what part of the mold it was in or how exactly this technique worked. We hypothesized that it would only make sense to leave the medal in the upper, or male half of the flask, after making a negative imprint with it in the bottom, or female half. Pressing the obverse (the front) of the original medal all the way into the female half and pressing the reverse of the original firmly into the male half would ensure sufficient space between them for the molten metal to enter. Variations on how deeply the medal would be pressed into the sand on either side would allow for results of various thicknesses.

Patricia Tuttle proposes a model for the manufacture of hollow cast medals in which the original medal is first used to make an impression in the sand in the female flask and is then taken out. After drying this female half of the mold, the male flask is filled by fitting it over the female flask. After the application of a separating agent between the male and female halves, such as fine ash, it is filled with sand, thus creating a positive imprint of the same medal. Again, this half is also left to dry. To create a thin cavity between the two halves into which the molten metal could be poured, Tuttle suggests the use of a shim whose thickness would be that of the desired medal. This shim would be fastened to the outer edges of the male half, and filled with the molding sand surrounding the positive imprint. After cutting the pouring channel and vent(s) the two halves would be joined and the medal could be cast [Figs. 1a-1f: Fig1a_TuttleModel1.jpg – Fig1f_TuttleModel6.jpg].[10]

We decided to experiment with both methods: the Tuttle method, and the one contained in the manuscript. We hoped to test Tuttle's proposed model and see whether that would actually work and what difficulties might arise during the process. Second, we wanted to see whether our hypothetical method based on fol. 92r—in which we would leave the original in the male half of the mold—would be workable and what disadvantages or advantages this method might have. [Fig. 2: Fig2_MsMethod_Animation.mov]

For all experiments we used the following materials: an original brass medal, wooden casting flasks, sand, ground charcoal dust as a separating agent, a

wooden casting flasks, sand, ground charcoal dust as a separating agent, a metal ruler to level the flasks filled with sand, a knife to cut gates into the sand, pewter [what percent tin?], a cast-iron melting ladle in which to melt the pewter, a propane torch to melt the pewter, and clamps to hold together the two halves of the mold. The most difficult of these materials to obtain was the sand. Without significant casting experience, how to decide which sand to use? The Delft clay used in a previous experiment seemed inauthentic because it contained oil as its binder,[11] and so we searched for a so-called "green sand" used for casting by foundries that would be bound with water. We wanted to use a modern sand rather than make our own based on a recipe from the manuscript because we hoped that this would remove some variables in the experiments (the focus of which was to be on the *process* more than on the materials) and would provide a stable and effective medium for casting. We decided upon a mixture of sand with an added 10% of clay (bentonite) and 4% water [Fig. 3: Fig3_MixingSand.jpg; Fig. 4: Fig4_TuttleMethod_LevelingFemaleHalf.jpg].[12]

Our choice of sand, however, turned out to affect our products negatively. It was crumbly and very brittle, even more so after we dried them, with many of the grains of the sand unbound [Fig. 5: Fig5_TuttleMethod_MedalinSand.jpg; Fig. 6: Fig6_TuttleMethod_ImpressioninBrittleSand.jpg]. Possible improvements include altering the ratio of sand-clay-water; pushing the sand through a sieve or cloth to ensure the use of only the finest grains; and mixing the mixture longer or more thoroughly. Or, as other recipes from the manuscript suggest, perhaps we let the molds dry too much or too quickly, or perhaps we used the wrong sand altogether for casting pewter:

You can find some excellent [sand] for use with lead, tin and copper close to the hill of Pech-David, close to Toulouse. It should not be reheated much because drying out suddenly, it will lose its binding [properties; *sa liaison*] and retract [?] at the first inflow of metal, which makes the work become rough and unclean [*grumeleus & mal net*].[13]

And, on a different page,

I believe that the secret of casting well lies in finding a sand that conforms well to the metal, this one for lead, the other for another, because each has its own particular one, so that it be molded easily and keenly. Then let it firm up on its own for a few days if you have the leisure for it. And afterwards let it really heat up again, not instantly nor with a large fire, but little by little, otherwise it will crumble & always have some defects.[14]

Tuttle's method

Despite the careful text explaining her tentative method and its accompanying illustrations, getting a good grasp of Tuttle's method with all its steps proved challenging. Although we understood the basic idea, we failed to see exactly how Tuttle proposed to make the shim, and so we came up with our own solution.[15] Our solution, in which we used a thin sheet of wood with the shape of the medal cut out [Fig. 7a: Fig7a_TuttleMethod_FemaleHalf.jpg; Fig. 7b: Fig7b_TuttleMethod_MaleHalf.jpg; Fig. 8: Fig8_TuttleMethod_Casting.jpg] instead of Tuttle's thin third layer of sand, functioned similarly to hers, since both methods involved producing one side of the mold (male) from the negative imprint in the other half (female).[16] Making our wooden shim to fit perfectly was the most challenging part of this experiment and proved relatively time-consuming and labor-intensive. [Fig. 9: Fig9_TuttleMethod_ResultwithShim] A shim filled with sand, as proposed by Tuttle, may be easier to achieve, although the challenge there might be to leave the edges of the positive imprint uncovered while leveling this thin third layer of sand.[17] We concluded that the method might work if executed with more practice. More experience with the casting process and the use of a different type of sand would most likely have resulted in a more desirable outcome [Fig. 10a: Fig10a_TuttleMethod_ResultObverse.jpg; Fig. 10b: Fig10b_TuttleMethod_ResultReverse.jpg]. We attribute the coarseness of our medal cast in this way to our inexperience and to the unsuitable, crumbly sand we prepared, rather than necessarily to Tuttle's suggested method. More experimentation using different sands and different shims is necessary to conclude anything decisively.

The manuscript's method

We made the molds for our first experiment with our hypothesized method before the failed experiments with the Tuttle method, and so we used the same unsuitable sand. Nevertheless, following the method outlined in the manuscript worked relatively well. We first pressed the medal into the sand-filled female half until its flat reverse was leveled with the sand [Fig. 11: Fig11_MsMethod_PressedintoFemaleHalf.jpg]. Following this, we could immediately move on to making the male half of the flask, without having to wait for the female half to dry. To ensure perfect alignment, we put the sand-filled male flask on top of the female flask (with a layer of lamp black in between as a separator), while the latter still contained the original medal [Fig. 12: Fig12_MsMethod_PackingSand.jpg]. We then kept the two halves together [Fig. 13: Fig13_MsMethod_TwoHalvesBeforeTurned.jpg] and turned them upside-down, before removing the female half (now on top) with a little tap, which left the original medal in position on the male half that was

perfectly aligned with its impression on the female half [Fig. 14: Fig14_MsMethod_OpenwithMedalinMaleHalf.jpg]. Now it just needed to be firmly pressed into the sand of the male half and remain there during the rest of the casting process [Fig. 15a: Fig15a_MsMethod_ImpressioninFemaleHalf.jpg; Fig. 15b: Fig15b_MsMethod_MedalinMaleHalf.jpg].

The obverse of our cast medal during this first experiment with the manuscript's method was, like the result of the Tuttle experiment, coarse [Fig. 16: Fig16_MsMethod_OpeningMoldafterCasting.jpg; Fig. 17a: Fig17a_MsMethod_ResultObverse.jpg]. The reverse, on the other hand, was smooth and highly detailed: a perfect negative of the brass original that it had molded on to [Fig. 17b: Fig17b_MsMethod_ResultReverse.jpg]. We concluded that using the original medal as part of the mold could result in a highly detailed reverse. The method, as we envisioned it based on fol. 92r, worked. The coarseness of the obverse seems to be a direct result of the coarseness of the sand. Before we poured the metal, we also noted that the sand had crumbled on the edges of the imprints in both halves of the flask. This most likely caused the molten pewter to extend beyond the edge of the original medal, enclosing it and making it a difficult task to separate one from the other.

Because of the disappointing quality of the sand, we decided to do another experiment with the manuscript's method using the green casting sand, Delft clay. We made smaller flasks out of mason jar caps [Fig. 18: Fig18_MsMethod2_BothHalvesOpen.jpg; Fig. 19: Fig19_MsMethod2_ClosedVents.jpg] and poured from above, directly into the sand, with the medal horizontal instead of almost vertical [Fig. 20a: Fig20a_MsMethod2_Pouring.jpg]. We also chose to push the medal only halfway into the male flask, to experiment with the thickness of the cast medal. Although at first the molten pewter did not seem to have entered the mold at all, the result was surprisingly good: a pewter medal with a clear image on obverse *and* reverse. The main drawback was that the pewter failed to flow into the entire cavity [Fig. 20b: Fig20b_MsMethod2_PouringDone.jpg; Fig. 21: Fig21_MsMethod2_ResultingMold.jpg; Fig. 22: Fig22_MsMethod2_OutofMold.jpg; Fig. 23a: Fig23a_MsMethod2_ResultObverse.jpg; Fig. 23b: Fig23b_MsMethod2_ResultReverse.jpg]. This may be improved by alterations such as tilting the mold at an angle as the metal is poured, heating the pewter to a higher temperature before pouring it into the mold, or slightly increasing the diameter of the negative imprint—which would also cause more filing to be done afterwards. Compared to the Tuttle method, the manuscript's method has the advantage of being less time consuming

and less labor intensive: both halves of the mold can be made at the same time and the additional step of making and drying a shim can be skipped altogether [Fig. 24a: Fig24a_ResultsObverse.jpg; Fig. 24b: Fig24b_ResultsReverse].[18]

Related Recipes & Terminology

One other recipe from BnF Ms. Fr. 640 describes a similar method for making medals that includes leaving the original in the box mold during the entire casting process, which is also titled very similarly, "Molding one part in relief and one hollow side" [*Mouler de relief d'une part et creux de l'autre*], and which is found a few pages before 92r, on fol. 83v:

It is necessary to cast two parts of very clean copper, latten or a similar metal and then when you mold the hollow [*cave*] in sand, leave the metal figure that you have molded in the box mold, without budging it from its place. Then cast and if there is not enough thickness press a bit and force the figure down into the box mold....When you mold, always leave your medal in one of the box molds without stirring it because if your hollow [*cave*] is not clean, it will not mold well.

Interestingly, this recipe uses two different words for "hollow": *creux* and *cave*. While the former is here used for the hollow reverse side of the final product (the medal), the latter is used to indicate the cavity, or negative impression made into one half of the mold. Although not entirely consistent, it seems that this distinction can be made more generally. In all of the five recipes where we found the use of *creux* in BnF Ms. Fr. 640 it indicates the hollow part of a cast object, i.e., either the hollow reverse of a medal or the hollow or cavity on the inside of a more complex object like an animal.[19] *Cave*, on the other hand, is used throughout this manuscript to denote either object or mold, i.e., it is used to refer to the hollow part of a piece of equipment, not the end product.[20]

There is another technique described in the manuscript to create medals that are one-sided and hollow cast. The recipes on fols. 130v ("For molding thinly") and 153r-153v ("Thickening a medal you want to mold") both use a "paste." On fol. 130v a *lasagne de paste* is applied onto the impression of the original in the hollow mold: "... once you have greased the cavity [*le cave*] of your first hollowed mold [*moule cavé*] with butter, apply the paste to it and then the upper part of the second mold." Although this recipe does not refer to medals (or any type of object in particular), this method could certainly be used towards that end. The recipe on fols. 153r-153v uses an original medal to make the female (hollow) mold half, but rather than also pressing

that medal into the male half, it uses a paste (like in fol. 130v) to create the space between the two parts of the mold, on top of which the male half of the mold is made.[21] Then, after separating the two halves to remove the paste before joining them again, the medal can be cast and will be one-sided and hollow, with the same thickness as the paste.[22] Some of these steps are not spelled out literally, but are implied; this conjecture is based on the knowledge we gained from other recipes and our hands-on experience.[23]

However, the hollow reverse of the products resulting from these paste-methods are unlikely to have displayed the same level of detail as the relief on the obverse, depending on the qualities of the paste and the amount of pressure that could be exerted pressing the paste into the *cave* without affecting the mold. Patricia Tuttle's observation that some of the medals she examined displayed traces of a cloth fabric: "... others must have had wax pressed into a mold using a piece of cloth, possibly as a separator, which left behind its fabric pattern in the metal surface. These molds were probably made of plaster, reinforced plaster, or sulfur, as the sand molds discussed above would be too delicate to withstand the pressure of pressing semi-hard wax against their surface."[24] The recipe on fols. 153r-153v does indeed recommend strengthening the mold material: "[sand] ... mixed with filings or very ground iron scales to make your mold firmer." Tuttle's assumption that wax was used, together with her suggestion that the cloth was used as a separator, is thus open to question, based on the text from fols. 153r-153v, "Thickening a medal you want to mold," where a piece of cotton is used to press the paste into the hollow mold.

This paste-method corresponds almost exactly with one of the methods described by Benvenuto Cellini "On Cardinals' Seals."[25] He explains that he started with a relief modeled in wax onto a polished black stone, of which he made a negative cast in plaster. He proceeds to describe how to press this plaster form into one half of a sand mold.

"This done," he continues,

... dry well that portion of the mould where the figures come ..., then have ready a little dough [*Pasta di pane crudo*] in the form of a cake similar in shape & thickness to what your silver or metal seal is finally to be, and put this over the figures formed by the gesso and which will appear in relief, having previously smoked over the mould with a little candle-smoke. This done, take the second box, fill it with the same moist earth and when dried set it upon the first. Mind in so doing that you do not disturb the part already dried where the figures are. ... Then open the mould, after taking out the dough-cake, make the mouths and the two vent holes, beginning at the bottom and going up as high as the mouth or ingress hole. When both parts

bottom and going up as high as the mouth of ingress hole. When both parts are dry, smoke them over with a little candle-smoke and let them cool, have your silver well molten and then pour it in.[26]

In addition to this contemporary Italian source, an only slightly later Dutch source exists. A manuscript sent to Constantijn Huygens by Willem Dedel (dated 1629) contains some recipes about casting medals.[27] One of these recipes is titled "To cast a medal that is too thick thinly" [*Om een medaille die te dunne is dick te gieten*]. The technique described here is similar to that of the paste-method, but instead of using a paste of flour the author suggests using (several layers of) paper.[28] This same treatise contains a recipe "To cast a medal in relief and with a flat back hollow" [*Om een verheven medaelle die achter plat , hol te gieten*].[29] This recipe has similarities to both the method described on fol. 92r and the paste-method from fols. 153r-153v, but it neither leaves in the original medal, nor does it apply a paste. How the thin cavity between the two mold halves is achieved is unclear, but perhaps this is related to the added extra step of breaking the first female half of the mold and remaking it.[30]

Conclusion

To our question whether the manuscript provides a method for the casting of one-sided hollow medals, the answer is a definite yes. In fact, it suggests multiple techniques towards this end. The ambiguity of the same techniques and materials used towards different ends, or vice versa, both throughout BnF Ms. Fr. 640 and in other contemporary sources suggests that early modern craftsmen used whatever materials were available: original patterns, dough, paper, sand, etc., all of them serving similar purposes. Artisans throughout Europe are likely to have known about the various qualities and properties of the materials and substances available to them, and deduced how to utilize them for their purposes.

Given that the author of BnF Ms. Fr. 640 provides various methods to obtain a similar result, and given the difference in reverses and their level of detail in early modern one-sided hollow cast medals examined by Tuttle, it seems likely that there was not one way of doing things, although there may have been personal preferences. As Cellini recommends when discussing two methods for making a cardinal's seal: "Do not, however, fail to try both, because it is good for you to learn them, & you will find them very helpful to you in many ways in other branches of the goldsmith's art."[31]

Patricia Tuttle noted common features of many one-sided hollow cast medals. The reverse, she says, is a highly detailed negative of obverse, which could definitely be explained by the manuscript's method on fol. 92r.

where the original medal remains a part of the mold. There is often evidence of filing, usually around perimeter, that may suggest increasing the diameter of the imprint on the female half (which would also help the molten metal to flow throughout the entire impression). Third, she comments that the reverse is generally coarse as compared to the obverse. This, we think, would indicate the use of a different method than that explained on fol. 92r of BnF Ms. Fr. 640, where the use of the original as part of the male mold actually seemed to result in the opposite; namely, the reverse being sharper than the obverse.[32] Following Tuttle, it may be interesting to investigate to what degree a separating agent can affect this.

The even thinness of this type of cast decreased the likelihood of casting flaws. On this point, on fol. 102v ("Casting"), the author of the manuscript notes that "Tin casts better when it is thin and delicate, than when it is thick, because when it is thick it contracts in high heat. So if you want to mold a thick piece in tin, mold it only one side, and if it is possible, make it hollow [*cave*] on the other side. In this way your piece will be neater. And then you can solder two half pieces together." This technical advantage, as Tuttle also suggests, may be at the heart of the questions concerning the reasons for the manufacture, interest in, and use of such one-sided hollow cast medals.[33]

Finally, for a better understanding of the methods used to produce one-sided hollow cast medals more experimentation is necessary, as well as more research on early modern sources, both in searching them for related recipes, as well as in examining their vocabulary. Perhaps most fruitful, however, would be to examine extent medals for the traces of their facture in the light of the new knowledge presented in this annotation.

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1 Concerning the appropriateness of this terminology: the use of 'incuse-reverse' would seem the least confusing given its specificity, however it also implies a different technique than the one that is actually being used. As Patricia Tuttle explains, this term derives "from the Latin *incusus*, 'hammered or stamped-in, an impression in intaglio'"; see Patricia Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," *Studies in the History of Art* 21 (1978), p. 207. This technique of stamping an impression into a medal was used for the manufacture of coins, for example, and as such we feel that this is not an accurate enough description of the method and its products discussed in BnF Ms. Fr. 640. The alternative designations "without reverse," "one-sided," and "uni-face" can also be used for medals that have a flat reverse, which is why we have chosen to further refer to the medals central to this annotation as being "one-sided hollow cast." Further support for this decision can be found in the few extant early modern sources that mention such medals. As discussed in this annotation, the author of BnF Ms. Fr. 640 uses the words *cave* and *creux*, which are both best translated as "hollow" (see below). A handwritten 1629 Dutch treatise concerning the casting of medals also uses an equivalent of "hollow" [*hol*]. The author of this treatise further explains that such hollow cast medals may seem to be pressed, rather than cast [*als off sy gedreven waer*]; these handwritten notes come from the possession of Constantijn Huygens and are currently kept in the Royal

Dutch Library in The Hague, KA XLVII, fol. 220ff.; see for a discussion and citation A.R.E. de Heer, "Constantijn Huygens en de Penningkunst," *Jaarboek voor munt- en penningkunde* 80 (1993), 271-288; our gratitude goes to Tonny Beentjes for bringing these sources to our attention.

2 George F. Hill, "Notes on Italian Medals XII," *The Burlington Magazine for Connoisseurs* 20, no. 106 (1912), 201-202: "In almost every collection of medals and plaquettes will be found reproductions *in cavo*, which we may, for brevity's sake, speak of as matrices. ... such matrices could be used as stamps for leather or any other soft substance"; Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 211; Luke Syson, "Holes and Loops: The Display and Collection of Medals in Renaissance Italy," *Journal of Design History* 15, no. 4 (2002), 234: "It might even be argued that the majority of mid-to-late-sixteenth-century uniface pieces, those condemned for their one-sidedness by Michel Pastoureau as not being true medals ... were, by abandoning the reverse, deliberately fashioned to be mounted in some way."

3 "The possibility that they may simply be post-Renaissance copies, specifically electrotypes, has been raised, since in thinness and precision of detail they resemble electrotypes almost exactly." Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 212. George F. Hill, in his influential study of Renaissance Medals acknowledges the existence of these one-sided hollow cast medals (although he treats them as part of two hollow halves that would be joined together), but has little to say about their manufacture: "Although hollow shells, made by casting the two sides separately and joining them together by their edges, are exceptional before the seventeenth century, it is quite common in the sixteenth century to find such hollow castings of single sides. They are often so fine that nearly every detail is as plain on the back as on the front; that side of the mould which produced the hollow back was evidently an exact positive reproduction of the model of the front," from George F. Hill, *Medals of the Renaissance*, rev. and enl. ed. Graham Pollard (London: British Museum Publications Limited, 1978), 27.

4 There is one recipe that seems to describe the same process as discussed in fol. 92r, which is "Molding one part in relief and one hollow side" (fol. 83v). Several recipes describe a different process, but mention one-sided hollow cast medals as a result: fol. 69r, "Sand"; fol. 85v, "Sand experiments"; fol. 102v, "Casting"; fol. 130v, "For molding thinly"; fols. 153r-153v, "Thickening a medal you want to mold." Finally, there are several recipes that use similar terminology (especially the key term 'hollow' [*cave*]), but that upon reading neither describe the same process, nor mention hollow cast medals as a product: fol. 81r, "Earth for molding"; fol. 81r

hollow cast medals as a product: fol. 81r, "Earth for molding"; fol. 81r, "Thick paper"; fol. 91r, "molding with cuttlefish bone"; fol. 118v, "Casting in a box mold"; fol. 120r, "Stamped medals made from wax"; fol. 124r, "Noyaulx for molding hollow"; fol. 153r, "Molding hollow seals or other things"; fol. 156r, "Quickly molding hollow mold and relief"; and fol. 169v, "How to reduce a round form into a hollow." Several of these will be discussed below.

5 Cotgrave suggests the following translations for the French *fin*: "wittie, craftie, subtile, cunning, wilie, fraudulent, cautelous, beguiling; also, fine, small, prettie, curious; perfect, exact, pure, exceeding good, of the verie best; also, most, very utmost," see Randle Cotgrave, "*Fin: m. fine: f,*" in *A Dictionarie of the French and English Tongues* (1611), http://www.pbm.com/~lindahl/cotgrave/445small.html. In this instance, where the quality of the tin is related to its higher melting point [*qui est plus dur a fondre*] relative to the metal being used for the cast, 'pure' seems to be the most accurate translation.

6 In the manuscript: *Et co{mm}e elle est nette, on moule avecq icelle*; Cotgrave, "*Net: m. nette: f.*," http://www.pbm.com/~lindahl/cotgrave/658.html: "Neate, cleane, pure, cleere; spotlesse, unspotted; polished, smooth; briske, smug; faire."

7 We follow Professor Pamela H. Smith and Tonny Beentjes in referring to the author of BnF Ms. Fr. 640 using singular masculine pronouns. See Smith and Beentjes, "Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques," *Renaissance Quarterly* 63 (2010): 128-179.

8 Cotgrave, "*Gect: m.,*" http://www.pbm.com/~lindahl/cotgrave/485.html.

9 This necessity in the process corroborates Tuttle's observation that a detailed negative of the image on the obverse can be obtained in various alloys; see Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 207.

10 Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 209-210.

11 To date, we have not found any early modern recipes for sand where oil is used as a binder.

12 We would like to thank Bret Smith from Lancaster Foundry Supply for advising us on which ingredients to use, in what ratio, and for providing us with these materials. The failure of this sand for our purposes was ours; Mr

with these materials. The failure of this sand for our purposes was ours, Mr. Smith suggested that this sand is usually mixed mechanically, which may contribute to its abilities.

13 BnF Ms. Fr. 640, fol. 81r, "Sand"; This 'caving in' of the sand was exactly what happened to our first mold. At the slightest touch – when joining the two halves of the flask together – the sand from the pouring mouth fell into the mold, destroying it. Luckily, we had made a second mold.

14 BnF Ms. Fr. 640, fols. 85v-86r, "Sand experiments".

15 Our misunderstanding of part of Tuttle's tentative model, no matter how well described and illustrated, provides an example of the shortcomings of knowledge transferred through textual exposition. Hands-on knowledge of these practices would have provided a deeper understanding of the processes. For related literature on this point, see for example, Erin O'Connor, "Embodied knowledge in glassblowing: the experience of meaning and the struggle towards proficiency," *Sociological Review* (2007): 126-141.]

16 We feel strengthened in this opinion by Tonny Beentjes' observation that various materials could function as a shim: "The shims could be made from several materials as long as they are made from a heat resistant material," correspondence with the authors, December 9, 2014.

17 We would recommend further experiments with this method in order to fully understand the method's possibilities and challenges.

18 As mentioned earlier, this method necessitates a significant difference in melting points between the material of the original medal and the metal to cast with. It would be interesting to further experiment with slight variations of this factor with experienced founders, perhaps even trying to cast a very thin medal using an original of a similar metal, but that is significantly heavier (thicker)—so that the thin layer of molten metal has solidified even before it can affect the original—to see whether it would be possible to use this method to cast bronze as well (the relatively high melting point of which would otherwise call for an iron or steel original). Our gratitude goes to Tonny Beentjes for suggesting this.

19 Apart from the recipe on fol. 83v the word *creux* appears on fol. 69r, "Sand" (*creuse* used for the hollow reverse side of the medal), fols. 153r-153v, "Thickening a medal you want to mold" (*cave* being used five times to indicate the hollow part of the mold (the negative impression), while *creux* is used towards to end indicating the hollow reverse side of the medal obtained with this method: *et tu auras ta medaille aussy tanure et creuse d'un*

coste que tu vouldras), and fol. 124r, "Noyaulx for molding hollow" (*creux* is here used not for the hollow part of a medal cast in a box mold, but that of an animal cast with a core [*l'ame*]).

20 In addition to the recipe on fol. 92r discussed in this annotation, the recipes on fols. 85v ("Sand experiments"), 102v ("Casting"), and 152v ("Reworking cast things") also use *cave* to refer to the hollow reverse side of a medal. The recipes on fols. 42r ("Casting in plaster"), 81r ("earth for molding"), 81r ("Thick paper"), 91r ("Molding with cuttlefish bone"), 130v ("For molding thinly"), 153r ("Molding hollow seals or other things"), 156r ("Quickly molding hollow mold and relief") and 169v ("How to reduce a round form into a hollow"), however, all use this word to indicate the hollow or negative impression made as a mold, or as part of the process of making a mold. The summer 2014 Paleography Workshop came to a similar conclusion concerning the term *cave*. Biringuccio also uses this term (the Italian variant *cavo*) for the cavity of hollow part of a mold; see "The Methods of Moulding Various Kinds of Reliefs" in Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publication, 1990), 329-332. Cotgrave's entry for the French *cave* reads: "A cave, cellar, vault, or hollow place in the ground." This relationship to "ground" is particularly interesting considering the "earths" used for sand casting; Cotgrave, "*Cave: f.*," http://www.pbm.com/~lindahl/cotgrave/165.html.

21 With the difference that in the recipe on fol. 130v the butter is applied between the dried female mold and the paste, and in the recipe on fols. 153r-153v the butter is applied over the paste before adding the sand for the male half on top of that. Our experiment on December 8, 2014 suggests that this latter method causes the problem of the sand sticking to the paste – and thus ruining the male mold when removing it from the female half. Further experiments with the amount and temperature of the butter and the drying of the male mold before removing it again may result in new insight.

22 As indicated by the title of this recipe ("Thickening a medal you want to mold") the even thickness of the paste is of great importance. This is further emphasized by not only the attention this issue receives in the text, but also the small illustration accompanying it, portraying the tool that the author suggests to make and use for rolling out the paste evenly and to the desired thickness [Fig. 25: Fig25_fol153v_HDdetail.jpg].

23 During our experiments with Tonny Beentjes, we (Tonny Beentjes, Jonah Rowen, and Rozemarijn Landsman) wondered whether the recipe "Casting in

a box mold" on fol. 118v, also used a method to make one-sided hollow casts. After careful study, however, it can be concluded that this is not the case. The author fills the female half of the box mold with sand, covering the medal (although in a note he says that he first filled the mold with sand and then pressed the medal into it). Than, turning this half of the box mold around so that the medal faces upwards, he draws a line on the back of the medal (near the edge [*bord*]) that continues onto the sand – to indicate where to make the pouring mouth [*pour denoter la place pour faire le gect*]. Without removing the medal from the female half, he then adds a layer of charcoal onto the still uncovered side [*contour*] of the medal, adds the male half of the flask on top of the female half, and fills it with sand. Only after both halves of the mold are made does he remove the medal. Thus, this would make an exact replica of the original medal, rather than a one-sided hollow cast version.

24 Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 211.

25 Tuttle also notes this similarity to Cellini's recipe, in "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 211.

26 Benvenuto Cellini, *The Treatises of Benvenuto Cellini on Goldsmithing and Sculpture*, trans. C.R. Ashbee (Whitefish, MT: Kessinger Publishing, 2006), 61-63; according to a footnote accompanying this 2006 translated edition the 1568 edition "gives a clearer version of this process than the original codex."

27 Willem Dedel *l'advocat*, who sent the Dutch manuscript to Huygens (together with more notes concerning (life) casting) is unlikely to have been the author of the treatise. It is attributed to the goldsmith Adriaen Rottermont, nephew of the famous sculptor Adriaen the Vries. See de Heer, "Constantijn Huygens en de Penningkunst," 271-288.

28 For the use of paper as a molding material, see also BnF Ms. Fr. 640, fol. 81r, "Thick paper."

29 Interestingly, the Dutch author comments that such a one-sided hollow cast medal looks "as if it were embossed" [*alsoff sy gedreven waer*]. This brings us back to the discussion about terminology and why "incuse-reverse" may not be the most accurate to use, while the association is certainly justified. The outcome of both processes is evidently related. BnF Ms. Fr. 640 offers at least one recipe concerning this embossing technique: fol. 120r, "Stamped medals [*medailles de stampe*] made from wax"; see also

fol. 120r, "Stamped medals [*medaillies de stampe*] made from wax"; see also note 2 of this annotation.

30 What the effect or benefit of this extra step is remains unclear to us. Could it be that the first female mold half had become too dry to use?

31 Cellini, *The Treatises*, 62.

32 Of course, this would also depend on the sand used for the mold. It would be interesting to see whether it is also possible to use an original medal that is already one-sided and hollow cast. This would allow for the medal to be first used to impress the upper half of the mold, while leaving it into the lower half. Perhaps this would result in a smoother surface for the obverse as compared to that of the reverse. But, depending on the reverse of the original, would a medal cast this way also obtain the same level of detail on the obverse? Furthermore, as Tonny Beentjes suggested, it might be worthwhile to measure shrinkage in either method, since in theory the manuscript-based method would cause the details on the reverse to be slightly larger than on the obverse. One could, for example, measure this difference using precise 3D-scanning.

33 Tuttle "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," 212.

Molded Roses_129r_155r_155v

July 1, 2015 mkp-admin 2014_Fall, Annotation
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Raymond Carlson and Jordan Katz

Making and Knowing Project

Annotation for BnF Ms. Fr. 640, fols. 129r; 155r; 155v:

"Molded Roses;" "Molding a Rose;" "Roses"

BnF Ms. Fr. 640, fol. 129r

Transcription [tc_p129r, 12 February 2015]

<title id="p129r_a4">Roses moulees</title>

<ab id="p129r_b4">Elles sont malaisees a mouler a cause que les feuilles sont fort subtiles et foibles et doubles mays pour obvier a cela il les fault oindre dhuile de froment qui est fort dessicatif et estant bien tost sec il affirmist et roidise les feuilles pour les pouvoir distinguer et soustenir le sable destrempe le mesme se fait auc mouches aux pensces et semblables choses delicates aux fleurs de capries</ab>

Translation [tl_p129r, 12 February 2015] with proposed changes underlined

<title id="p129r_a4">

Molded roses </title>

<ab id="p129r_b4">

Roses are molded with difficulty because of their petals[1] which are very delicate, weak, and doubled. To obviate these disadvantages rub it with wheat oil which is very desiccative, once dried the oil stiffens the leafs which will withstand soaked sand. Do the same thing with flies, pansies, and other delicate things like capers </ab>

BnF Ms. Fr. 640, fol. 155r

Transcription [tc_p155r, 12 February 2015]

<title id="p155r_a1">Mouler une rose</title>

<ab id="p155r_b1">Pourceque les branchetes du rosier qui sont aupart aultour de<lb/>

la fleur sont quelques fois fort dilatees & feroient<lb/>

un trop grand moule On les faict et moule a part Et la rose<lb/>

& quelquees boutons a part Et puys on raporte<lb/>

avecq souldure les branchettes & foeuilles de rosier a la<lb/>

queue de la rose a laquelle on laisse expressem{ent} de<lb/>

petits bouts des branchettes Mect la foeuille ou rose<lb/>

le plus bas que tu pourras dans le moule pourceque le **sable**<lb/>

la releve tousjours Tu en peulx aussy mouler plusieurs<lb/>

foeuilles ensemble estant disposees lune sur laultre les<lb/>

distingant avecq les filets co{mm}e dict est Et pour le regard<lb/>

de la rose tu peulx donner une legere couche de **beurre fondu**<lb/>

au dos de la foeuille de aulx premieres foeilles de dehors non a celles de dedans be pour laffermir & luy donner force de<lb/>

soubstenir affin que le sable destrempe ne les dilate & escarte plus quil ne fault Tu les peulx bien mouler aussy les foeuilles<lb/>

des rosiers fraisiers & semblables qui sont plates<lb/>

& qui se peuvent aplatir sans les gaster a deulx gects<lb/>

pour ouvrir ton moule quand il est recuit & le nettoyer<lb/>

de la cendre Toute et faire des souspirails &<lb/>

plusieurs gects Et ceste voye est la plus facille<lb/>

Mays laultre se peult faire aussy Et avecq de petits<lb/>

filons de **cire** adaptes & joincts de foeuille a foeuillle<lb/>

tu peulx fayre des gects Mesmes tu peulx faire<lb/>

despuys le dos de la premiere foeuille jusques un filon de **cire**<lb/>

qui se raportera au gect Tout cela facilite le gect<lb/>

Aulcu Le principal est de laisser bien froidir les<lb/>

moules recuits plustost que les nettoyer & soufler dedans<lb/>

pour faire sortir la **cire** pourceque quand le moule est<lb/>

chault la cendre se tient co{mm}e attachee Mays quand il<lb/>

est froid elle sesperd et sort avecq le vent ou quand<lb/>

on retire lalheine a soy par le petit pertuis</ab>

Translation [tl_p155r, 12 February 2015] with proposed changes underlined

<title id="p155r_a1">Moulding a rose</title>

<ab id="p155r_b1">Because of the little branches of the rose bush, which are around the flower, are sometimes very spread out, they would demand too big of a mold. We make and cast them separately, the rose and the rosebuds separately as well. And then one brings them together, soldering the little branches and leaves of the rose bush to the stem of the rose, on which you will have purposefully left bits of the small branches. Put your petal or rose as low as you can in your mould, because **sand** will always bring it up or raise it. You can also mould several petals together, arranged one on top of the other, separating them some thread. And for the look of the rose you can give a thin layer of **melted butter** on the back of the petals, but only on the outside petals, not the inside petals, to stiffen them and give them the strength to withstand, so that the wet sand does not stretch or spread them out more than necessary. You can also mold well the leaves of a rosebush, strawberry plant and similar things that are flat and can be flattened without being spoiled. For two castings, to open your mould, when it has been reheated and then clean the ashes out, make some vents, and [you will be able to do] several casts. This is the easiest way and you can also do the other. And with little vents of **wax** that has been adapted and joined from leaf to leaf,[2] you can make casts. You can even make a little vent of **wax** from the back of the first petal, which will join up with the main cast. All of this will facilitate the casting process. The main thing is to let your reheated moulds cool down rather than cleaning them and blowing inside them to make the wax come out, because when the mold is hot, the ash almost attaches itself to it. But when it is cold it, it detaches and leaves with air draft or when one draw in one's breath through the small opening.

<note id="p155r_c1a">You can also give a little thickness at the ends of the stems that are holding up the petals, by lightly oiling them underneath with **melted butter**, because the petals are big and weigh heavily, and the stem made of lead or tin will not have enough strength [to hold it]. </note>

made of **lead** or **tin** will not have enough strength [to hold it].</note>

<note id="p155r_c1b">I would be of the opinion to mold the rose on its own with a bit of its stem close to its bud, and then to join the rose to a longer one [a stem] made of **glazed brass**, because the rose bloom is very big and heavy.</note>

<note id="p155r_c1c">Moisten your rose with **spirits** before placing it in the clay. Do not forget to oil the **wax** cast. And when you have thrown in your **wet sand**, blow heavily, until it begins to set. The rose came out well. But because the **sand** was mixed within the petals, soak your work in water for a long time so that when you shake it in the water, the earth comes off.</note>

BnF Ms. Fr. 640, fol. 155v

Transcription [tc_p155v, 12 February 2015]

<title id="p155v_a1">Rose</title>

<ab id="p155v_b1">Pource que la fleur espanouye est vague & ha ses<lb/>

foeuilles confuses & entournees en diverses facons elle<lb/>

ne se monstre poinct belle quelle ne soict paincte & daulta{n}t<lb/>

aussy quelle ha pois on fir que la queue d**estain** qui<lb/>

est aigre & subtile ne pourroict pas susporter On moule<lb/>

la fleur de la rose seule & apart Luy faisant le gect<lb/>

grosset affin quelle vienne b mieulx Puys on couppe<lb/>

ce gect au ras de la queue du bouton dans<lb/>

lequel apres on hante & soulde une tige de **fil de letton**<lb/>

a laquelle aussy on soulde les foeuilles Mays pourceque<lb/>

lestain estant ainsy tanvre est fascheux a soulder et se<lb/>

peult fondre quelque foeuille Et quaussy les fleurs<lb/>

gectees & principallement la rose ne sort pas belles sans estre<lb/>

painctes On ne prend poinct la peine de soulder Mays on le <lb/>

hante les pieces a raporter & on les colle avecq dela **colle<lb/>**

de poisson qui soict un peu destrempee & parfondue espesse<lb/>

Et affin quelle preigne mieulx on chaufe legerem{ent} & de lomg<lb/>

louvraige **destain** car estant froit la **colle** ne prendroit pas<lb/>

Apres que ta fleur est ainsy reparee Tu resuits les<lb/>

joinctures des choses raportees avecq de la **cire** esb a esbaucher<lb/>

qui est **cire** blanche meslee de force **ceruse** bien broyee ou pour mieulx<lb/>

blanc de **plomb** la parfondant & acommodant sur ton ouvrage<lb/>

avecq une petite poincte de **fer** chaulde En ceste sorte tu peux<lb/>

reparer ces petites barbes qui sont au milieu de la rose ou<lb/>

les trous de la qui pourront estre en quelque foeuille Apres<lb/>

tu paindras ta rose selon le naturel Si tu gectes ta<lb/>

rose en **or** ou **argent** tu peulx bien raporter & soulder Et<lb/>

en ces mesmes metaulx quand tu as quelque chose delicate a<lb/>

raporter co{mm}e une mouche ou semblable chose sur la fleur<lb/>

la **colle de poisson** y est singuliere & tient bien fort larresta{n}t<lb/>

avecques quelques petites poinctes qui servent de clou<lb/>

Les foeuilles & bouttons se peuvent mouler a deulx moules<lb/>

qui se pourront ouvrir estant recuits mays non pas plustost<lb/>

Apres lesdictes choses se raportent</ab>

Apres lesdictes choses se raportent</ab>

Translation [tl_p155v, 12 February 2015]

<title id="p155v_a1">Rose</title>

<ab id="p155v_b1">Because the rose bloom is rather wavy, and its petals are all mixed up and arranged in various ways, it will not be beautiful if it is not painted, and you must also consider that its weight cannot supported by the **tin** stem which is sour and fine. One moulds the flower of the rose in a separate mould, casting it thickly so that it comes out more easily. Then one cuts the cast at the edges of the stem of the bud, in which you graft and solder a stalk of brass wire to which you also solder the leaves. But because this **tin**, being so thin, is hard to solder, and may melt some of the leaves and also the cast flowers; [you should consider] that cast flowers, especially roses, are not beautiful without being painted, so one does not make the effort to solder them, but [instead] one grafts the pieces that you want to join together and glues them with **fish glue** that has been a little moistened and melted until thick. And so that it takes better, you heat the work in **tin** lightly and for a long time, because if it is cold, the **glue** will not take. Once your flower is thusly repaired, you follow the joints of the added parts with some **esbaucher wax**, which is a white **wax** mixed with much well-ground **ceruse**, or even better, **white lead**, melting it and placing it on your work with a small warm bit of **iron** needle. In the same way you can repair the little filaments that are in the middle of the rose, or the holes that may appear in some of the petals. Then paint your rose realistically. If you cast your rose in **gold** or **silver**, you can also rejoin [parts] and solder its. And in those materials, when you have join something very delicate together with the flower, such as a fly or other similar things, **fish glue** is excellent, and holds very well, fixing it with a few little needles that act as nails. The leaves and buds can be cast in two molds that can be opened once they have been reheated, but not before. Then these things join up [with the flower].</ab>

Annotation

At least nine recipes in BnF Ms. Fr. 640 pertain specifically to the process of casting flowers and herbages.[3] Among these, three recipes are devoted exclusively to the steps taken to cast a rose. This technique is closely related to contemporary practices of making “life casts” of flowers, as there are clear precedents in the artistic production of Bernard Palissy and Wenzel Jamnitzer. As this entry will show, the motives for singling out roses as an object to be molded are likely related to the literary production of sixteenth-century France.

Within BnF Ms. Fr. 640, the lengthiest recipe on the molding of roses appears on fol. 155r. The recipe calls for the different parts of the rose to be cast separately: the branches, rosebud and the stem, advice not given elsewhere in the manuscript in regard to different cast flowers (such as a marigold).[4] The author notes the possibility of molding the rose petals together by separating them with thread, indicating the particular care devoted to ensuring a detailed cast of the petals without allowing them to be crushed. To help strengthen the rose, the author calls for coating the outer petals with butter. This represents a major divergence from an earlier recipe about roses on fol. 129r, "Molded Roses," which explicitly calls for the use of wheat oil to help stiffen rose petals ("*les feuilles*").[5] Evidently in the course of writing the manuscript, the author discovered a problem with this technique, or simply changed his mind. In the recipe "Strengthening flowers and delicate things" on fol. 154v, the author explains that wheat oil should *not* be used to strengthen flowers, but rather that melted butter should coat the *backs* of flower petals (as in the case of roses and pansies).[6] In any case, the nature of this difference may offer a clue to the temporally linear process of the manuscript's transcription, as this example signals a clear difference in the processes used at a later point in the manuscript. The author self-corrects.

To help metal to flow between the leaves, the author notes later in the recipe on fol. 155r that one they should be connected with sprues: "Et avecq de petits filons de cire adaptés & joincts de foeuille à foeuillle, tu peulx fayre des gects." It is difficult to know in this instance whether the word "*foeuille*" refers to leaves or petals, although the former would coincide well with an illustration provided by the manuscript author. A drawing in the right-hand margin of the folio illustrates the larger spruing system in place that would have connected the rose leaves to one another and to the rose buds, which are surprisingly *not* shown detached from the stem **[Fig. 1: Rose drawing]**. It may be that this illustration accounts for a marginal note further below, which states that one can mold the rosebud near a piece of its stem, which is to be connected later to a separate brass stem.

The latter half of the recipe is largely given over to the process of reusing the mold. The author references that one can reuse the mold to cast again by cleaning it out, and the author's oblique comment, "This is the easiest way and you can also do the other,"[7] may have signaled to the reader to return to the recipe on fol. 117v, "How to clean flower and herbage molds." As flowers and other objects burned in molds could leave a charcoal residue that would obstruct the flow of liquid metal and introduce impurities, this step is clearly necessary. The virtue of the reproducibility of a flower mold is that the artisan could craft a bouquet of cast flowers. Multiple molds

would allow for a variety of flowers in such arrangements, of which the rose or roses would presumably have been the hallmark.

The end-product of the recipe for rose casting on fol. 155r was clearly meant to be altered further, as other recipes in the manuscript reveal. The recipe "Rose" on fol. 155v is a clear rejoinder to that which came before it, as it implies all the ways the rose casting on fol. 155r would have been incomplete. It begins by stating that because of the waviness of the rose bloom and the various arrangements of its petals, "it will not be beautiful if it is not painted." For emphasis, this fact is stated again later in the same recipe. While the author does not explicitly describe the process for enameling the rose here, the reader could easily have returned to fol. 116r of the manuscript, which contains the recipe "Enameling very find gold rose leaves and others." Still, one should note that the recipe on fol. 155v speaks specifically to the making of the rose in tin — not gold. The recipe on fol. 155v also offers suggestions for how to correct imperfections in the cast (ex. "holes that may appear in some of the petals"), as well as how to glue or pin various pieces back together. Enameling may not have been the only means of further emending the cast rose. On the next folio in the manuscript, 156v, the author gives a recipe for molding a fly, which he affixes to a bouquet of sage. The proximity of this recipe to that on fol. 155r is significant, as the process of molding the delicate rose petals seems linked to the molding of the fly's wings, which are thin, necessitate separate casting, and are later soldered back onto the body of the fly.[8]

Equally significant to what is contained in the rose recipes is what is left out: detailed discussion of the actual process of casting. Only in the margin of fol. 155r does the author add that the rose should be soaked in spirits to ensure a clean cast. One should understand the recipe on fol. 155r as an elaboration on a process that had been more clearly described elsewhere in the manuscript. For example, fol. 117r contains the recipe "Molding flowers and herbages," which outlines the means by which to arrange a flower or herb in clay and actually lute the mold. The process of luting the mold, for example, is nowhere found in the recipe on 155r.

There was certainly important precedent for the life-casting of roses in sixteenth-century Europe, and surviving examples of this process can be traced to the workshops of Bernard Palissy and Wenzel Jamnitzer.[9] The bouquet of flowers atop Jamnitzer's table ornament of 1549 (Rijksmuseum, Amsterdam) reflects one potential arrangement of such objects together in a particularly masterful art object **[Fig. 2: Jamnitzer Table Ornament]**. Separately cast plants of exceptional delicacy attributed to Jamnitzer also survive **[Fig. 3: Jamnitzer Plants]**. It seems more likely that the author of BnF Ms. Fr. 640 was aware of the production of Bernard Palissy. On fol. 1r of the

Mr. Fitzo is was aware of the production of Bernard Palissy. On fol. 1r of the manuscript, the author includes the name Bernard Palissy in a lengthy listing of individuals whose writing presumably informed his own **[Fig. 4: Fol. 1r, Palissy]**. He writes: "Master Bernard Palissy, inventor of rustic figurines to the king and the queen mother," adding a cross to the right of Palissy's name. This inscription is a nearly exact citation of the designation given to Palissy on the title page of Palissy's book *Discours admirables, de la nature des eaux et fontaines, tant naturelles qu'artificielles, des metaux, des sels et salines, des pierres, des terres, du feu et des maux* (Paris, 1580) **[Fig. 5: Palissy Frontispiece]**.[10] The manuscript author therefore knew of Palissy's text, which makes several references to the properties of roses, such as their perishability.[11] One cannot know whether the manuscript author had direct knowledge of objects produced by Palissy, but the author's recipes for roses deserve comparison to the *Rustic Ewer Decorated with Roses* (Musée du Louvre, Paris) attributed to Palissy or a close follower **[Fig. 6: Palissy Rose Ewer]**.[12] While it is made of *faïence*, the ewer uses roses cast from life; the petals have evidently been crushed in the process. There were likely other examples of live-cast roses to be found in France. As Palissy's *Discours admirables* makes clear, his work extended far beyond the making of tableware to the decoration of grottos, of which there were many in the vicinity of Toulouse and which the manuscript author references once.[13]

The recipe on fol. 155v of the manuscript, which begins with a call to paint the rose because of the need to instill it with beauty, indicates a careful attunement to the aesthetic properties of roses. This entry contends that an awareness of the need to make such objects beautiful was likely connected to the lyric poetry produced in France in the sixteenth century, a significant proportion of which used flowers as a central motif. The poems of Pierre de Ronsard (1524-85) and Jean de la Taille (1540-1608), to name a few, gained immense popularity in France and frequently dealt specifically with flowers. Consider, for example, the following poem by Ronsard, published in 1553 with the collection *Les amours*:

My pet, come see, this eventide,

If that fair rose that opened wide

Its crimson robe, at dawn, unto

The sun, sees not already flown

Its crimsoned folds, and, like your own,

Its blush of morning's tender hue.

Ah me, my pet! Alas, see what

A little time will do! In but

A trice, its beauty wilts, undone.

Stepmother nature! Wicked, she,

If such a flower — ah me! ah me! —

lasts but from morn to setting sun.

Thus, if you heed my word, my pet,

Whilst childhood blooms and blossoms yet,

Green, fresh and new is the hour:

Before it fades, pluck, pluck your youth,

Lest, all too soon, old age, forsooth,

Wither your beauty, like the flower.[14]

Flowers and their blossoming had long been associated with youth and beauty in lyric poetry, a metaphor especially well-explored by Francesco Petrarca in his *Rerum Vulgarium Fragmenta.* Within the context of Ronsard's writings, the rose takes an especially central role as a trope through which to praise his beloved's appearance while warning her of its transience. As Ronsard expresses in the final verse of the second stanza of the ode, the rose — like physical beauty — is subject to the ravages of time and "Lasts but from morn to setting sun!" (v.12).

One must consider that the same individuals who read poetry by Ronsard were likely also the primary consumers of precious life-cast objects. In the context of the rose discussed by the manuscript author, such an object would have inspired conversation about the impermanence of life. The very goal of a life cast was to render everlasting an object whose beauty was paradoxically heightened and doomed by its impermanence. Furthermore, the poem calls to mind important questions of imitation. Ronsard's poetry is concerned with broader models of poetic imitation in the Renaissance, which has been explored in depth by scholars including Thomas Greene and

which has been explored in depth by scholars including Thomas Greene and, more recently, JoAnn DellaNeva.[15] Greene identifies a certain randomness to the borrowings within Ronsard's poetry, discussing sources ranging from Petrarca to Hesiod. DellaNeva, by comparison, explores an even more wide-ranging set of Italian poetic sources that informed Ronsard's verse. What is important to stress is that one's capacity to imitate and adhere closely to Petrarchan formulae was highly prized in sixteenth-century lyric production. It is worth drawing a parallel, therefore, between poetic imitation that would have been clear to readers of Ronsard's poem and the imitation of nature that was central to the products of life casting. Like the poems, life casts were prized for their ability to imitate their given source. With the subject of the rose to link these two objects of artistic creation, one could certainly imagine Renaissance individuals discussing these links between poetry and sculpture when standing before a life-cast rose.

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1 Translation of the word *feuille* is a complex matter, as the word can be understood to mean either petal or leaf, depending on context. For a further discussion of this term and its translation, see note 5.

2 The reason to translate "*foeuille*" as leaf in this instance is based on the illustration in the margin of this text, which will be discussed below.

3 See Bibliothèque Nationale de France, Paris, Ms. Fr. 640 (henceforth cited as BnF Ms. Fr. 640), fols. 116r, 117r, 117v, 129r, 145v, 154v, 155r, 157r, 160r.

4 For the author's discussion of his molding of a marigold, see the recipe "Flowers" on fol. 145v.

5 Translation note: There is a major inconsistency in the current translations of the manuscript regarding the words *feuille*, *foeuille*, and *foille*, all of which are variants on the same term. In the sixteenth century, such words could be translated as "petal" or "leaf," a distinction the current translations struggle to achieve. The word *pétale* was first used in 1649 by Fabio Colonna precisely in order to differentiate petals from leaves. See Émile Littré, *Dictionnaire de la langue française* (Paris: L. Hachette, 1873-77), III: 1084. This entry here corrects the current translation of fol. 129r, which refers to "*feuilles*" as leaves, which far more likely makes reference to a petals, as the entry later emphasizes the softness of the *feuilles*. On fol.

155r, by comparison, *foeuille* is translated as petal.

6 As stated in note 3, there is a substantial discrepancy in the current translations of the word *feuille* and its variants. In the recipe on fol. 154v, the translation currently calls for this word to be translated as "leaf," however, given the explicit reference to the delicacy of the *feuilles* of pansies and roses in the recipe, it seems much more likely that this term refers to petals.

7 "*Et ceste voye est la plus facille, mays l'aultre se peult faire aussy*."

8 In a note in the margin on fol. 156v, the author notes that should there be any defects in the fly's wings, they can be substituted by simply cutting out a thinly hammered piece of tin, gold or silver. Such a substitution seems less likely for the more conspicuous rose petals.

9 On Palissy, Jamnitzer and the process of life casting, see especially Pamela Smith, "Between Nature and Art: Casting from Life in Sixteenth-Century Europe," in *Making and Growing: Anthropological Studies of Organisms and Artefacts*, ed. Elizabeth Hallam and Tim Ingold (Aldershot, Vt.: Ashgate, 2014), 45-63; Pamela Smith and Tonny Beentjes, "Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques," *Renaissance Quarterly* 63 (2010): 128-79; Edgar Lein, "Über den Naturabguss von Pflanzen und Tieren," in *Nürnberger Goldschmiedekunst 1541-1868. Band II. Goldglanz und Silberstrahl. Begleitband zur Ausstellung im Germanischen Nationalmuseum, Nürnberg. 20. September 2007 – 13. Januar 2008*, ed. by Karin Tebbe (Nürnberg: Verlag des Germanischen Nationalmuseums, 2007), 205-15; Petra Kayser, "The intellectual and the artisan: Wenzel Jamnitzer and Bernard Palissy uncover the secrets of nature," *Autstralian and New Zeland Journal of Art* 7 (2006): 45-61; Kris Ernst, *Le Style rustique: le moulage d'après nature chez Wenzel Jamnitzer et Bernard Palissy (1926) suivi de Georg Hoefnagel et le naturalisme scientifique (1927)* (Paris: Macula, 2005).

10 Marc Smith made this observation in the current comments section of the translation of the manuscript. See Bernard Palissy, *Discours admirables de la nature des eaux et fontaines, tant naturelles qu'artificielles, des métaux, des sels et salines, des pierres, des terres, du feu et des émaux* (Paris: Martin le Jeune, 1580).

11 For example, Palissy notes that flowers (including roses) lose their colors "*en un instant*," whereas natural stones do not. See Palissy, *Discours admirables*, 240.

12 On this object and its relation to Palissy's artistic production generally,

see Pamela Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago and London: The University of Chicago Press, 2004), 100-106; Leonard Amico, *Bernard Palissy: In Search of Earthly Paradise* (Paris and New York: Flammarion, 1996), 94.

13 The recipe "For grottoes" on fol. 118r discusses many different materials to be used in making grottoes. Especially notable are the recipe's multiple references to the distinctive beauty of the materials, which find a parallel in the discussion of beauty in the recipe for roses on fol. 155v.

14 *Mignonne, allons voir si la rose/ Qui ce matin avoit desclose/ Sa robe de pourpre au Soleil,/ A point perdu ceste vesprée/ Les plis de sa robe pourprée,/ Et son teint au vostre pareil. /Las ! voyez comme en peu d'espace,/ Mignonne, elle a dessus la place/ Las ! las ses beautez laissé cheoir !/ Ô vrayment marastre Nature,/ Puis qu'une telle fleur ne dure/ Que du matin jusques au soir / Donc, si vous me croyez, mignonne,/ Tandis que vostre âge fleuronne/ En sa plus verte nouveauté,/ Cueillez, cueillez vostre jeunesse :/ Comme à ceste fleur la vieillesse/ Fera ternir vostre beauté.* For a reproduction of the poem and its translation, see Norman Shapiro, ed. and trans., *Lyrics of the French Renaissance: Marot, Du Bellay, Ronsard* (New Haven: Yale University Press, 2002), 324-25.

15 Thomas Greene, *The Light in Troy: Imitation and Discovery in Renaissance Poetry* (New Haven and London: Yale University Press, 1982), 197-219; JoAnn Della Neva, *Unlikely Exemplars: Reading and Imitating beyond the Italian Canon in French Renaissance Poetry* (Newark, Del.: University of Delaware Press, 2009), 222-89.

Molded Letter Paper_131r

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Raymond Carlson and Jordan Katz

Making and Knowing Project

Annotation for BnF Ms. Fr. 640, fol. 131r:

“Molded letter paper”

BnF Ms. Fr. 640, fol. 131r

Transcription [tc_p131r, 12 February 2015]

<title id=”p131r_a2”>Le{tt}re **papier** moule</title>

<ab id=”p131r_b2”>Escripts de quelque **ancre** bien gommee ou de quelque **couleur**<lb/>

qui aye corps & qui ne se defface point estant mouille **deau**<lb/>

de vye puys pose ton papier sur la plastre **dardille** & le<lb/>

mouille **deau de vye** & gecte dune part & daultre</ab>

Translation [tl_p131r, 12 February 2015]

<title id=“p131r_a2”>molded letter **paper**</title>

<ab id=“p131r_b2”>Write with some **ink** bien gommé or any other **color dye** which has body, and which is not erased if dampened with brandy. Then put your paper on the sheet of clay, and dampen it with **brandy**. Cast both sides [of paper].</ab>

Annotation

The recipe “Molded letter paper” on fol. 131r of BnF Ms. Fr. 640 explains in just one sentence the process of laying thick ink onto a piece of paper and casting it into clay.[1] This recipe is without exact precedent in previous written sources, and this particular recipe does not clarify its intended final product. While a reconstruction of this recipe sheds light on its possible outcome, it does not illuminate its purpose. The limited nature of the text suggests that the recipe was not a subject of careful experimentation. Rather, as this entry will demonstrate, this recipe likely represents a less-developed idea inspired by two broader groups of recipes in the manuscript: those related to the casting of thin substances and those related to writing tricks.

The recipe begins by calling for writing that uses either well-gummed ink (“*encre bien gommée*”) or a colored liquid with body (“*quelque couleur qui aye corps*”). Immediately evident is the priority given to the viscosity of the

corps"). Immediately evident is the priority given to the viscosity of the writing liquid rather than its appearance, which implies that the paper onto which the ink is laid is unimportant to the final result. The recipe offers no indication of how to make "*encre bien gommée*," although for a contemporary reader, this would have likely been a straightforward process.

As Jo Wheeler has noted, the majority of surviving Renaissance ink recipes are related to the making of iron gall ink, which was used since the twelfth century and involved a combination of iron salts with gall from animal or plant sources.[2] A common source in which to locate such recipes are Renaissance books of secrets.[3] The *De Secreti* of Alessio Piemontese (1555), for example, is filled with numerous ink recipes, each with different merits (cost-effective ink, white ink, etc.). One recipe, "To make ink to write that will allow you to make a large quantity, and very quickly, and at very little expense, and that will be perfect. And to make furthermore ink to print," calls for the primary ingredient of fish gall, particularly that from ocean regions such as Venice.[4] To improve an ink of simple fish gall, the *De Secreti* calls for adding dust of cuttlefish or dried fish, charcoal, glass, gall, and gum (*gomma*). The practice of varying the ingredients in ink to fit a desired purpose or writing surface was therefore common in this period. Recipes in numerous books of secrets call for some form of gum — typically gum arabic — to be added to ink to adjust its viscosity.[5] To render ink "*bien gommée*," in turn, would likely have involved an increase in the amount of gum in the ink.[6]

The manuscript itself contains two recipes for making ink within a larger recipe on fols. 51r-v for making prints using copper plates.[7] The two recipes call for using linseed and walnut oil respectively and combining the oil with crushed garlic cloves and bread crusts. Because such ink was made expressly for the purpose of printing, in the reconstruction the decision was made to use a different ink. The primary properties of ink with which the author was concerned were its viscosity and its permanence when moistened. The recipe explicitly states that the ink must not run when wet with brandy,[8] and in a marginal note for a later recipe the author again discusses the need to use waterproof ink when molding paper.[9] In the reconstruction, two inks were used: a modern waterproof ink and an iron gall ink made to historical specifications by the Phoenix-based company "Old World Inks" **[Figs. 1-2: Waterproof Ink, Iron gall Ink]**. Selecting gum proved a greater challenge. Gum arabic seemed a natural choice, given the prevalence of gum arabic in this period, its use an ingredient for ink in many books of secrets, and its mention in numerous points of the manuscript.[10] In our reconstruction, however, a gum arabic solution was found to have a diluting effect when mixed with ink **[Fig. 3: Gum arabic solution]**. Rather than raise the letters, the surface of the ink remained flat, even when multiple

layers of ink mixed with gum arabic were applied **[Fig. 4: Gum Arabic Text]**. It may have been that a solid form of the gum arabic was needed, but it is worthy of note that the manuscript author references the use of (arabic?) gum in order to dilute paint pigments.[11]

In the reconstruction the decision was made to find a different gum to increase the ink's viscosity, and powdered tragacanth gum mixed with water was therefore used **[Fig. 5: tragacanth gum]**. A resin derived from the sap of an eastern Mediterranean plant, tragacanth gum was available in Europe in the sixteenth century and was widely used by artisans. It is explicitly mentioned in Renaissance artistic treatises, often as a binding agent known for becoming hard with time.[12] In the reconstruction, the tragacanth gum was mixed separately with both types of ink, forming a thick, gelatinous paste **[Figs. 6-7: Tragacanth gum mixed, Tragacanth gum and ink mixed]**. Initially applying this mixture with a calligraphy pen, the gum proved so dense that it was necessary to paint it onto paper with a brush. We inscribed a sheet using modern ink with the word "CRAFT" **[Figs. 8-9: CRAFT, frontal and side views]**, and a sheet using iron gall ink with "ART" **[Fig. 10-11: ART, frontal and side views]**.

After letting the ink dry over a period of several days, numerous changes took place. The ink shrank but remained thick and clearly raised above the surface of the paper. Despite applying the ink mixture to gelatin-sized sheets[13] made of hemp and cotton fiber that approximated the qualities of sixteenth-century paper, the sheets curled up after the ink mixture hardened over several days **[Fig. 12: Curled-up Paper]**.[14] The curling of the paper may partly explain why the recipe calls for dampening the sheet with brandy, which allowed the paper to relax in shape, albeit causing small cracks in the ink as it spread out. Brandy with a high alcohol content (92 proof) was used out of concern that the tragacanth gum was partly water soluble. An important question was when to apply the brandy. As the sheet with writing was meant to be imprinted into flat clay [*plastre d'ardille*],[15] one might expect to apply the brandy to both sides of the paper before imprinting it, as it would allow the paper to release from the clay more easily. The recipe however seems to call for the opposite order of operations: "*puys pose ton papier sur la plastre d'ardille & le mouille d'eau de vye*." While the curved paper relaxed in shape after the brandy was brushed on, our action of applying the brandy to the reverse of the paper after placing the paper on the clay may have created problems **[Fig. 13: Laying Paper onto Clay]**. Both sheets were pressed hard against the clay by rolling them with a small marble cylinder **[Fig. 14: Rolling cylinder]**, and when lifting the sheet using iron gall ink, the ink became stuck into the clay on two occasions and had to be forcibly pulled out with the tip of a knife **[Fig. 15: Removing Ink with Knife]**. It may be that the author's ordering of steps was not meant to be followed verbatim

that the author's ordering of steps was not meant to be followed verbatim, although this difficulty suggested that the recipe may not have been subject to careful experimentation by the author. Nonetheless, the ink created a clearly visible impression into the clay **[Figs. 16-19: Impressions of CRAFT and ART]**.

Once the paper was pressed into the clay and removed, the reverse was also molded in adherence to the recipe's order: "*gecte d'une part et d'autre*." While the flat side of the paper created a slightly visible texture in the clay **[Fig. 20: Reverse Molded]**, the objective of the recipe and especially the instructions to cast both sides remained unclear. The pieces of clay were left on a flat marble slab to dry for a period of several days, which caused them to warp slightly **[Fig. 21: Warped Clay]**. What was to be done next? Were the dry slabs of clay with an imprinted word the desired product? Their thinness made them brittle and impractical, causing one to break when handled **[Fig. 22: Broken Mold]**. It seems likely that such clay slabs would have been used as molds for a different substance such as plaster, which could simply have been poured onto the clay. The instruction to cast both sides of the paper may indicate that the author intended for the mold to be cast in two dimensions with the clay sheets pressed together. It may be that the clay was meant to have been inserted into a box mold or some other form. Such unknowns suggest that this recipe was not subject to rigorous experimentation.

It is noteworthy that the manuscript folio on which the recipe is found is very cleanly transcribed, with no strikethroughs in the main body of the text, a common feature of numerous other pages. Furthermore, the recipe should be considered in relation to the recipe immediately above it, which is entitled "Herbs difficult to burn in the mold" and offers one sentence of instructions to mold such objects "in two to three castings." The word "*essayer*" in the margin adjacent to the herb-molding recipe, is likely a derivation of the verb *essayer*, possibly in an antiquated version of its imperative form (*essaie* or *essaye*). This could indicate that the author wrote a reminder to himself to try the herb recipe, suggesting that he copied down these recipes from another source or without having actually executed them himself. This hypothesis is affirmed by the brevity of the recipes on this folio. Alternatively, the author may have meant to encourage another reader to try the experiment on his own.

One might surmise, in turn, that the recipe for molding ink on fol. 131r was simply a "thought experiment," an idea jotted down without empirical testing. The sources for such an idea are likely not textual, as no exact precedent for this recipe in printed books could be found. Rather, this recipe seems closely related first to a number of recipes related to writing

found much earlier in the manuscript. On fol. 19v is a recipe titled "To write on the left as well as on the right way," which states: "Write in the best manner possible with some well gummed ink [*encre bien gommé*] on as many cards as many words as you want to write and when your letter is full of ink, apply your paper and rub with a tooth the back of the cartel." This recipe provides a nearly identical process to that described in the first half of the recipe on fol. 131r, using the properties of raised ink to create an imprint onto another surface. It is highly significant that on fol. 19v the recipe explicitly focuses on using this technique to reverse the direction of one's words, as this same process obviously occurred when reconstructing in the recipe on fol. 131r. In the case of the recipe on fol. 131r, however, if something were cast into the clay, it would emerge with the writing again facing in the normal direction. This may indicate why the reversal of text was not explicitly discussed on fol. 131r.

The manuscript features an additional group of recipes related to writing that show the author's broader concern with practical techniques related to this process. Folio 46v presents a series of such recipes, "Sulfur oil for the scribe" (used to clean a quill), "Shoemaker" (writing permanent text on shoes), "Erase lettering" (removing previously written text), "How to write without ink," "How to make a letter on other material," and at the end, "Black letter on stone." All such recipes are composed of very brief descriptions with no strikethroughs or marginal notes, and many of them involve the same material: sulfur oil.[16] It is difficult to know how thoroughly these recipes were actually tested, although the recipes reflect knowledge of the properties of sulfur oil and its potential uses. The recipe "Shoemaker" on fol. 46v employs the third-person to describe the process of writing on shoes, beginning: "If he wants to make some work on black leather shoes." It may be that the author learned about sulfur oil from a shoemaker and experimented with this material in developing his own writing tricks.[17] Another possibility is that the author speaks of a hypothetical shoemaker who could use a technique the author himself discovered when using sulfur oil, just as a writer the author mentions in an earlier recipe on this folio could have used sulfur oil to clean quills.[18] In either case, the recipes on this folio show a primary concern with the material, sulfur oil, as a substance for writing. While some of these writing techniques may seem playful or even trivial, there are numerous examples of recipes in books of secrets for erasing ink, as well as for the production of invisible ink, for example.[19]

In the case of the recipe on fol. 131r, the manuscript author's decision to connect paper with raised ink with making an impression in clay likely relates to his broader interest in molding very thin materials, which is borne out in numerous recipes on nearby folios in the manuscript. On fol. 142r the author

gives the recipe for "Molding grasshoppers and other things too thin," which begins:

If you have a piece of written paper to mold, which is very thin, after you have made a first casting and it has taken, add a little thickness to the back of your paper with some melted butter, which is the most appropriate means there is, and [this method applies as well] for strengthening the wings of either a butterfly or grasshopper, or any delicate part of an animal for which you need to add some thickness.

The technique of adding butter to the back of paper recalls a similar recommendation by the manuscript author for the casting of rose petals.[20] As this recipe and others suggest, the author has established a category of very thin objects that are (evidently) common subjects for casting, such as paper, flower petals and insect wings.[21] The author is developing a set of techniques for casting such delicate and fragile objects, such as spreading and stiffening them, as it is understandably difficult to make an impression when such objects are too thin and fragile to make an impression.[22] As the reconstruction showed, fine clay would likely warp too much when dried to make an effective cast of paper. In turn, it is understandable that the author would recommend a shortcut for casting thin items, as he does in a separate recipe for molding a fly, noting that if its wings are imperfect, they can be made by cutting out a small piece from flattened metal.[23] In the case of the recipe on fol. 131r, however, such a shortcut would have been impossible, as the objective was to cast the impression of the lettering. With further experimentation, perhaps the author could have devised a more comprehensive recipe for casting raised writing on paper.

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1 Bibliothèque Nationale de France, Paris, Ms. Fr. 640 (henceforth cited as BnF Ms. Fr. 640), fol. 131r.

2 Jo Wheeler, *Renaissance Secrets: Recipes & Formulas* (London: V&A Publishing, 2009), 99.

3 On this genre, see especially William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Visual Culture* (Princeton, N.J.: Princeton University Press, 1994). C.f. Elaine Leong and Alisha Rankin (eds.), *Secrets and Knowledge in Medicine and Science, 1500–1800* (Farnham and Burlington, VT: Ashgate, 2011).

4 "*A fare inchiostro da scrivere che ne farete gran quantità, et prestissimo, et con pochissima spesa, et sarà perfetto. Et per fare ancora inchiostro da stampare*." The cheapness of the recipe derives from one's ability to eat the fish and save the gallbladder. See Alessio Piemontese, *Secreti del Reverendo Donno Alessio Piemontese* (Venice: Sigismondo Bondogna, 1555), 188.

5 Wheeler, *Renaissance Secrets*, 99.

6 A recipe in the manuscript on fol. 51r refers to the use of "*eau bien gommée*" to coat a stone on which to rub paper. This was presumably water with gum arabic added.

7 This recipe is titled "Cutters of printing plates." It is unclear whether this recipe refers to the use of an engraved or an etched plate, and the process could presumably be used for either type of process.

8 "*qui ne se d'efface point estant mouillé d'eau de vye*"

9 In a marginal note to the recipe on fol. 142r for casting very thin objects, the author writes: "If you write on paper or on cardboard, and your piece of writing has been made with gum, the wetness of the clay pack or of the cooked sand for the pewter will moisten it [and] ruin it. Thus, write with

soaked sand for the *noyau* will moisten it [and] ruin it. Thus, write with cinnabar mixed with oil, on oiled and stamped paper."

10 For example, the manuscript calls for using gum arabic in the making of yellow varnish (fol. 74v).

11 In a note adjacent to the recipe "Painting big figures" on fol. 65v, the author writes: "Illuminators who paint over sheets of paper, dilute their colors with gum. They mix gum with a bit of soap, this way colors run better."

12 Tragacanth gum could be used not only for making paints, but also for art objects that required greater volume, such as stucco and sugar sculptures. See Mary Merrifield, *Medieval and Renaissance Treatises on the Arts of Painting* (New York: Dover Publications, 1967), 1, 362, 484, 494; Marina Belozerskaya, *Luxury Arts of the Renaissance* (Los Angeles: J. Paul Getty Museum, 2005), 246.

13 Gelatin was frequently used along with other starch additives to stabilize the viscosity of the paper and improve ink resistance. See http://www.naturalpigments.com/art-supply-education/sizing-paper-gelatin for further information.

14 Corresponding with Timothy Barrett at the University of Iowa's Center for the Book, we decided that the best type of paper to use for this recipe would be gelatin-sized sheets made of hemp and cotton fiber. These sheets are typically used in the care and conservation of rare books from the period, thus they would have a comparable effect with regard to adherence to the ink. The sheets we received, according to Mr. Barrett's email correspondence, were "50-50 hemp and cotton, heavy weight for a book paper, and third quality."

15 In his French-English dictionary of 1611, Randle Cotgrave defines Ardille as "clay, loame, tough mold." See the entry in Cotgrave, *A Dictionarie of the French and English Tongues*.

16 Beyond the numerous references to sulfur oil on fol. 46v, this substance is mentioned only briefly on two other folios in the manuscript. On fol. 46r, the author mentions that to whiten teeth "it is said that sulfur oil is excellent," and later on fol. 117v the author says it can be used to wet asparagus when making a life cast of it, given asparagus's distinctive hardness.

17 Another shoe-related recipe using sulfur oil is found near the bottom of folio 46v, explaining that this substance could heat up boots without

folio 40v, explaining that this substance could heat up boots without producing flames.

18 The recipe titled "Escrivan huile de soufre", the author writes: "If a writer wants quickly to clean his quill from some dried thick ink, one has only to dip it in some sulfur oil, and immediately it will be white and clean."

19 On the history of invisible ink since antiquity, see Kristie Macrakis, *Prisoners, Lovers, and Spies: The Story of Invisible Ink from Herodotus to al-Qaeda* (New Haven: Yale University Press, 2014).

20 See fols. 154v-155r, as well as the "Annotation for BnF Ms. Fr. 640, fols. 129r; 155r; 155v:

'Molded Roses;' 'Molding a Rose;' 'Roses.'"

21 This recipe is itself likely related to that on fol. 131r, as a marginal note (reproduced above in note 8) specifically discusses the likeliness of ink mixed with gum to run when moistened.

22 For another recipe that discusses adding thickness to insects' wings before casting, see "Molding flies" on fol. 149r: "Large flies can be molded & cast. But you must grease them on top of their wings with wheat oil, which dries quickly and firms them up & gives them a little thickness. The same is done with butterflies, cicadas, grasshoppers & similar things."

23 In the recipe on fol. 156v, "Moulding a fly," the author writes: "If it happens that you have some defects with your fly's wings, hammer some very fine tin, or gold or silver, if you cast it, and shape with scissors the amount you need for your wings."

Magistry_84r

July 1, 2015 mkp-admin 2014_Fall, Annotation
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Fol. 84r (downloaded February 13, 2015)

<title id="p084r_a3">**Eau magistra**</title>

<ab id="p084r_b3">Fais dissouldre le **sel gemme** ou **suin de verre** subtilem{ent}<lb/>

pulverisé & mis sur un mabre dans une cave, & il se desseichera<lb/>

en recuisant le moule & luy donnera une liaison pour soubstenir<lb/>

plusieurs gects. Essaye de humecter avecq **huile de tartre**.</ab>

<title id="p084r_a3">**Magistry**</title>

<ab id="p084r_b3">Dissolve **rock salt** or **sandever** that you have pulverized finely and placed on a **marble** slab in a pot. It will dry out while you reheat the mold, and will provide it with a binding to enable several castings. Try moistening it with **tartar oil**. </ab>

"*Eau Magistra*" on fol. 84r provides instructions to make a liquid binder for casting sand. Variations of Eau Magistra in BnF Ms Fr 640 call for ingredients such as elm root and wine (or vinegar),[1] and "burnt oysters," likely a reference to their calcined shells.[2] The Eau Magistra on fol. 84r calls for finely ground and dissolved sandever or rock salt, moistened in tartar oil. Our investigation of this recipe helped to illuminate the meaning of the categories of "fat" and "lean" that scholars have identified in other early modern writings as forming an important aspect of the understanding of materials in early modern Europe.[3] Fat and lean appear to have been an important binary paradigm, perhaps having explanatory functions similar to the Aristotelian categories of wet/dry and hot/cold. In any case, our investigation of this recipe revealed an unexpected sensory aspect to the property of "fattiness."

It is not clear why some binder recipes in BnF Ms Fr 640 are titled magistry while other binders, seemingly identical to them in function, are not denoted as such. For example, on fol. 85v the author-practitioner suggests that egg whites be beaten together with earth to make a casting sand, as the egg whites should help make the impression "come clean and sets and stabilizes the material." Though the distinction between a magistry and a binder is not articulated in this manuscript, other contemporary sources define magistry as a liquid concoction that contains a wine or vinegar combined with a "salt."

Nonetheless, the recipes for "magistry" and other binders in BnF Ms Fr 640 share some general similarities: to help bind the dry casting material

together in such a way that it allows a crisp impression of the pattern, and also enable the sand to endure through more than one casting. The dry material, or "sand," is often described as "dry and lean," thus requiring a wet, or sometimes a "fatty" substance to bind it together.[4] For example, in describing sand made from ox hoof bones in fol. 84v, the author-practitioner writes that "on its own it makes a clean mold. But because on its own it is very dry and lean, it demands to be well wetted and humidified with a thick broth [made from] elm root." The author-practitioner writes on fol. 85r that "then I knew that sands used to mold big reliefs must be very moist with some kind of water, which gives body and firmness, like egg white, gummed water, [or] one [water] boiled with elm root....It can take as many firings as you want because it is as hard as glass." A little further in the recipe he goes on to say that a "fat metal needs a lean sand," using the same terminology to define the optimal combinations of metals and casting sands. This points to the importance of properties of dry, wet, lean and fat for understanding the properties of casting sands. Although the terms dry and wet used in sand casting recipes may seem to refer to the four humors, our process of reconstruction of fol. 84r shows that both dry and wet/moist are used in this manuscript to support the terms lean and fatty.

In order to test the Eau Magistra recipe on folio 84r, we first sought out sandever (also commonly referred to as glass gall), as the recipe stipulates, believing it would be especially interesting because another author understood it to be a "fatty substance floating on glass when it is red-hot in the furnace, and which being cold is as hard as stone, yet brittle, and easily broken". As the same French-English dictionary of 1611 continues, when separated from the glass and cooled to a solid, the glass gall "forms a white crumbly mass, sometimes quite white and at other times brown and fouled, and strongly saline, but not very uniform in its composition: being sometimes merely salt, often very bitter, probably as common salt or sulphate of potash predominates."[5] It would appear that characteristic properties of sandever were its bitterness and saltiness. A nineteenth-century source defines sandever as composed of "all those salts contained in common alkalis that readily melt at somewhat less than a glass-making heat, and are either naturally considerably volatile, or have little if any affinity for silex, and do not unite in the composition of glass, but, being superficially lighter, rise to the top." Apparently this byproduct of glassmaking was "generally skimmed off with iron ladles, and sold to metal refiners as a powerful flux."[6]

In the sixteenth and seventeenth centuries, sandever was also used as an ingredient in *crocus metallorum* in addition to antimony and salt-peter for an alchemical recipe, as a pesticide for garden walks, where it "destroys both weeds and vermin," and seems even to have been used in France for culinary

wood and vermin," and seems even to have been used in France for culinary purposes, "to powder their meat, and to eat, instead of common salt."[7] In general, sandever had multiple uses, as De Blancourt writes: "this salt which the French call (Suin de Verre) Sandever is useful for several purposes, and in several Chymical Operations. It has besides some other Uses and Virtues that are not known, even to very few of the Learned; I could tell some very surprising and wonderful uses of it. But this may serve to whet the Industry of, and excite the Curious to further Enquiries."[8]

Sandever as "glass gall" is now an obsolete material, impossible to obtain in modern glass making due to standardization and quality control of ingredients which ensures that byproducts such as sandever do not result from production. A toxic product called "sandever" is still produced in glass recycling, however it is now defined as the contaminants—such as asbestos—that result from the recycling of waste glass, and that must be separated from the glass mass in the furnace in order to produce useable glass.[9]

Thus, with no feasible way to obtain sandever for the magistry experiment, we decided instead to follow the recipe's suggestion to use rock salt in place of sandever. It seems that sandever and rock salt are interchangeable, both in this recipe, and for an eighteenth-century author who suggested in *Van Nostrand's Engineering Magazine* that for "pig or sow iron, videlicet, the ashes of wood and other vegetables, all kinds of glass and sandever, common salt and rock salt" be mixed into the iron mass to purify it.[10] Biringuccio also categorized rock salt in a family of salts that include potash (an important ingredient for glass making) and sal ammoniac.[11]

In BnF Ms. Fr. 640, sandever and rock salt are suggested for use as dry binding materials in different recipes. For example, the recipe titled "Sand from a Toulousain Mine" on fol.84r instructs the reader to use sandever as an ingredient in the sand itself: the sand, mined deep from the earth, "is excellent on its own, but to make it sustain multiple castings, I mix it with pulverized and moistened sandever, which hardens it, holds together well with it, and enables as many castings as you like." Similarly, the recipe on fol. 89r calls for mixing together pulverized ox bone and rock salt then moistening them. As investigation of this recipe showed, the combined ox bone and rock salt molds produced an unexpectedly hard mold that was firmly bound together, and remained intact enough to be cast more than once.

The Eau Magistra recipe on 84r specified that the resulting mold should be strong enough to withstand several castings. In order to produce the binder, we ground rock salt, mixed it with oil of tartar[12] then mixed it with a dry sand made from reground molds from previous castings. The main

ingredients of these reground molds were pulverized brick and plaster (also containing very small amounts of ammonium chloride solution that had been used as a binder). In combination with the Eau Magistra of fol. 84r, this recipe produced a two-piece mold that, despite some crumbling and partial disintegration, remained intact enough for a second clean casting.[13]

[Figure 1]

[Figure 2]

[Figure 3]

[Figure 4]

Although we cannot decisively conclude from this single trial[14] that the magistry of fol. 84r was responsible for the success of this mold, this trial did shed light on the meaning of “fat” and “lean.”

Significantly, the two recipes for mold material that specify rock salt (or sandever) do not rely upon a wet binder such as elm root infusions and egg whites,[15] but instead, binding action occurs when the salt mixture is moistened. Apparently, the author-practitioner understands this to be due to the “fatty” properties of rock salt (and, by extension, sandever). The fact that sandever and salt are dry materials that also successfully do the work of binders, points to their versatility as materials that apparently possess both a lean and fatty state.

How can salt be understood as “fatty”? In reconstructions of 84r and 89r, we struggled with the concepts of fat and lean, as they did not make sense within a modern understanding of salts, much less of “fat.” We began to understand the meaning of fat and lean, however, when we ground pink Himalayan rock salt for both the Eau Magistra of 84r and bovine bone/rock salt sand of fol. 89r.

[Figure 5]

[Figure 6]

After grinding the salt in rock mortars as finely as possible and storing it in an air-tight jar, we returned to the lab a few days later and found that the texture of the salt was very “sticky.” The salt had transformed from a fine, dry powder that poured freely from an outstretched hand to a sticky substance, in which the particles clearly adhered to each other, creating an

unexpected sensation of resistance when running one's fingers along the surface. The well-known material of salt unexpectedly possessed a completely different set of properties, and we *felt* the "fattiness" of the rock salt, which suddenly afforded a new workability. This allowed us to apprehend the place of "fatty" in the "science" of the author-practitioner, a rather different perspective than is given by our modern classification of salt as sodium chloride.

We thus concluded that these terms, fat and lean, rely very directly upon sensory interaction with materials. In the early modern period, the body itself was a tool in experimentation by which practitioners came to know the properties of materials and the possibilities they afforded or precluded.[16] Our modern knowing of this material through its chemical composition differs from the early modern practitioner's, which was a deeper, more intimate knowing through the bodily senses. This intimacy between practitioner and material was so close that it often was connected to – and could cost them – their health. Smith writes that "the body...was also implicated in the work: the bodies of metalworkers and the very matter upon which they labored interpenetrated each other: bad breath could prevent the adhesion of metal gilding, and, conversely, metal fumes were known to shorten the lives of metalworkers."[17] Sensory testing of materials and ingesting food for medicinal ends were not separated by a great distance—both involved the same types of substances and qualities, including cold, hot, wet, dry, fat, and lean, and both contributed to the intimate connection between practitioner and materials that helped reinforce an understanding of materials in the language of qualities and properties that could be apprehended by the senses.

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By Michelle Lee, with Pamela H. Smith.

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1 "Eau Magistra" in BnF Ms Fr 640, fol.87v

2 "Eau Magistra" in BnF Ms Fr 640, fol.84v

3 Pamela H. Smith, "The matter of ideas in the working of metals in early modern Europe," in *The Matter of Art: Materials, Practices, Cultural Logics, c. 1250-1750*, ed. Christy Anderson, Anne Dunlop, Pamela H. Smith (Manchester: Manchester University Press, 2014).

4 Notable instances of "lean and fatty" in the manuscript include, but are not limited to: p089r, p088v, p086r, p077r, p069v, p069r, p159r. p085r, p142v, p053r, and p165r.

5 Randle Cotgrave. *Dictionarie of the French and English Tongues.* (London: Printed by Adam Islip Anno, 1611), s.v. "sandever."

6 Unknown, "Sandiver or Glass-Gall" in *Brick, Pottery and Glass Journal* 6 (1879): 77.

7 Antonio Neri (d. 1614), *The art of glass, wherein are shown the wayes to make and colour glass, pastes, enamels, lakes, and other* curiosities, trans. Christopher Merret (London: Printed by A.W. for O. Pulleyn, 1662), 277.

8 Jean Haudicquer de Blancourt (ca. 1650), *The art of glass, showing how to make all sorts of glass, crystal, & enamel … Illustrated with proper sculptures* (London: Printed for D. Brown. T. Bennett, [etc., etc.], 1699), 58.

9 Glen Cook (Senior Research Associate at the Corning Glass Museum), email message to D. Mellon titled "RE: query: glass gall," 11 November 2014.

10 Josh Payne. "Decarburization and Purification by Means of Cinder, Ashes, Salt, Silex, Potash and Clay", *Van Nostrand's Engineering Magazine* 1 (1728): 194.

11 Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio*, trans. Cyril Stanley and Martha Teach Gnudi (New York: Dover Publications, 1990), 112.

12 Oil of tartar is distinct from cream of tartar, which is white crystallized potassium bitartrate found on the sides of wine barrels. As defined by Newton, oil (sometimes called salt) of tartar is potassium carbonate, created when potassium bitartrate is calcinated.

13 An unknown variable caused a yellowish-gold coloring to the medal cast in the mold made with the *eau magistra* of fol. 84r. Although we initially believed it to be caused by the rock salt, the medals cast in our ox bone and rock salt molds (fol. 89r) did not result in this color, despite the fact that these molds contained a much higher ratio of salt than the *eau magistra* mold. Other medals previously cast in the same brick/plaster sand had also displayed the same sort of discoloration to a lesser extent, but at the time of writing, it is hard to positively identify what caused the coloring.

14 We unfortunately could not conduct multiple trials for this project as planned, and urge anyone interested in performing this experiment to conduct multiple trials, especially with clean sand that has not been employed in casting before and thus has not had other binders mixed into it.

15 Recipes calling for egg whites and elm root as binders include, but are not limited to, the following: p084v, p082r, p083r, p085v, p087v, p085r, p086r, p087v, p069v, and p072r. For further discussion of these two ingredients used as binders, please refer to AnnotationFall2014_CataldoVisco_binders.

16 Smith, 44.

17 Ibid.

Excellent Mustard_48r

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Transcription [from tc_p048r, accessed February 12, 2015]

<title id="p048r_a3">Excellente **moustarde**</title>

<ab id="p048r_b3">Fais seicher du **pain** au four puys le **larde de girofle** & **Canelle**<lb/>

& ainsy mects le tremper dans de bon **vin** Puys passe tout<lb/>

par **lestamine** estant bien pile & lincorpore avecq ta **graine**<lb/>

de moustarde</ab>

English translation [from tl_p048r, accessed February 12, 2015]

<title id="p048r_a3">Excellent **mustard**</title>

<ab id="p048r_b3">Dry some **bread** in an oven, then stick **cloves** & **cinnamon** into it and put it to soak in good **wine**. Then, being well crushed, pass everything through a **cloth** strainer and incorporate it with your **mustard seeds**.</ab>

Excellent Mustard, 48r

Diana Mellon

At first glance, the recipe for mustard in BnF Ms. Fr. 640 appears to be one of very few culinary recipes in the manuscript. This recipe lies beneath a drawing showing the design of an oven for melting metals, between instructions on how to cure a dog of mange, above, and how to stuff animals and birds, below. Other "culinary" recipes in the manuscript include those for vinegar (40r) and "Vin brusle et sucre" ["Burned and sweet wine"] (71r). Most of the "food" recipes in the manuscript are actually related to food preservation (16v, 50r, 98v) or medicines (7v, 20v, 37r, 47r, 77r). For example, "Medecine pour lestomach qui leschaufe et desopile le foye" ["Medicine for the stomach which warms it [stomach] and unstops the liver"]

(37r) is an opiate which clears gas and phlegm and heals the stomach. There are also several recipes related to keeping fruit- or nut-bearing trees. A cursory look through the manuscript's entries translated so far left us wondering why the author-practitioner had included this particular food recipe in a compilation largely focused on other bodies of knowledge. While his curiosity was clearly wide-ranging, it does not seem to have extended to the vast body of culinary knowledge that was likely available to him. Why mustard then?

Mustard is mentioned elsewhere in the manuscript as a point of reference for the desired thicknesses of different substances (89v, 113v, 121v). These instances suggest that mustard had a relatively consistent viscosity that the target reader, if we can speak of one, would have been familiar with. These three non-culinary recipes in BnF Ms Fr 640 helped us form a clearer image of what our reconstructed mustard should look and feel like—a spreadable paste thicker than sauce. Still, the main early modern uses and qualities of mustard were unclear to us before beginning our experimentation and research.

~

As we ground our yellow mustard seeds by hand in a marble mortar with a marble pestle, we noticed no spicy smell wafting up towards our faces, only the physical challenge of breaking each tiny, firm seed open and pulverizing it.[1] [Fig. 1, grinding mustard seeds] The ground cinnamon and clove, added to dried bread, smelled familiarly warm and aromatic. [Fig. 2, bread and spices] In our first trial, we used red wine to soak our spiced bread; our second trial was tripartite in that we used Concord grape juice, muscat wine, and red wine for three different mustard variations. [Fig. 3, three mustard varieties in progress] In all cases, shortly after the spiced liquids combined with the mustard seeds, we were able to smell the pungent seeds. [Fig. 4, combining ingredients] The initial smell was incredibly sweet due to the sugars in the liquids combined with cinnamon and clove, spices we associate with sweet foods and drinks. This eventually gave way to the stronger, stinging smell of mustard.

After tasting it, our first batch of mustard seemed to remain present as a burning sensation in our mouths, throats and stomachs far longer than we desired. We later related this tingling to the early modern belief that mustard, when applied topically, could draw diseases to the skin's surface so that other medicines could access them.[2] Subsequent batches of mustard made with the three different liquids mentioned above varied in color and flavor. The mustard made with muscat wine differed from the

other two samples primarily in color—it had a golden color familiar to us from contemporary mustard. [Fig. 5, muscat wine mustard] Its flavor was milder than the red wine mustard, but sharper than the Concord grape juice mustard. [Fig. 6, three finished mustard varieties]

A few clues helped us clarify certain aspects of the recipe we were taking on. First, the suggestion about the consistency, mentioned above. After our first trial, we noticed that the mustard seeds might make a more consistent and finer powder if the seed husks were removed, [Fig. 7, mustard seeds during grinding; Fig. 11, first mustard results] which was confirmed by Hugh Plat's 1602 recipe for "Mustard Meale":

IT is usuall in Venice to sell the meale of Mustarde in their markets as we do flower and meale in England: this meale by the addition of vinegar in two or three dayes becometh exceeding good mustard, but it would bee much stronger and finer, if the husks or huls were first divided by searce or boulter, which may easily bee don, if you drie your seeds against the fire before you grind them. The Dutch iron handmils, or an ordinarie pepper mill may serve for this purpose.[3]

Based on this and our experiences in our first trial, we decided to sieve the husks from the seed kernels in our later trials, which gave us better results.

In Plat's recipe, we learned also that we might have saved time by using a hand-mill instead of a mortar and pestle. An illustration in Bartolomeo Scappi's 1570 treatise *Opera* shows a nutmeg grinder, [Fig. 8, Scappi's nutmeg grinder] suggesting that specialized grinding tools were available, and a recipe for "Terre fondue des potiers" (90v) in our manuscript make use of a "moulin de moustard," or "mustard mill."[4] A second image in Scappi's treatise helped us imagine what "lestamine" ["a cloth strainer"] mentioned in our recipe might look like [Fig. 12, Scappi's cloth strainer]. We used a cotton cheesecloth, single or doubled-up depending on the thickness of our liquid, as a readily available modern substitute for a tammy cloth.

Our greatest challenge in executing the author-practitioner's recipe for mustard consisted in establishing the correct proportions of liquid to dry ingredients, and understanding how long to leave the spiced bread in this liquid to achieve the exact desired thickness. Our first trials left us with an extremely thick paste, [Fig. 10, thick spiced wine paste] nearly impossible to squeeze through one layer of our cotton cheesecloth, [Fig. 9, squeezing paste through cloth] but later trials left us with a very thin liquid. The type of bread used and the way its material reacts to manipulation and liquids most likely have an effect on this and should be studied further.

likely have an effect on this and should be studied further.

~

Early European mustard recipes date back to ancient times,[5] and black mustard (*Brassica nigra*) and its less pungent relative white (sometimes called "yellow") mustard (*Brassica alba*) grew in Western Europe at the end of the sixteenth century. The availability of the seed and the frequency with which mustard is mentioned in early modern recipes suggest that the substance was not rare. A 1606 declaration in Rouen, reproduced in a nineteenth-century publication, demonstrates that local *moutardiers* (as well as *vinaigriers*, *aigriers*, and *faiseurs d'eau de vie*) were regulated as a profession in response to unhealthy practices like the addition of improper ingredients to a mustard, such as, "des graines de choux et de rabettes qui la randaient huileuse et de mauvaise goût, et du jour au lendemain putrefaicte, conséquemment indigne d'entrer au corps humain" ["cabbage and [?] seeds, which make it oily and bad-tasting, and from one day to the next rotten, therefore unfit to enter the human body."][6] The account mentions that the King himself attached such significance to this ordinance to see it through quickly, though the author seems to think this was for fiscal reasons. The accompanying ruling stated that active members of the aforementioned professions, including *moutardiers*, had to be apprenticed to a master for at least three years. Interestingly, although production was limited to authorized masters, "Sera néanmoins permis aux bourgeois d'en fair pour leur usage." ["The bourgeois will nevertheless be able to make it for their own use."]

As the "first and only native pungent spice available to early Europe,"[7] mustard played a unique role, but not only as a readily available flavor for the European palate. According to Aristotelian and Galenic humoral theory, foods and people were understood to have complexions which generally had combinations of two of these four qualities: hot, cold, wet and dry. Substances which had certain of these qualities would sometimes, but not always, influence the balance of the associated humors within the human body. In his treatise *De Simplicium Medicamentorum*, Galen mentions that pepper, for example, is cold to the touch but has the effect of heating the human body.[8]

In Robert Pemell's 1652 treatise on medicinal simples, the mustard seed is "hot & dry in the fourth degree."[9] Following these qualities, mustard seeds were thought to be good for those suffering from cold and wet diseases like gout or "cold stomach," but bad for cholerics. The medicinal properties of mustard were directly tied to its influence on cold and wet humors; as Pemell writes of mustard: "by the sharpnesse thereof it pierceth to the

Brain, and purgeth it by sneesing and drawing down rheume and other tough humours which by their residence do much offend."[10]

Not surprisingly, the other ingredients in this recipe seem to share these basic characteristics. Pemell categorizes cinnamon as being "hot and dry in the third degree, or hot in the third-degree and dry in the second," while cloves are "hot and dry in the second or third degree."[11] Both are described as being used, like mustard, to combat cold and wet disease and are not recommended for cholerics. Wine was known to contribute to the general revival of spirits, increasing blood flow because it was believed to be easily converted into blood.[12] Mustard was also included in the category of "aperients," substances which dilate the inner body, increasing flow; again, this would be detrimental to a choleric's health.[13]

It would be incorrect to apply our own distinction between medicines and foods to the early modern usage of mustard. Nevertheless, it appears that the recipe for "excellent mustard" on fol. 48r is, rather than a culinary anomaly within the manuscript, another example of a substance with medicinal properties. The thick and spicy paste maintained its "hot and dry" nature even when used as a condiment for meats, as it is today.

Several early modern authors recommend mustard as a corrective to the less desirable qualities of meats and other heavy foods.[14] This union of meat and mustard was about more than just flavor. Ken Albala mentions the belief that "mustard's cutting and abstersive qualities will help us digest the gross and heavy pork."[15] Certain fatty or heavy meats, such as the animals' heads mentioned by Baldassare Pisanelli in a 1586 treatise, were considered safer to eat if combined with mustard.[16] William Bulleyn, whose health book was published in London in 1558, writes that a broth made with mustard helps with the digestion of meat.[17] For Benedict of Nursia, whose work was published in 1475, flatulence caused by beans could be corrected with the addition of mustard and wine, among other ingredients.[18]

Our own experience in the kitchen and in the lab confirmed the difference between the inert mustard seed's status as a cold and dry substance and its activation into a hot and dry substance through the process of making mustard. Chemically, we now understand that the spiciness in the mustard seed, caused by irritants called isothiocyanates, emerges when it reacts with liquids: "The combination of moisture and cell damage revives the seeds' enzymes and allows them to liberate the pungent compounds from their storage forms."[19]

Interestingly, using an acidic liquid such as wine or vinegar, the two liquids

most commonly used in early modern mustard recipes, slows down this reaction and makes the pungent taste last longer.[20] This sheds light on a recommendation in *Le Ménagier de Paris*: "If you want to make a supply of mustard that will keep long, make it during the picking-season (of wine grapes) from fresh stum [must]."[21] In fact, in our own experiments making mustard with three different liquids, we found that our mustard made with red wine, kept in a refrigerated airtight container for several weeks, held its sharp flavor even after the other two mustards had lost theirs.

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Through a combination of research and the direct observation of the powerful sensory experience of making and eating mustard, we can now suggest that our author-practitioner's recipe for mustard is as much about its medicinal properties as its appeal as a food substance. A powerful antidote or accompaniment to other foods, mustard fits into a series of recipes for wine- or vinegar-based remedies and other medicines for cold and wet diseases (see fn. 1) within the manuscript. What appeared to us at first as a superfluous condiment might in fact have been a common ingredient in early modern meals prized for its clearly defined physical properties and its effect on the human body.

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1 In our most successful experiments, we used the following ingredients and protocol: 11 oz. bread (whole wheat or white); 2 sticks cinnamon; 50 cloves; 1.5 cups of red wine, muscat wine, or Concord grape juice; 1/16 cup yellow mustard seeds. If bread is not already dry (hard), preheat oven to 300 F. Slice bread to 1-1 ½-in thick slices. Place bread directly on oven tray and leave until dry, about 18 min. In the meantime, grind clove and cinnamon roughly in mortar with pestle. Grind mustard seeds finely, and sift through tight sieve to remove large husks. Remove bread from oven, combine in bowl with cinnamon and clove, 1.5 cups liquid of choice, crush all together with pestle, leave to soak for 20 min or longer, depending on bread. Strain through cotton cheesecloth and combine enough of resulting liquid with ground mustard seeds to produce desired paste.

2 According to Robert Pemell, mustard "...easeth the Sciatica and other Gowts, pains in the side or loines, the shoulders or other parts of the body, upon the applying thereof to raise blisters, and by drawing the pains to the place from the inward or more remote, cureth the dis|ease, or diverteth it to those outward places where locall Medicines may help." Robert Pemell, *Tractatus de simplicium medicamentorum facultatibus. = A treatise of the nature and qualities of such simples as are most frequently used in medicines, both purging, and others* (London: Printed by M. Simmons, for Philemon Stephens, at the guilded Lyon in St Pauls Church-Yard, 1652), Chapter 161. The recipe

by the author "A.T." for "A Medicine to breake the Botch," ground mustard seeds are combined with other ingredients to form a plaster that can "draw foorth all the venome." A. T., practitioner in physicke, *A rich store-house or treasury for the diseased Wherein, are many approued medicines for diuers and sundry diseases, which haue been long hidden, and not come to light before this time*, 2nd ed. (London: Thomas Purfoot and Ann Raph Blower, 1596), 65.

3 Hugh Plat, *Delightes for ladies to adorne their persons, tables, closets, and distillatories with beauties, banquets, perfumes and waters* (London: Peter Short, 1602), Chap. 25. Interestingly, Plat continues: "I thought it verie necessarie to publish this manner of making of your sauce, because our mustard which wee buy from the Chandlers at this daye is manie times made vp with vile and filthy vinegar, such as our stomak would abhorre if we should see it before the mixing therof with the seedes."

4 Bartolommeo Scappi, *Opera*, (Venice: Michele Tramezzino), 1570.

5 Lucius Iunius Moderatus Columella, *De Re Rustica*, vol. XII, 57.

6 Ch. de Robillart de Beaurepaire, *Cahiers des États de Normandie sous le règne de Henri IV*, vol. 2, (Rouen: C. Métérie, 1880-2), 282-85. See also Hugh Plat's comment on vile vinegar in fn. 3, above. All bracketed translations except BnF Ms Fr translations are by the author of this annotation.

7 Harold McGee, *On Food and Cooking: The Science and Lore of the Kitchen*, rev. ed. (New York: Scribner, 2004), 415-16.

8 Galen, *De Simplicium Medicamentorum,* I 11: XI 398f.

9 Pemell, *Tractatus,* Chapter 161. The author mentions "Galenus, printed 1549" as one of his sources.

10 Pemell, *Tractatus*, Chap. 161.

11 Pemell, *Tractatus,* Chap. 14 and Chap. 91, respectively.

12 Ken Albala, *Eating Right in the Renaissance* (Berkeley, CA: University of California Press, 2002), 74.

13 Albala, *Eating Right,* 101.

14 See also the dialog between Katharina and Grumio in William Shakespeare's *The Taming of the Shrew,* IV.iii.17-35.

15 Albala, *Eating Right,* 242.

16 Baldassare Pisanelli, *Trattato della natura de'cibi et del bere* (Venice: Giorgio Alberti, 1586), 88-89.

17 William Bulleyn, *A newe booke entitled the government of healthe* (London: John Day, 1558), 75v-76r.

18 Benedictus de Nursia [Nenedetto de'Riguiardati di Norcia] *Opus ad sanitatis conservationem* 2nd ed. (Bologna: Domenico de Lapis, 1477), 17r.

19 McGee, *On Food*, 415-16.

20 McGee, *On Food*, 416-17.

21 Georgine E. Brereton and Janet Mackay Ferrier, eds., *Le Ménagier De Paris: A Critical Edition* (Oxford: Oxford University Press, 1981), 258.

Casting in a Box Mold_118v

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Raymond Carlson and Jordan Katz

Annotation for BnF Ms. Fr. 640, fol. 118v:

"Casting in a Box Mold"

BnF Ms. Fr. 640, fol. 118v

Transcription [tc_p118v, 12 February 2015]

<title id="p118v_a2">Gect en chassis</title>

<ab id="p118v_b2a">Le mesme **sable** qui ha servi aulx noyaulx recuits composes<lb/>

composes<lb/>

co{mm}e dict est de **plastre brique** & **alum de plume** est excellent pour<lb/>

jecter en chassis Et lay ainsy experimente Jay pile les lopins<lb/>

qui estoient provenus des moules de noyau dans un mortier en traina{n}t<lb/>

le pilon pourceque ce **sable** est fort doulx Je ne lay poinct passe<lb/>

par le tamis pourceque **lalum de plume** mesle parmy qui donne<lb/>

liaison ny passeroit pas Mays jay subtilie sur le mabre ce<lb/>

qui me sembloit trop grossier Et layant ainsy prepare je lay<lb/>

humecte avec de **leau de sel armoniac** faict daussy gros<lb/>

de **sel armoniac** co{mm}e deulx noix dans une bouteille deau commune<lb/>

de telle grandeur quune bouteille dans laquelle on faict bouillir<lb/>

de la ptisane ou dans un bon pot deau Que tu trouves leau<lb/>

mediocrement salee Jay mesle parmy leau de demy verre de<lb/>

sel armoniac deulx ault deulx [illegible] cueillerees dargent d**eau de**<lb/>

vye Ayant ainsy humecte le **sable** de facon quil faisoict bonne<lb/>

prise sesmiant toutesfois aisement Jay saulpouldre ma medaille<lb/>

avecq du **charbon pulverise** avec une lime pour la desgraisser<lb/>

dhuile & tout aultre graisse quil fault bien eviter car cela feroit<lb/>

garderoit de bien despouiller Jay soufle ma medaille & lay moulee Et<lb/>

la femelle du chassis estant remplye<lb/>

Jay marque & faict une ligne sur le revers [illegible] la & bort de la<lb/>

medaille & sur le sable prochain aussy Affin que le second<lb/>

chassis sui prene empraincte la dessus pour denoter la place<lb/>

pour faire le gect Ayant remply la femelle du chassis esta{n}t<lb>

remplye Jay descouvert le contour de la medaille Et ay ponce<lb/>

de **charbon pulverise** tout ce coste Et puys ay remply le masle<lb/>

de sable Ayant fai Jay separe le chassis et nay poinct<lb/>

frappe aulx coings de la d medaille pour la faire despouiller<lb/>

pourceque cela estonne le **sable** & le faict esmier Ains jay<lb/>

frappe au revers du chassis tenant lendroit de la medaille en<lb/>

bas et elle ha moule fort net Si elle neust ainsy despouile<lb/>

jeusse attendu de loster jusques a ce que les chassis fussent<lb/>

este desseiches au foeu Jay allume [illegible] un rang de **charbons**<lb/>

entre deulx petits trepies de fer en la forme que tu vois Et ay<lb/>

mis le dos [illegible] & revers des chassis dessus & lempraincte en<lb/>

hault pourcequen ceste sorte ilz se desseichent doucem{ent} et si par cas<lb/>

fortuit pour estre trop humectes il se fendent cest au dos qui<lb/>

[illegible] prend plus aprement le foeu & lempraincte demeure sauve & entiere</ab>

<note id="p118v_c2a">Pour medailles &<lb/>

choses plattes la vraye<lb/>

chaleur du **plomb** & **esta[i]n**<lb/>

cest quand il est fondu doulcem[{ent}]</note>

cest quand il est fondu doulcem[(ent)]</note>

<note id="p118v_c2b">Note que jay emply le<lb/>

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quil ne varie point<lb/>

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mects du **sable** humecte<lb/>

il nen tiendra que plus<lb/>

ferme</note>

<note id="p118v_c2c">Fais le gect qui ne soict<lb/>

pas trop espes pour<lb/>

ne charger pas la<lb/>

medaille Mays si<lb/>

large vers la medaille<lb/>

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la tierce partye<lb/>

Noublie pas<lb/>

les souspirals</note>

<image id="p118_d2"></image>

<note id="p118v_c2d">Desseicher les chassis<lb/>

cest les priver dhumidite<lb/>

quilz ne fument plus<lb/>

estants neantmoings<lb/>

bien chaults</note>

<note id="p118v_c2e">Recuire est rougir le chassis ce qui se faict pour lor & pour largent</note>

Translation [tl_p118v, 12 February 2015]

<title id="p118v_a1">Excellent sand</title>

<ab id="p118v_b1a">Get some of the same sand, the finest that you can, for covering the medal.</ab>

<ab id="p118v_b1b">For the best [result], it is necessary to take sand already used in the core before using it in the box mold, until it can no longer be taken out.</ab>

<title id="p118v_b2">Casting in a box mold</title>

<ab id="p118v_b2a">The same sand which has been used in composed heated cores, i.e. of plaster, brick and feather alum, is excellent for casting in box molds, and I have tried it as follows. I crushed the pieces which had come out of core molds in a mortar, pestling slowly, because this sand is very soft. I did not pass it through a sieve, because the feather alum mixed in, which makes it bind together, would not pass through. But I did refine upon marble what seemed to me too coarse, and having thus prepared it, I moistened it with the **sal ammoniac water** made of sal ammoniac the size of two walnuts, in a bottle of common water the size of a bottle in which one boils ground barley, or in a good pot of water. You should find the water fairly salty. I mixed in half a glass of sal ammoniac two silver spoonfuls of spirits. Having thus moistened the sand in order to give it a nice hold,

though it still came apart easily, I sprinkled my medal with charcoal pulverized with a file to remove the oil fat, and all other fat. One must avoid these, since they hinder good stripping. I blew on the medal and molded it, and with the female part of the box mold full, I marked and made a line on the back and side of the medal, and on the nearby sand as well. In order that the second box mold take the imprint thereupon to indicate the place for making the cast, I uncovered the contour of the medal and pounced the whole side with pulverized carbon, and then I filled the male part with sand. I separated the box mold and did not strike the corners of the medal to make it strip, since that cracks the sand and makes it come apart. But I did strike the back of the box mold, holding the place of the medal on the bottom, and it molded very cleanly. If it hadn't stripped thus, I would have waited to remove it until the box molds had been dried out over heat. I lit a row of charcoal between two little trivets of iron in the form that you see [viz. image id="p118_d2" in the left margin], and put the back of the box molds thereupon, and the imprint on top, since in this way, they dry out slowly. And if, by chance, they should crack from being too moistened, it's on the back that they take the harshest heat, and the imprint remains safe and whole.

<note id="p118v_c2a">For medals and flat things, the true heat of lead and tin. That is when it is melted gently.</note>

<note id="p118v_c2b">Note that I filled the box mold before pressing, and did not strike it, but pressed it with the strength of my hands alone, since striking it may distort it. Make sure that your box mold does not move at all, and if you put some moistened sand under it, it will only hold in place more firmly.</note>

<note id="p118v_c2c">Make a cast that is not too thick, as not to weigh the medal down, but cast wide enough over the medal that it covers the third part. Do not forget the vents.</note>

<note id="p118v_c2d">Drying box molds means removing their dampness, so that they do not smoke any longer, though they be very hot.</note>

<note id="p118v_c2e">To heat is to redden the box mold, which is done for gold and for silver.</note>

Annotation

The recipe "Casting in a Box Mold" on fol. 118v appears after a dense grouping of recipes that detail various forms of casting, such as *en noyeau* casting (casting with a core) and the casting of flowers.[1] The box mold

casting recipe privileges discussion of how to produce sand and how to heat the mold, devoting little attention to the casting of metal itself. As this entry will show, such emphases within this recipe can be explained through the process of reconstruction in conjunction with examination of relevant textual sources. Further, this recipe should be understood through its presumed use in producing portrait medals, whose mounting popularity in late sixteenth-century France aligns with the dating of the manuscript.[2]

The author begins the recipe by describing the production of sand made by grinding cores from previously used molds, which are composed of plaster, brick and feather alum.[3] It is unsurprising that sand would be reused, as this is still common practice today in metal foundries, where sand casting is the main technique used for the production of industrial machine parts.[4] In our reconstructions, the only previously used cores available lacked feather alum. This ingredient, "*alun de plume*," could refer to asbestos, or other minerals such as feldspar or gypsum; in modern terms, it refers to the mineral Halotrichite, which is made of soft, parallel strands of a white color, which has the appearance of a feather.[5] Whatever it was, "*alun de plume*" appears to have been important as a binding agent, but for which no substitute was introduced for the previous molds **[Fig. 1: Grinding Previously Used Molds]**. This omission made it possible for us to pass the sand through a sieve, which the feather alum rendered impossible for the author **[Fig. 2: Feather Alum]**. Given the time needed to break down the old molds, even using a sieve, one can only imagine the time needed to grind these molds to a "very soft" consistency without one, as the manuscript directs. In the recipe, the author then outlines the preparation of sal ammoniac water (a solution of ammonium chloride) using two balls of sal ammoniac the size of walnuts [*noix*], a process similar to that described in an earlier recipe on fol. 111v.[6] In accordance with the manuscript, this solution was mixed with spirits (interpreted as brandy) and mixed with the sand we had produced through the grinding and sieving process **[Fig. 3: Sand Mixture]**, which was pressed into the "female-sided" box mold over the medal **[Fig. 4: Filling Female Box Mold]**. (The recipe calls for the molding of a medal, although the reconstruction used molded plaster models, which were seen as a fair substitute.) The author does not stipulate the process of filling the sand into the mold, however this required a great deal of time in our reconstructions, as the medal was placed facing upwards as small quantities of sand were slowly layered on top of one another with additions of sand or water to adjust the mixture as needed.

After the molding of the medal, the author describes marking the medal's side and reverse, as well as the sand, a step whose function was not immediately clear during our reconstructions and therefore not undertaken.[7] Prior to filling the male side with sand, the author calls for the

undertaken. Prior to filling the male side with sand, the author calls for the dusting of the entire side of the female mold with charcoal ("*charbon pulverisé*"), just as the medal itself had been dusted before insertion into the female side **[Fig. 5: Applying Charcoal to Female Mold]**. In the reconstruction, this step was very helpful when separating the male and female molds. At this point the author warns specifically not to disturb the medal in order to remove it from the mold. The function of marking the location of the medal earlier becomes clear now, as the author explains that he supported the area of the box mold where the medal was (presumably the point marked) and then struck the back of the mold with his hand. Evidently, on rereading his text, the author rethought the word "struck" ("*frappé*") adding a note in the margin to state that he had not struck the box mold, but instead pressed it with his hands ("*l'ay pressé de la seule force des mains*") to avoid distorting it **[Fig. 6: Marginal Note, re: Frappé]**.

A major concern of the author was the heating of the box molds. Had the medal not separated after striking the molds, the author explains that he would have heated them. During reconstructions we were far less patient, opting not to heat the mold to remove the plaster model. Rather, our technique for removing the plaster model was to insert a knife into the channel made for pouring, creating a wedge that could lift the model out **[Fig. 7: Inserting Knife into Mold]**. Our impatience would prove more problematic when we did not heed the author's next step: heating the molds by resting on two iron trivets with the imprinted side facing upwards. The author's attention to this action is evidenced by the small marginal drawing at right in the manuscript and the corresponding marginal note indicating the proper spacing of the trivets **[Fig. 8: Drawing in Margin, Iron Trivets]**. While the recipe ends here, not explaining how in fact to pour the medal, there are two further marginal notes that explain what is meant by heating the mold **[Fig. 9: Additional Marginal Notes]**. As a result, our decision to let the molds sit in a laboratory fume hood overnight and warm for five to ten minutes in a moderate oven was inadequate preparation for casting, as the moisture in our molds caused imperfections in the coloration and details of the medals **[Figs. 10-11: Final Medal, Obverse and Reverse]** during casting. The author's second marginal note, which emphasizes the need to "redden the box mold" for gold and silver, proved especially prescient: when pouring silver into one box mold during reconstruction, steam and a spray of silver quickly shot from the one mold **[Fig. 12: Spray of Sparks]**, as the moisture retained in the sand turned explosively to steam. The resultant silver medal is a perfect snapshot of what occurred inside the mold as the steam forced the molten silver out of the mold and up through the gate **[Fig. 13: Silver Medal Showing Effects of Moisture]**.

To understand the properties of the sand and the need to heat the mold, a

particularly noteworthy recipe for comparison elsewhere in the manuscript can be found on fol. 161r, "preparing sand to cast in a molding box." This recipe outlines a nearly identical process of breaking up previously used cores with a stick to create sand, soaking the sand in sal ammoniac, baking the sand in a furnace until it reddens, and grinding it up again. The recipe on fol. 161r gives insight to the value of using sand from previously used cores, as it explains that through the repetition of this process, the sand will reach a state such that it does not separate from the box mold. The author also stresses the importance of cooking the mold adequately so that the sal ammoniac can calcinate properly. The presence of Latin words in the recipe on fol. 161r, "*gip de lateribus*" and "*alumen jameni*" (i.e., the "brick mortar" and "*alumen album*" of which the cores are composed[8]) suggests a textual source for this recipe, which unfortunately could not be identified based on these phrases.

The recipe for sand-casting in BnF Ms. Fr. 640 is assuredly linked to the longstanding tradition of portrait medals, which were frequently made using this process. The earliest surviving Renaissance portrait medals are two lost medals that entered the collection of Jean de France, Duc de Berry (1340-1416), by 1413, although there is no way to know whether the originals were cast or produced with a *repoussé* technique, as copies of both types are extant **[Figs. 14-15: Duc de Berry Medals, Constantine the Great and Hercules]**.[9] Such objects complicate the widespread scholarly consensus that cast portrait medals were developed in Italy.[10] The mass production of pilgrimage badges (made by pouring a tin-lead alloy into molds), as well as the production of medals for numerous French monarchs affirm the presence of artisans in 15th-century France capable of casting medals.[11] Nonetheless, the most extensive early written sources of portrait medal casting are of Italian origin: Cennino Cennini furnishes a brief recipe for the making of medals using a plaster and either a wax or clay mold, and Leon Battista Alberti was known to model portraits in relief in wax that were subsequently cast in bronze.[12] The individual credited with the invention of the portrait medal genre itself is Pisanello (Antonio di Puccio Pisano, c.1395-c.1455), who was installed at the Este court in Ferrara.[13] Bringing together humanist learning with erudite patrons concerned with the propagation of their fame, the Este court offered the ideal environment for the birth of the portrait medal, which shows a portrait on one side and an emblem or *impresa* on the reverse **[Fig. 16: Pisanello Medal]**.[14] As Ulrich Pfisterer has shown, portrait medals grew in popularity in Italy over the course of the fifteenth and sixteenth centuries, functioning as "social currency" that patrons could exchange in order to establish and solidify bonds of friendship.[15] The level of erudition needed to decode the messages implicit in emblems and *imprese* delineated membership within tightly controlled social circles of learned individuals.[16]

tightly controlled social circles of learned individuals.

Knowledge of the production of medals certainly carried from Italy to France through the travel of Italian artisans to France, the best known of which are Francesco Laurana in the fifteenth century and Benvenuto Cellini in the sixteenth century. While portrait medals were produced in France at the hands of goldsmiths beginning in the fifteenth century, Mark Jones has demonstrated that in France, centers for medal-making developed around Lyon — the center of French trade with the Italian peninsula — and reached their apogee of manufacture between the second half of the sixteenth century and the early seventeenth century.[17] The appearance, function and understanding of medals in France differed somewhat from that in Italy. In the sixteenth century, French medals deemphasized erudite pairings of emblems and individual portraits in favor of standard images of French monarchs, and the function of such objects seems to be more closely centered on exchange with the royal court as a means of currying favor.[18] Mounting interest in portrait medals in mid-sixteenth-century France is epitomized by Guillaume Rouillé's *La premiere partie du promptuaire des médailles des plus renommées personnes [...]* (1553), which was dedicated to Marguerite of France, sister of the Duc de Berry, and features engravings of coins (some invented by Rouillé himself) with subjects ranging from Adam to Charles V to Soliman, emperor of Turkey **[Fig. 17: Guillaume Rouille]**.[19] Rouillé writes in a prefatory note to readers that such portraits recalled antique tradition, preserving together for posterity text and an image of each subject's face, "the most beautiful and most honest part of man."[20] Portrait medals were also linked to the academies that developed in late sixteenth-century France. As Frances Yates has shown, the first public French academy (*L'Académie de poésie et de musique*) produced medals for the admission of members.[21] While such medals with portraits of academicians survive, they do not bear members' *devises* on the reverse **[Fig. 18: French Academy Medal]**.[22] By the time the author of BnF Ms. Fr. 640 produced his manuscript, therefore, there was a well established demand for medals in France.

While the sand-casting recipe in BnF Ms. Fr. 640 is presented in a first person narrative that implies that all presented knowledge was achieved through direct experimentation, earlier published sources offer precedents for many of the techniques described by the author.[23] Numerous books printed in sixteenth-century Italy detail methods for sand casting that closely align with the recipe in BnF Ms. Fr. 640. In his *Pirotechnia* (1540), Vanocchio Biringuccio outlines the process of using a wax or clay model for the invention of one's design, which can be preserved by casting this model in plaster of Paris, a technique that allows for the reuse of both the original and plaster models.[24] Biringuccio offers multiple recipes for how to mold

such a model in a wooden box frame that has been filled with sand, a process that closely mirror the technique identified in the manuscript.[25] Similarly, Benvenuto Cellini discusses the casting of medals using a model made of wax in his *Due trattati*, which were published in Florence in 1568.[26] In comparison to the information presented in such historical accounts and treatises, the author of BnF Ms. Fr. 640 is far more detailed in explaining the merits of the various ingredients and referencing means whereby the readers can test whether their use of the ingredients matches his own. For example, the author explains that the water with two walnut-sized pieces of sal ammoniac should be "fairly salty." By presenting his text as a recipe, the author closely aligns himself with the tradition of Renaissance books of secrets. In his account of Renaissance books of secrets, William Eamon explains that the use of a "recipe" to record technical information was a common trait of books of secrets, distinguishing them from the "descriptive-historical" method that characterized authors such as Vanocchio Biringuccio.[27]

The casting of portrait medals can be viewed as part of a broader early modern interest in the transformation of materials. Along with knowledge of the heavens and understanding of the body, the ability to manipulate materials provided a key impetus for interest in the acquisition of knowledge about nature. Yet metallurgy and casting also remained a secretive endeavor during this time. Because expertise in metalworking frequently garnered the support and patronage of the nobility and royalty, the practitioner often saw it in his best interest to keep this knowledge secret and mine it for its potential social and political expediency. Biringuccio's *Pirotechnia*, however, discussed the technical details of mining gold ore openly within the framework of knowledge acquisition, dismissing craft secrecy as a duplicitous method of suggesting expertise and technique where it did not exist. From Biringuccio's characterization of this phenomenon, though, it is evident that secrecy was indeed a common trope in such works.[28] As an example, Bernard Palissy, the most well-known of French life-casting artisans, remained secretive concerning the specifics of his casts, the techniques of which can only be extrapolated from manuscripts such as our own.[29] The classification of knowledge as "secret" could be rhetorical at times, but it also conveyed a concern about sharing knowledge in a society without any copyright protection.[30] This designation was applied not only to esoteric knowledge, but also frequently to the techniques and skills of artisans and craftspeople, collectively termed *arcana artis*.[31]

Portrait medal casting recipes thereby fit into a larger corpus of books of secrets, the most famous of which was the book *Secreti del Reverendo Donno Alessio Piemontese*, first published in Venice in 1555 [Fig. 10: De Secreti

Alessio Piemontese, first published in Venice in 1555 **[Fig. 19: De Secreti Frontispiece]**.[32] The first French translation of the text appeared in Anvers only two years later, and within a decade the text had been published more than twenty times in Italian, French, Latin, Dutch, English and German. The *Secreti* are divided into six books, which were arranged somewhat thematically and included recipes for remedies, perfumes, preserved fruits and vegetables,[33] beauty secrets, dyes and inks, and metals. (While books of secrets generally display an interest in remedies and medical knowledge, BnF Ms. Fr. 640 records little of note in this regard; it betrays a comparative lack of focus on healing procedures when juxtaposed with Piemontese's *Secreti*. As noted in the annotation to fol. 48r ("Excellent Mustard"), the medicinal recipes in BnF Ms. Fr. 640 are limited to those on fols. 7v, 20v, 37r, 47r, 77r.

In 1567, Girolamo Ruscelli — best known as an important editor and literary figure in Venice[34] — claimed authorship of Piemontese's text in the prefatory letter of his posthumously published *Secreti nuovi di meravigliosa virtù del signor Ieronimo Ruscelli* **[Fig. 20: Ruscelli Frontispiece]**.[35] Presumably written prior to Ruscelli's arrival in Venice in 1548, the text offers new recipes to the original *Secreti*, claiming that the text is a product of experiments undertaken and of knowledge gained by Ruscelli and 27 fellow members of the "Accademia Segreta," although no other sources related to the academy are known.[36] As William Eamon and Françoise Paheau have shown in their study of the *Secreti nuovi*, the text contains a far higher number of medical recipes than the original *De Secreti* (1,024 in comparison to 108).[37] It seems possible that the author of BnF Ms. Fr. 640 was aware of Ruscelli's text, as he wrote the Latinized version of Ruscelli's name on the first page of the manuscript among a list of other classical and contemporary authors who presumably informed his writing **[Fig. 21: BnF Ms. Fr. 640, fol. 1r, Ruscelli]**.[38] It may also be that the Ruscelli's presumed authorship of Piemontese's text was commonplace knowledge at the time of the manuscript's writing.

A comparison of the recipe for sandcasting in BnF Ms. Fr. 640 to the *De Secreti* and Biringuccio's *Pirotechnia* reveals many parallels between the techniques described in the two processes, as well as a few differences, the most significant of which will be highlighted here.[39] The first has to do with the means of releasing the medal from the mold: Biringuccio recommends greasing the medal in animal fat, and applying charcoal dust to it.[40] Ruscelli notably does not recommend applying charcoal at all.[41] The author of the BnF Ms. Fr. 640, by comparison, stresses instead that any grease or oil on the medal should be *removed*, and charcoal should be applied at numerous stages in the mold-making process. Like the author of BnF Ms. Fr. 640, the *De Secreti* and *Pirotechnia* both place significant emphasis on drying the

molds over a fire, devoting no time in this section to the actual pouring of the medal.[42]

A final note of difference here is the type of sand required for the recipes. The sand casting recipe in BnF Ms. Fr. 640 advocates the use of old crushed molds in fols. 118v and 161r. Biringuccio and Ruscelli, by comparison, offer very detailed steps for different types of clay and powder that can be used in any combination for such an enterprise. Following the recipe for "The true and most perfect practice of molding medals," the *De Secreti* includes a list of seven different types of sand ("*Terra prima da gittarvi i metalli fusi*," "*Terra seconda*," "*Terra terza*," etc.) **[Fig. 22: De Secreti, Terre]**.[43] Still, the objective of such sands remains the same, that "the goodness and perfection of each sand in which to cast fused metals consists in the following: that they are very soft, as if impalpable, because the designs are imprinted very clearly."[44] Such information was carried through in later translations of the text.[45]

The author of BnF Ms. Fr. 640, however, was by no means unconcerned with the properties of casting "sands." Far from it. There are 41 recipes spread throughout BnF Ms. Fr. 640 with titles that indicate a recipe devoted exclusively to "sand," many of them indicating the ideal properties of sand, as well as where and how to procure it.[46] The differences among types of sand in such recipes attest to the many uses of this material within the workshop, as well as the clear attention the author paid to the ideal function for each variety of sand. It may be that the author of BnF Ms. Fr. 640 simply did not believe such diverse sands to be necessary to the production of medals, at least in this one instance. In the upper right margin of the folio with "Casting in a box mold," the author later inserted a recipe for "Excellent sand," which simply restates the value of sand made from crushed, used cores. One may hypothesize that the author found that this particular recipe of sand worked best for the sand casting of medals, offering a personal touch to a recipe that would otherwise have been well known among metal-makers in this period.

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1 Bibliothèque Nationale de France, Paris, Ms. Fr. 640 (henceforth cited as BnF Ms. Fr. 640), fol. 118v.

2 Pamela Smith and Tonny Beentjes have demonstrated that the manuscript likely dates from the last two decades of the sixteenth century. See Pamela H. Smith and Tonny Beentjes, "Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques," *Renaissance Quarterly* 63 (2010): 130, n. 4.

3 The manuscript makes reference to the use of "*alun de plume*," which translates to feather alum, according to a definition provided in a 1611 French-English dictionary by Randle Cotgrave. See the entry for "*alun de plume*" in Randle Cotgrave, *A Dictionarie of the French and English Tongues* (London: Adam Islip, 1611).

4 On the reuse of sand in molds, see the following online data sheet: CWC, Managing Partner of the Recycling Technology Assistance Partnership (ReTAP), "Technology Brief: Beneficial Reuse of Spent Foundry Sand," August 1996, http://infohouse.p2ric.org/ref/05/04013.pdf.

5 See E.H.S. Bailey, "'Feather Alum' from Colorado," *Transactions of the Annual Meeting of the Kansas Academy of Science* 12 (1889-90): 101.

6 The recipe on fol. 111v calls for sal ammoniac balls the size of chestnuts. Under the heading "Sal ammoniac water," the author writes: "You need two chestnuts [*chastaignes*] of sal ammoniac which is crushed into a water pot, when you taste it should not be too much salted." The translation of *noix* as walnuts follows the definition of this term provided in the French-English dictionary of 1611 by Randle Cotgrave. See the entry in Cotgrave, *A Dictionarie of the French and English Tongues*.

7 "*J'ay souflé ma medaille & l'ay moulée, et la femelle du chassis estant remplye,*

j'ay marqué & faict une ligne sur le revers & bort de la medaille & sur le sable prochain aussy."

8 Thanks for these translations are given to Heather Wacha, who indicated them in the comments section of the online edition of the manuscript.

9 A collection inventory of 1413 references the presence of medals depicting Constantine the Great and Hercules. Medals made with the

repoussé technique are composed of two hammered plates soldered together. On the origin of portrait medals and the two medals in the collection of the Duc de Berry, see the entries by Stephen Scher in Stephen Scher, ed., *The Currency of Fame* (New York: Harry N. Abrams, Inc., Publishers, in association with The Frick Collection, 1994), 13-16, 32-37.

10 Within the vast literature on Italian medals, see especially Lore Börner, *Die italienischen Medaillen der Renaissance und des Barock (1450 bis 1750)* (Berlin: Gebr. Mann Verlag, 1997); John Graham Pollard, *Renaissance Medals. Volume I: Italy* (New York and Oxford: Oxford University Press, 2007).

11 On the technical processes of making pilgrimage badges, see Brian Spencer, *Pilgrim Souvenirs and Secular Badges* (London: The Stationery Office, 1998), 7-13. On the production of medals in fifteenth-century France, see Fernand Mazerolle, *Les médailleurs français du XVe siècle au milieu du XVIIe* (Paris: Imprimerie Nationale, 1902-4): I: vi-xii, 3-8; II: 1-9; III: pls. 1-3.

12 The two earliest surviving manuscripts of Cennini's text diverge in their description of which materials could be used for the making of molds for medals. The manuscript in the Biblioteca Riccardiana lists *terra* (clay) while the manuscript in the Biblioteca Mediceo-Laurenziana lists *ciera* (wax). See Cennino d'Andrea Cennini, *The Craftsman's Handbook. The Italian "Il libro dell'arte,"* trans. by Daniel Thomspon, Jr. (New York: Dover Publications, 1960), 130.

13 Pisanello's contribution to the genre of medals was well-known in the Renaissance, as Vasari cites a letter by Giovanni Paleologo Il Giovio in praise of Pisannelo in his *Vite*: "Costui fu ancora prestantissimo nell'opera de' bassi rilievi, stimati difficilissimi dagl'artefici, perché sono il mezzo tra il piano delle pitture e 'l tondo delle statue. E perciò si veggiono di sua mano molte lodate medaglie di gran principi, fatte in forma maiuscola della misura propria di quel riverso che il Guidi mi ha mandato del cavallo armato." See Giorgio Vasari, *Le vite de' più eccelenti pittori, scultori e architettori*, ed. Gaetano Milanesi (Florence: Sansoni, 1906), III: 10-11. On Pisanello and the production of portrait medals, see especially Luke Syson and Dillian Gordon, *Pisanello: Painter to the Renaissance Court* (London: National Gallery Company, distributed by Yale University Press, 2001), 109-30; Beverly Louise Brown, "Portraiture at the Courts of Italy," in *The Renaissance Portrait from Donatello to Bellini*, ed. Keith Christiansen and Stefan Weppelmann (New York: The Metropolitan Museum of Art, Distributed by Yale University Press, 2011), 26-47.

14 On the use of *imprese* in medals, see especially Kristen Lippincott, "'*Un*

Gran Pelago": The Impresa and the Medal Reverse in Fifteenth-Century Italy," in *Perspectives on the Renaissance Medal*, ed. Stephen Scher (New York and London: Garland Publishing, Inc., 2000), 75-96.

15 Ulrich Pfisterer, *Lysippus und seine Freunde. Liebesgaben und Gedächtnis im Rom der Renaissance oder: Das erste Jarhunder der Meaille* (Berlin: Akademie Verlag, 2008), 221-57.

16 Whether medals could also function as actual currency rather than as social currency is a well-debated topic. See, for example, Andrea Saccocci, "Funzioni monetarie della medaglia," in *Le stagioni della medaglia italiana. Atti del sesto convegno internazionale di studio sulla storia della medaglia 17-19 dicembre 1998*, ed. Giovanni Gorini (Padvoa: Editoriale Programma, 2001), 57-68. On the function of precious metals as a material for currency versus as an object of material production in sixteenth-century France, see Rebecca Zorach, *Blood, Milk, Ink, Gold: Abundance and Excess in the French Renaissance* (Chicago and London: The University of Chicago Press, 2005), 196-208.

17 Jones claims that until 1550, the making of medal remained "a provincial Italian rather that specifically French cultural phenomenon." See Mark Jones, "Medal-Making in France 1400-1650: The Italian Dimension," *Studies in the History of Art* (1987): 57-71 (64).

18 In the seventeenth century, the use of emblems or *devises* became more common in French medals. See Mark Jones, "Medals and devices in seventeenth century France," in *Medaglisti e committenti. Il ruolo della committenza nella creazione della medaglia. Atti del quinto convegno internazionale di studio sulla storia della medaglia. Udine 8-11 giugno 1984* (Padova: Editoriale Programma, 2002), 37-46. On portrait medals in sixteenth and seventeenth century France broadly, see especially George Hill, *Medals of the Renaissance*, ed. Graham Pollard (London: British Museum Publications Limited, 1978), 130-42; Jones, "Medal-Making in France"; Scher, *The Currency of Fame*, 305-43; John Graham Pollard, *Renaissance Medals. Volume II: France, Germany, The Netherlands, and England* (New York and Oxford: Oxford University Press, 2007), xxvi-xxix.

19 Guillaume Rouillé, *La premiere partie du propmptuaire des médailles des plus renommés personnes qui ont esté depuils le comencement du monde: evec brieve descrpition de leurs vies & faicts, recueillie des bons auteurs* (Lyon: Guillaume Rouillé, 1553). The enduring popularity of this text is evidenced by its reprinting in 1577. On Rouillé and the broader Renaissance tradition of anthologizing portrait medals, see Francis Haskell, *History and its Images: Art and the Interpretation of the Past* (New Haven and London: Yale University

and the Interpretation of the Past (New Haven and London: Yale University Press, 1993), 26-36.

20 "*la tresbelle, & treshonneste partie de l'homme*." See Rouillé, *La premiere partie*, fol. 3^{r}.

21 See Frances Yates, *The French Academies of the Sixteenth Century* (London: The Warburg Institute, 1947), 22. In the production of emblems, the French term *devise* is understood to substitute the Italian term *motto*, which constitutes the short Latin phrase that was part of an emblem. See Henri Zerner, *Renaissance Art in France: The Invention of Classicism*, trans. Deke Dusinberre, Scott Wilson, and Rachel Zerner (Paris: Flammarion, 2003), 89.

22 Yates, *The French Academies*, 22, n.2.

23 This essay will set aside the question of what information the author may specifically have gleaned from oral conversations with other artisans.

24 Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio. The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. and ed. by Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), 232-33.

25 *Ibid*, 234-38, 326-27.

26 Benvenuto Cellini, *Due trattati uno intorno alle otto principali arti dell'oreficeria. L'altro in materia dell'arte della Scultura; dove si veggono infiniti segreti nel lavorar le Figure in Marmo, & nel gettare di Bronzo* (Florence: Valente Panizzij, & Marco Peri, 1568), 19-20.

27 See William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994), 131.

28 Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001), 181.

29 Hanna Rose Shell, "Casting Life, Recasting Experience: Bernard Palissy's Occupation between Maker and Nature," *Configurations* 12:1 (2004): 9.

30 Daniel Jütte, "Trading in Secrets," 682.

31 *Ibid*, 683. See footnote 62, where Jütte notes that porcelain

31 *Ibid*, 335. See footnote 32, where Sutte notes that porcelain manufacturers in eighteenth-century Dresden were kept under strict surveillance and forbidden from sharing their craft secrets.

32 Alessio Piemontese, *Secreti del Reverendo Donno Alessio Piemontese* (Venice: Sigismondo Bondogna, 1555).

33 There are many recipes related to fruits – preserved fruits, sugar-coated fruits, and others in BnF Ms. Fr. 640. The recipe for preserved melon has an interesting borrowing from the Tuscan dialect.

34 On Ruscelli's role as an editor, see Brian Richardson, *Print Culture in Renaissance Italy: The Editor and the Vernacular Text 1470-1600* (Cambridge: Cambridge University Press, 1994), *passim*.

35 Girolamo Ruscelli, *Secreti nuovi di meravigliosa virtù del signor Ieronimo Ruscelli* (Venice: Gli heredi di Marchiò Sessa, 1567).

36 On the text, see John Ferguson, "The Secrets of Alexis. A Sixteenth Century Collection of Medical and Technical Receipts," *Proceedings from the Royal Society of Medicine* 24 (1931): 225-46; William Eamon and Françoise Paheau, "The Accademia Segreta of Girolamo Ruscelli: A Sixteenth-Century Italian Scientific Society," *Isis* 75, no.2 (1984): 327-42.

37 Eamon and Paheau, "The Accademia Segreta," 335.

38 BnF Ms. Fr. 640, fol. 2r.

39 For an excellent overview of the processes described in the *Pirotechnia* and *De Secreti*, see Patricia Tuttle, "An Investigation of the Renaissance Casting Techniques of Incuse-Reverse and Double-Sided Medals," *Studies in the History of Art* 21 (1987): 205-212.

40 Biringuccio, *Pirotechnia*, 326.

41 Tuttle has rightly observed the oddity of this omission, given the need for charcoal to help the molds separate (Tuttle, "An Investigation," 206).

42 "Having brought them [the molds] to this point, finally cast them in whatever metal you wish," Biringuccio blithely concludes. See Biringuccio, *Pirotechnia*, 327.

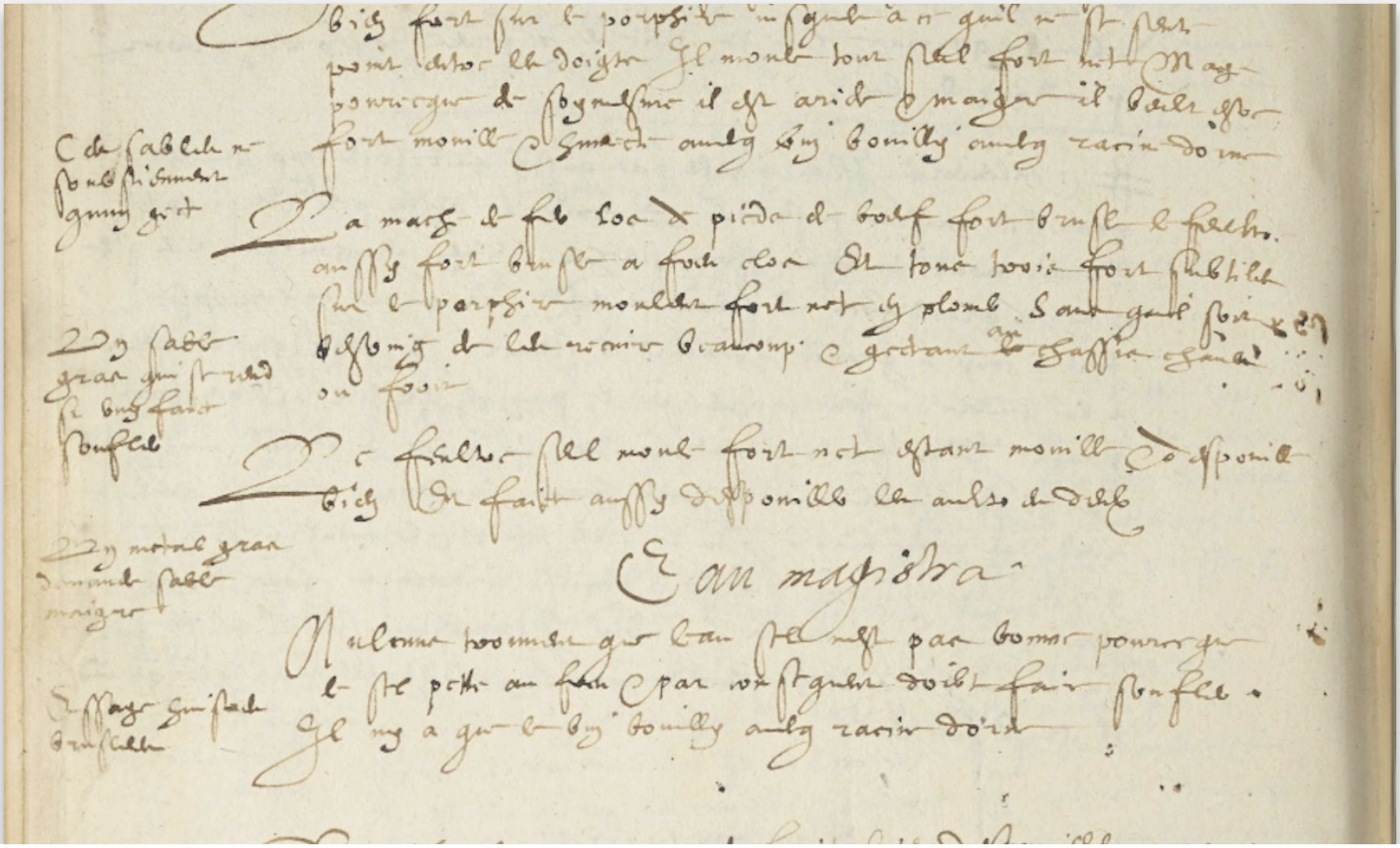
43 The full title of the recipe is: "*La vera et perfettissima pratica di gittar medaglie, & ogni altro lavoro di rilevo basso, così in bronzo, come in oro, argento*

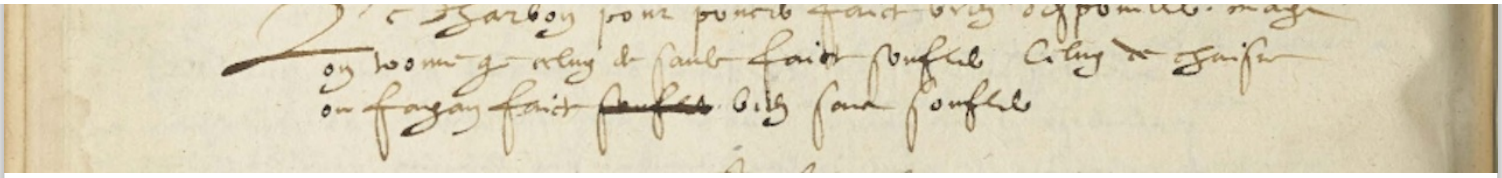
medaglie, & ogni altro lavoro di rilevo basso, così in bronzo, come in oro, argento, rame, piombo, stagno, & ancor di cristallo, di vetro, & di marmo" (Piemontese, *De Secreti*, 205).

44 "*La bontà & perfettione di ciascuna terra da gittarvi dentro metalli fussi consiste in queste cose, cioè che principalmente sieno sottilissime, & come impalpabili, perche i disegni vengano improntati nettissimi*" (Piemontese, *De Secreti*, 206).

45 An English version of the *De Secreti* repeats such information, noting that the sand should be "fine and small, and in no ways rough, or full of grommel." For the relevant recipes, see Alexis of Piedmont, *The secretes of the reverende mayster Alexis of Piemovnt . Conteinyng many excell t remedies against dyuers diseases, woundes, and other accidentes. with the manner to make distillations, parfumes, confitures, dyinges, colours, fusions, and meltings. A worke wel approued, verye profytable and necessary for euery man*, trans. by Wyllyam Warde (London: 1559), fols. 133v-134v.

46 Such a count includes only recipes about sand and excludes recipes on how sand can be used. See fols. 41r, 49r, 67r, 67v, 69r, 71v, 81r, 81v (two recipes), 82v, 83r (four recipes), 84r, 84v (two recipes), 85v (two recipes), 86v, 87r, 87v (two recipes), 88v (two recipes), 89r, 89v, 90r (two recipes), 92v, 93r (two recipes), 99r, 111v, 117v, 118v, 120r, 132v, 134r, 160r, 164v.





Calcined Oysters_84v

July 1, 2015 mkp-admin 2014_Fall, Annotation
Leave a comment

Transcription [from tc_p084v]

<title id="p084v_a2">Eau magistra</title>

<ab id="p084v_b2a">Aulcuns trouvent que leau sel nest pas bonne pourceque<lb/>

le sel pette au foeu & par consequent doibt faire soufler<lb/>

Il ny a que le vin bouilly avecq racine dorme</ab>

<ab id="p084v_b1d">Le charbon pour poncer faict bien despouiller mays<lb/>

on trouve que celuy de saule faict soufler celuy de chaisne<lb/>

ou fayan faict soufler bien sans soufler</ab>

<note id="p084v_c1">Essaye huitres bruslees</note>.[1]

Translation [from tl p084v]

<title id="p084v_a2">Eau Magistra</title>

<ab id="p084v_b2a">Some people think that salt water is not good, because the salt releases gas when heated and as a result causes bubbles. [In this case], there is only wine boiled with elm root.</ab>

<ab id="p084v_b2b">Sanding charcoal makes [things] come off well. But one finds that willow charcoal creates bubbles, but oak or beech charcoal does the job without making bubbles.</ab>

<note id="p084v_c2">Try burnt oysters.</note>.[2]

<note id="p084v_c2">Try burnt oysters.</note>.[2]

Calcined Oysters: Investigating Oysters, Calcination and Marginalia

The recipe on folio 84v of BnF Ms. Fr. 640 titled “Eau Magistra” briefly describes a process of making a binding agent from elm root and wine, which we explore in a separate entry. However, this recipe includes a marginal note next to the main body of the texts that reads “Try burnt oysters [Essaye huitres bruslées].”[3] As it turns out, these three words are dense with information.

The note is embedded within two sections of the text: this recipe on *eau magistra,*[4] and a collection of marginal notes on sand for sand casting that can be read together in the left margin of the text as an addition to the previous experiment on the page, “Sand [Sable].”[5] The reader’s perception of the location within the text directly determines the interpretation of the recipe. If perceived as belonging to the other marginalia in a vertical column, the injunction to “try burnt oysters” is located within a context of different types of sand. If perceived horizontally with the main body of the text, it belongs to the recipe for Eau Magistra.[6]

The puzzle of which recipe “burnt oysters” belongs to is further compounded by the fact that the only two other references to oysters present in BnF Ms. Fr. 640 interestingly also both appear as marginal notes. A note on fol.80v in the recipe “Casters of small tin work” reads, “Try calcinated [*calcinèe*] oyster shells; they are said to be excellent for moulding.”[7] On fol. 49r, next to a recipe entitled “Lead casting,” another note mentions oyster shell, though the meaning is less clear: “*Poncet*. They cast by soldering [using what] the glass-makers use. Lump [of metal] of… Calcinated [*calcinèe*] oyster shell.”[8] These additional suggestions raise issues concerning whether their peripheral placement in the text is significant. What is their relationship to the text? Should we consider these in the light of Michael Camille’s work which has called attention to both the value of marginalia and the relationship between the author and reader of a text?[9] Much recent scholarship explores the early modern reader’s interaction with texts by way of notes, annotations, and images in marginalia, making clear the diverse functions of marginal notes, from directing attention to particular sections, to exegesis, to engaging in dialogue with the author.[10] However, questions of authority and mediation are further complicated in the marginalia of BnF Ms. Fr. 640 because the author is both reader and writer (and practitioner). In this case, the marginal writing may reflect a second or later iteration of his experiments or a reflection on his experience. Did the author-practitioner of BnF Ms. Fr. 640 actually try to work with oyster shells, or did he observe someone else

perform this technique?[11] If they are untested suggestions, should they be considered as an invitation to experiment?[12] If so, this implicitly raises the issue of the manuscript's intended audience. This line of inquiry may help shed light on the larger mystery of the author's identity and profession.

Reconstructing Marginalia

To determine the best interpretation of the recipe, we decided to reconstruct it using both readings. [fig. 1] Two of the notes refer to calcination ("*calcinées*"), while the third note speaks of burning ("*bruslèes*"). In order to determine whether these were separate processes, we needed to find out what exactly calcination was. In Cotgrave's 1611 French dictionary, four entries refer to calcination. *Calciné* is defined as "calcinated, turned into dust, reduced by fire, unto pouder;" the verb *calciner* means "to calcinate, burne to dust, reduce unto pouder, by fire, any mettal or minerall.[13] It seems that the calcined materials were often used in sand casting, but little information on the actual process of calcination—besides applying heat or fire—can be found in the manuscript or other early modern sources. What preparation did we need to do in order to calcine the oyster shells? How should the shells be prepared and heated (i.e. at what temperature, and for how long?). What type of transformation or transition would the oysters undergo?

BnF Ms. Fr. 640 makes mention of calcination is several places. On fol.100r of the manuscript in the recipe "Vitrified saltpeter," the author describes calcining other stones, suggesting that different heat sources and processes can lead to different levels of purification.[14] In the recipe for "Grafting" on fol. 91r, a marginal note reads, "When the lead gets too hot, it calcinates."[15] On fol. 83r in a recipe about sand, the author directs the reader to "[Take] finely crushed slate and pumice stone mixed together. Calcinate them three times in a covered and sealed pot in strong fire, and each time dilute them with urine."[16] Other materials that are listed as calcined include stone, glass, bone, and shells. A recipe on fol. 92v about river tellins and mussel shells tells us that "The long shells that can be found in rivers of fresh water, being calcinated, make a white and very fine [*impalpable*] sand which moulds very clean."[17]

We encountered information that provided some point of reference for our own calcination undertakings (albeit obliquely) from modern sources. In current scientific scholarship, oyster shells have been the subject of study due to both the problem of shells in landfills, as well as their potential antifungal properties. Raw oyster shells principally consist of calcium carbonate ($CaCO_3$), while calcination of oyster shells yields calcium oxide

(CaO).[18] The “optimal temperatures for calcination” in one modern calcination experiment is “900°-950°C” (1472°-1562°F).[19] Another experiment exposed oyster shells to 1050°C (1922°F) and reported that the resultant powder had “turned completely into CaO after the treatment,” and that in order to produce this result, the “shell was washed several times and dried in an oven at 60°C (140°F) for twenty-four hours.”[20]

To prepare our oyster shells, we boiled them in water and cleaned them by removing any remaining adductor muscle.[21] We then removed the barnacles and other attached shells with hammers and pliers. After the shells had been rinsed in water several times, we contained the shells in a large towel and broke them into smaller pieces with a hammer. We attempted the calcination several times: the first time, we used a small jewelry kiln heated to 1500°F, exposing just a few pieces of shell to the heat.[22] After ten minutes, the shells had turned to white, slippery ash.[23] The next several attempts at calcination were done with a much larger ceramic kiln.[24] After several attempts, in which we were able to produce a crushed oyster ash that was gray in color, though not fully calcined,[25] the shells finally calcined after heating them over a 9-hour period, in which they reached a temperature of 1800°F for an hour. The resulting powder was smooth and silky, and quite similar in feel to talcum powder. In the pseudonymous Alessio Piemontese’s contemporaneous *De Secreti*, this kind of sand—“very soft, as if impalpable”—is described as perfect for casting.[26]

This was the material we used to conduct our two experiments: in the first, we interpreted the oyster ash as an ingredient in a binding agent used to moisten a sand in a sand-casting process; in the second, we used the oyster ash as the sand itself.

In the first process, the calcined-oyster-wine decoction, we wanted to examine the performance of the decoction as a binder in comparison to the other binders tested.[27] Modelled after the procedure for creating the elm root infusion in fol. 84v “Eau Magistra,” we boiled two teaspoons of calcined oyster shells with one cup of inexpensive Cabernet Sauvignon on a hot plate. Upon contact with the wine, the powder immediately turned a teal green, then briefly became a clear emerald green, which then transitioned into a dull, opaque olive green—this was perhaps an oxidation reaction that produced these dramatic color changes. [fig. 2, fig. 3, fig. 4] We poured the mixture into an airtight glass container. After a few minutes, the mixture separated into a watery brown liquid on top and a muddy green mixture on the bottom. A half cup of this emulsion was then added to two cups of sifted sand and used for sand casting.

In preparing our sand for this casting, we pulverized and then sifted pre-

In preparing our sand for this casting, we pulverized and then sifted pre-used molds made of a 2:1 mixture of plaster and pulverised bricks. After stirring the decoction to reconstitute the suspension of the ash particles in the wine, we gradually added approximately half a cup total of calcined oyster wine infusion to two cups of sifted sand. It was easy to achieve the desired texture for sand casting; the mixture would hold together when squeezed into the palm of the hand, but dissolved with the pressure of a fingertip.[28] [fig. 5] We built the mold around a plaster pattern dusted with charcoal, and the resulting pattern was crisp and clear.[29] [fig. 6] A day later, the mold was dry and ready for the metal pour. We poured molten tin into the mold and the resulting cast object was extremely fine in its detail—indeed, the best cast accomplished in our research. [fig. 7] The mold, however, did not survive; it broke apart and thus was only usable once. [fig. 8] Our test of this recipe produced one of the desiderata of a good "sand"—fineness of impression—but not the concomitant durability.

In our second experimental process, we used the sifted calcined oysters as the sand. Two cups of calcined oysters were mixed with the whipped egg whites of two eggs. This did not seem to moisten the oyster shell "sand" sufficiently; the sand seemed to absorb the moisture much more quickly that the brick dust molds—it would not ""clump" enough to be a useful packed mold material. Out of eggs in the lab, we used some of the remaining elm root emulsion we had on hand.[30] We kept adding this until the mixture would "clump", but then the mixture had the qualities of being wet and dry at the same time; the calcined oyster shells seemed "dry", but when squeezed, water would come out. It was as if they were both absorbing and repelling the water. [fig. 9, fig. 10]

We made our box mold according to the sand-casting process described in BnF Ms. Fr. 640 on fol.118v, building the wet sand around a plaster pattern and leaving the mold to dry.[31] We placed extra sand in a plastic cup. Unexpectedly, when we checked on our mold several days later, the sand had expanded out of the frame into a useless, dry pile—the calcined oyster shells had turned to "quicklime." The exothermic reaction that occurred when the lime present in the CaO reacted with moisture from the air resulted in a mold that "puffed up" and disintegrated. The heat of the exothermic reaction melted and deformed the plastic cup in which we had stored the extra sand. We could not use either the mold or the sand for a metal pour. [fig. 11]

In retrospect, the successful sand-casting of our first experiment using oyster ash as a liquid binder indicated that the fine oyster ash might have mixed with the brick dust and plaster of pulverized molds from previous castings to produce a finer sand that resulted in the fine impression.[32] The

manuscript does not say explicitly to mix the oyster shells with another sand, but this is how the successful cast worked; the oxidation reaction that produced the brilliant green color in the wine perhaps holds the key to the success of the experiment. The calcined oyster shells had already been exposed to moisture, so they had already undergone a reaction. Meanwhile, the wine still acted as a binding agent in the mold.[33] It would be interesting to determine if the oyster ash that produced the exothermic reaction could be used again as a sand in a box mold; perhaps this sand would be capable of hardening and maintaining an impression in which to cast metal. Further experimentation with oyster ash is certainly worth pursuing.

In conclusion, a hands-on approach in the laboratory, paired with textual research and analysis enabled us to explore the ways in which the oyster marginalia might illuminate the compilation of the text and the author's role as both writer and reader of his own text. Our findings suggest that the author knew or speculated about the promising properties of oyster shells, but he had yet to perfect a procedure for their successful use. The presence of distancing language, phrases such as "try" or "it is said to be..." indicate that the author was less personally familiar with the use of oyster shells as a material. Perhaps he heard it suggested or had observed the properties of calcined oyster shells in another context. But unlike other more confidently phrased imperatives, such as, for example, in "Casting in a box mold" on fol. 118v where the author writes in the first person, on fol. 84v he offers no tips, warnings, or reminders that would suggest a hands-on-familiarity with the processes. Perhaps these notes were untested by the author and instead intended as suggestions for future experiments, as seems to be the case with a list of processes on fol. 169r in which the author-practitioner appears to differentiate between processes he has "seen" and included in the manuscript and those he aspires to try.

Emogene Cataldo, Julianna Van Visco

List of illustrations

Figure 1: Detail of Bnf. Ms. Fr. 640, folio 84v. Note the placement of the note "Essaye huitres bruslées," which is the last marginal note on the right side of the folio.

Figure 2: The white calcined oyster powder turned green immediately upon contact with the red wine.

Figure 3: Once on the hot plate, the mixture turned a brilliant emerald green, and then a lighter, more opaque green.

Figure 4: Once the mixture turned a dull, olive green, it did not change. After being poured into a glass container, the mixture separated into a green substance and a red-brown liquid.

Figure 5: Applying the "squeeze test" mentioned in 118v, "Molding in a box frame." The mixture can be squeezed together, but readily falls apart after applying slight pressure with a fingertip.

Figure 6: The fine, detailed impression of the mold.

Figure 7: The resulting tin cast from the mold; the black substance is from smoking the mold with a flame before pouring the molten tin.

Figure 8: After one cast, the edges around the mold fell apart, making it unable to take a second cast.

Figure 9: Notice the moisture on the table after packing the calcined oyster sand mold.

Figure 10: While other sands might fall in the middle of these scales, the calcined oyster shell sand was dry, prone to crumbling, yet both absorbed and repelled moisture.

Figure 11: The oyster shell mold produced an exothermic reaction, resulting in the expansion of the sand, which was completely dry and produced no salvageable impression.

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1 Marc Smith, Professor of Paleography, École des chartes, has noted that this marginal note does not necessarily belong to the “Eau Magistra” entry, but rather part of the preceding entry titled “Sand” [*“Sable”*].

2 See note 1.

3 BnF Ms. Fr. 640, 84v, “Eau Magistra.”

4 See Cataldo and Visco, “Eau Magistra”: Investigating Binders for Sand-casting.”

5 BnF Ms. Fr. 640, 84v, “Sand.”

6 See Cataldo and Visco Field Notes, 14-15 October 2014, “Sand casting,” for further details on sand-casting recipes.

7 BnF Ms. Fr. 640, 80v, “Casters of small tin work”

8 BnF Ms. Fr. 640, 49r, “Lead casting”

9 See Michael Camille, *Image on the edge: the margins of medieval art*

(Cambridge, MA: Harvard University Press, 1992).

10 For more on reading as a visual mode see William H. Sherman, *Used Books: Marking Readers in Renaissance England* (Philadelphia, PA: University of Pennsylvania Press, 2009), and Ann Blair, *Too Much To Know: Managing Scholarly Information before the Modern Age* (New Haven: Yale University Press, 2011).

11 For an early modern perspective on observing workshop practices, see T.L. Davis, *The Life of Denis Zachaire: An account of an alchemist's life in the sixteenth century* (Edmonds, WA: The Alchemical Press, 1993). Hugh Plat also observed and collected workshop practices and recipes.

12 On this point, see William Eamon's discussion of recipes as "prescriptions for an experiment," William Eamon, *Science and the Secrets of Nature* (Princeton University Press 1994), p. 194, and his more recent critical reflections on recipes as straightforward instructions for action: William Eamon, "How to Read a Book of Secrets," in *Secrets and Knowledge in Medicine and Science, 1500 -1800,* eds. Elaine Leong and Alicia Rankin. (Aldershot: Ashgate Publishing Limited, 2011).

13 See Randle Cotgrave, *A Dictionary of the French and English Tongues* (London: Adam Islip, 1611), s.v."c*alcination*," "*calcinatoire*," "*calciné,*" and "*calciner*."

14 Bnf. Ms. Fr. 640, 100r, "Vitrified saltpeter."

15 Bnf. Ms. Fr. 640, 91r, "Grafting": "Quand le plomb chaufe trop, il se calcine." Marginal note.

16 Bnf. Ms. Fr. 640, 83r, "Other sand": "Charbon de sarment & terre argille bien tamisée tant d'un que d'aultre, & le joindre ensemble avecq glaire d'oeuf bien battue, puys le faire calciner dans le four, & pour en user le destremper en vinaigre."

17 BnF Ms. Fr. 640, 92v, "Sand of river tellins and mussels": "Les coquilles longues qui se trouvent aulx rivieres d'eau doulce, estant calcinées, font un sable blanc impalpable qui moule fort net."

18 CaO (s) + H2O (l) Ca(OH)2 (aq) (Hr = −63.7 kJ/mol of CaO). For more on the chemistry of slaked lime, see Bassam Z. Shakhashiri, "Lime: Calcium Oxide CaO," in "*Science is Fun*," University of Wisconsin, Madison. Accessed 19 December 2014,

<http://scifun.chem.wisc.edu/chemweek/PDF/LIME_CalciumOxide.pdf>

19 See Jong-Hyeon Jung, Kyun-Seun Yoo, Hyun-Gyu Kim, Hyung-Keum Lee, "Reuse of waste oyster shells as a SO2/NOx Removal Absorbent," *Journal of Industrial and Engineering Chemistry*, 13.4 (2007) 512-517. doi.

20 Ronge Xing, Yukun Qin, Xiaohong Guan, Song Liu, Huahua Yu, Pengcheng Li, "Comparison of antifungal activities of scallop shell,oyster shell and their pyrolyzed products", *Egyptian Journal of Aquatic Research* 39 (2013) : 83-90.I Available online 5 September 2013. *doi*: 10.1016/j.ejar.2013.07.003.

21 Many thanks and sincerest gratitude to Donna Bilak, Ph.D., for procuring these shells from the Grand Central Oyster Bar, boiling them, and helping us remove barnacles and prepare them for calcination.

22 We were able to do this thanks to Jeanette Caines, who allowed us to use her small kiln at the Jewelry Arts Institute in midtown Manhattan and was an invaluable resource for guiding this reconstruction.

23 We tried also to calcine a whole shell, but the shell exploded in the kiln. See Cataldo and Visco Field Notes, 5 November 2014, "Calcinating oyster shells trial run."

24 We used a Paragon Dragon kiln (24 x 24 x 19 inches). We are grateful to Julia Walther, professional ceramicist, and her advice on operating kilns.

25 Fully calcined oyster ash is slippery and white in color. See Cataldo and Visco Field Notes, 24 November 2014, "First kiln attempt" as well as 5 December 2014, "Successful oyster calcination."

26 Alessio Piemontese, *Secreti del Reverendo Donno Alessio Piemontese* (Venice: Sigismondo Bondogna, 1555), p. 206. See also the annotation on fol. 118v (Raymond Carlson and Jordan Katz).

27 See Cataldo and Visco's annotation on binders, as well as Bnf. Ms. Fr. 640, fol. 84v, "Eau Magistra."

28 For the "squeeze test" specified by the author, see BnF Ms. Fr. 640, fol. 118v, and its analysis by Emogene Cataldo and Juliana van Visco in their annotation on "Eau Magistra," discussing, among several binder recipes, fols. 82r and 84v.

29 These were skills and processes we learned during the residency of

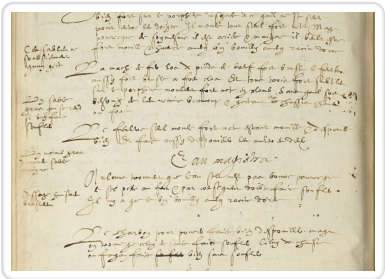
expert maker, T.P.C. (Tonny) Beentjes of University of Amsterdam.

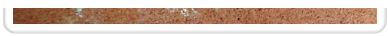
30 This substitution seemed to be very much in the spirit of the manuscript and the Making and Knowing project. As William Eamon has written, “Even if some writers of books of secrets — Isabella Cortese and Leonardo Fioravanti, for example — discouraged readers from deviating from their instructions, readers did not shy away from experimenting with ingredients and procedures, substituting ingredients, changing the amounts specified, and even pronouncing them useless in their experiments found them so.” William Eamon, “How to Read a Book of Secrets,” in *Secrets and Knowledge in Medicine and Science, 1500 -1800,* eds. Elaine Leong and Alicia Rankin. (Aldershot: Ashgate Publishing Limited, 2011), 34.

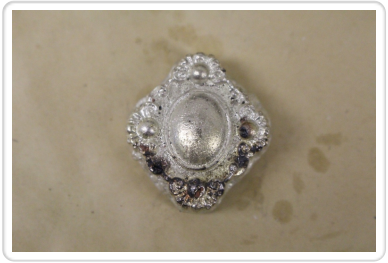
31 We are grateful for the expertise of Tonny Beentjes, Programme leader metals conservation, University of Amsterdam, who guided us as we reconstructed sand casting techniques from Bnf. Ms. Fr. fol. 118v, “Casting in a box mold” in the Craft and Science Laboratory Course Fall 2014.

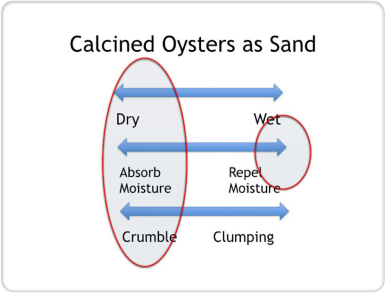
32 See Fall2014Annotation_CataldoVisco_Binder

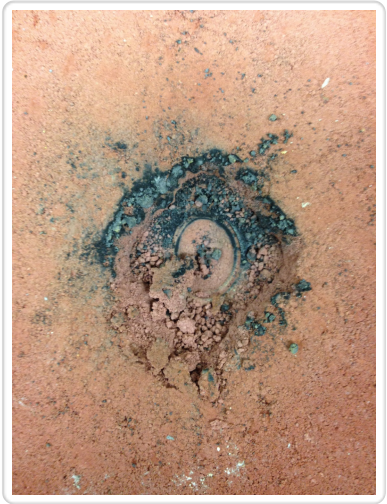
33 Biringuccio suggests that wine alone can be used as a binder in sand casting. See Vannoccio Biringuccio, *The Pirotechnia of Vannoccio Biringuccio. The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, trans. and ed. by Cyril Stanley Smith and Martha Teach Gnudi (New York: Dover Publications, 1990), 328. On folio 69r in the recipe “Sand,” the manuscript author also mentions wine alone as a binding agent for sands in casting processes.











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