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Annotations Research - G8906 Craft and Science

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029r - *Stucco for Moldings* and 076v - *Making cheap and very beautiful gold color*

- Preliminary List of Ingredients and Special Equipment:
  - 029r:
    - Tragacanth Gum;
    - Water;
    - Rye Flour;
    - Linseed oil - The recipe calls for cane oil, AKA calamus oil derived from the *Acorus calamus* root, however cane oil is toxic and is banned in the US (See http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=189.110).
    - white glue -
  - 076v:
    - Oranges – What kind? Where from? [More research needed];
    - Sulphur;
    - Very clean mortar;
    - Flask of glass;
    - a cellar of wet place;

- Discussion:

  - Recipes 029r – *Stucco for Moldings* and 076v – *Making Cheap and Very Beautiful Gold Color* will be experimented with in order to be use as an entry point in which to discuss issues related to cost and the economics of the manuscript. 029r states, “Then, apply some white glue or [...] glue as you want, and you will be able to paint them, ornate them with gold and other colours.” Thus these two experiments will be combined to produce one series of objects.

  - It would be of little consequence to establish that the author would be interested in decreasing the cost of his inputs, while maximizing his outputs. Anyone engaged in profit making enterprises would be naturally inclined to do so. What is of interest is how he sought to achieve this goal and what this can tell us about how he interacted with his material inputs, manufacturing processes and his market audience. Of course, it is understood that not all of these questions can or will be answered, but it they should be kept in mind when conducting the reconstructions, in order to tease out as much as we can about.

  - Specifically concerning material inputs, where was he willing to cut costs and how? Was he willing to sacrifice appearance or quality in order to reduce costs?

If he had to choose between costs and appearance, which would he choose? He often mentions the scarcity of materials and suggests alternatives. What are the economics that are driving this need for alternatives and experimentation? Did he achieve the results he desired?

- Concerning processes, how concerned was he in reducing the costs or steps of production? Did he streamline steps in order to save costs? Did he expand or add steps in certain recipes that would not have normally been present? What does an expansion of the process tell us about his values?
- What can his interaction with material inputs, manufacturing processes tell us about his customers? How important was quality to them? How important was cost? What does this say about their status? Did he even have customers, as we conceive of them today? Did he have a patron?
- What currencies was he using and what can this tell us about him interacting with the market for inputs and outputs? What is the geographical reach of these currencies?
- Currencies or currency denominations mentioned in the manuscript: ecu, reals, escu, ecuelle, livre, cents, mark, pounds, sols

• Related recipes (not a complete list):

- In these recipes he suggests alternatives for inputs with the aim of reducing costs:
  - 004v - Black varnish for sword guards, [metal] bandanas for chests, etc.; 165r - Dragon's blood;
- These recipes seek to modify processes of production procedures in order to save on cost:
  - 162r - Iron vase assembled and soldered; 124r - Core for molding hollow;
- These recipes provide insight into the methods and materials he is using to imitate other materials and the choices he was making between costs and appearance:
  - 003r - Imitation coral; 010r - Imitation jasper; 010r - Roses; 012r - Paper; 051r - Damask Cloth; 138v - Imitation diamonds put into the work;
- Recipes that associate materials with a cost or currency mention currency
  - 004v - Black varnish for sword guards, [metal] bandanas for chests, etc.; 016v - Silk; 017v - About cannons; 020r - Glazier; 030r - Pewterers; 038v - Crimson colors; 039r - Goldsmith; 058v - Azure; 094r - Burnisher.

• Words in the manuscript that are associated with cost/money:

- profits, goods, savings, saleable, value, cheap(er), cost(s), expensive, spend, money, coin, costs, imitation

- Words in the manuscript that require further examination:
  - amounting, conserved, ingots, numerous, aggregate, preseveres, quantify, producing, production, copying, exchange, reduction, mathematics, average, maximum, numbers, margin, exceed, agent, capacity, artificially, paid, mean, thousand, free, quantities, mine, amount, produces, equal, hundred, quantity, merchents

- Secondary recipes from external sources:
  - Cennini, *The Craftsman's Handbook:*
    - The basis of the profession, the very beginning of all these manual operations, is drawing and painting… (Kindle Locations 368-369).
    - HOW YOU SHOULD ALWAYS MAKE A PRACTICE OF WORKING WITH FINE GOLD AND WITH GOOD COLORS. CHAPTER LXXXXVI Most people make a practice of embellishing a wall with golden tin,138 because it is less costly. But I give you this urgent advice, to make an effort always to embellish with fine gold, and with good colors, especially in the figure of Our Lady. And if you wish to reply that a poor person cannot make the outlay, I answer that if you do your work well, and spend time on your jobs, and good colors, you will get such a reputation that a wealthy person will come to compensate you for the poor one; and your standing will be so good for using good colors that if a master is getting one ducat for a figure, you will be offered two; and you will end by gaining your ambition. As the old saying goes, good work, good pay. And even if you were not adequately paid, God and Our Lady will reward you for it, body and soul (Kindle Locations 1163-1170).
    - VARIOUS WAYS TO DO HANGINGS. Also, for painting hangings, you may cut white cloth, and put it on top of the blue cloth, fastening it on with pastes, like glue; and lay it on according to the figures which you wish to distribute over the ground; and you may paint with washes of colors, without varnishing afterward. And you get more done, and cheaply, and they are handsome enough at the price (Kindle Locations 1810-1818).
  - Theophilus, On Divers Arts
    - Therefore, whoever you are, dearest son, whose heart God has inspired to investigate the vast field of the divers arts and to apply your mind and attention to gather from it whatever pleases you, do not disparage any costly or useful thing just because your native soil has spontaneously and unexpectedly produced it for you. For he is a foolish merchant who suddenly comes across a treasure while digging the soil and neglects to gather it up and save it. If your

> common shrubs should produce myrrh, frankincense, and balsam, if your local springs should pour forth oil, milk, and honey, if spikenard, cane, and various aromatic herbs should grow in place of nettles, thistles, and other garden weeds, would you despise all these as cheap local products and travel over land and sea to procure foreign ones that are no better and are perhaps of less value? Even in your own judgment this would be a great folly. For although men normally accord highest rank to, and guard with the greatest care, every precious thing that has been sought after with much sweat and acquired at extreme expense, yet if now and then similar or better things turn up or are found for nothing, they are guarded with similar or even greater vigilance. (Kindle Locations 624-632).

- Favier, Jean. *Gold and Spices: the Rise of Commerce in the Middle Ages.*
- Braudel, Fernand. *The Wheels of Commerce.*
- Medieval and Early Modern Data Bank (Database of early modern currencies and prices), http://www2.scc.rutgers.edu/memdb/index.html

• Further issues to be explored (time permitting):

- specialization (AKA division of labor); labor; economies of scale; scarcity; efficiency; opportunity cost; business cycle; supply and demand

145r - *Cuttlefish bone* and 106r - *Making gold run for casting*

The two recipes that we intend to focus on will be 145r and 106r. Thus, our experiment will have two aspects: one in which we focus on a recipe for pouring gold, and another in which we focus on what the manuscript has to say about casting (gold) with cuttlefish bone.

As such, 106r is a recipe for “making gold run”, and 145r is one of two recipes that mention casting gold in cuttlefish molds (one of four that mention cuttlefish casting generally). We would prefer to limit our investigation of gold casting recipes to these on cuttlefish casting. Although there are several references in the manuscript to gold being cast in spalt, sphalt or asphalt from Germany, we think we will already be dealing with so many factors that adding the additional factor of an unknown and difficult to procure type of sand for making molds will muddle our experiments and decrease their validity by multiplying the number of factors without increasing the controls.

Primary recipes:

p106r: Making gold run for casting

Because gold cools down very quickly, you have to give it a mixture when it is well melted that will keep the heat. **Sublimate** softens it nicely. But, since it vanishes into smoke, it won't aid you for very long. Therefore mix this *mixture* into it when you want to cast it: of **sal ammoniac**, the best **verdigris** that you can find, a bit of **borax** and some **saltpeter**. And this, held over the heat, will become neat. The saltpeter makes it clear and heats it. But the key thing in this mixture is the verdigris, which has to be good. This mixture softens your gold so much that it becomes as tractable as lead, even if it is good gold.

Ingredients:
Gold (well melted)
Sublimate
Sal ammoniac
Verdigris (the best you can find)
Borax (a bit)
Saltpeter (some)

Tools:
Copper & vinegar (to make verdigris)
Container to mix sal ammoniac, verdigris, borax and saltpeter
High heat

Experiments:

This recipe indicates we might attempt three separate experiments with gold: one in which nothing is added to the gold (as a control), one using sublimate to help it run/soften, and one with the preferred mixture of sal ammoniac, verdigris, borax and saltpeter.

I believe we will also have to do some work to create our own verdigris, and in particular, will probably have to try more than one attempt to see if we can figure out what makes verdigris "good" and how to make it "the best".

Initial questions arising from the recipe:
-What is sublimate? If it is a mercury product obviously we cannot use it.
-What is "good" and "the best" verdigris?
-What is "neat" gold?
-What is "clear" gold?

p145r: Cuttlefish bone

Do not cast tin or lead too hot, because it would burn the bone & become lumpy. And to know when it is the right temperature, dip **a little piece of paper** in it. If it turns black without catching fire, it is the right temperature. But if it burns & makes a fire, it is too hot. *Gold & silver can indeed be cast, but it never comes*

out clean. To cast something delicate well, it is necessary that **the bone** not be extremely dry, because it is rough & does not strip neatly & crumbles & scales off. In any case, before you cast, *dry them [the bones] & principally for gold*, which does not admit any humidity. You will know that they are dry enough when, after putting them near **some fire** for a bit, they cry & crackle inside & when you press them when you bring your ear close. Now join the bones & daub the joints with **a little clay** and slowly dry it on a fire & cast & then shake the mold or scratch the rough crannies and let it cool down before opening it. Commonly one cuts the bone in the middle, and the dull part that does not have half circles is more delicate and smoother to mold, and therefore on always presses it first, the other is scaled on the inside just as is manifest on the outside. Even so one is not helped at all by this with delicate things that are molded in two places. Make smooth & flatten these two halves on **some even piece of wood**, then grate **some charcoal** on top make it strip well. And to make the charcoal run evenly everywhere, hit the side which holds half the bone with your hand. Being both covered in charcoal, take the first bone that was prepared & rounded on the edges, and having posed **the medal** above it, thrust it down hard and press very hard. But with fingers you cannot press evenly, because if you press on the edges, the middle will remain hollow. Start therefore with the middle, & then do the edges. But to do it better, put something flat & even on the medal, or **some large square file**, & press with that; because you will press evenly, sometimes with your knee, other times with your foot with your shoe taken off. & do it from above, so that you impress it without breaking it. If it is not well molded on the first go, do it again several times. Then restore and flatten your halves of molded bone from the sides. And to cut them well, always start from the most tractable part, coming out to the shell. And if your medal does not come out on its own, scratch the rough bone from behind and it will strip. When you want to cast, settle & affix the two bones with **little pins of wood** & in order to cast neatly, you have only to try it with **sand**.

Ingredients:
Cuttlefish Bone (pre-dried until it “cried and crackles”)
Gold
A Little Bit of Clay
Little Pins of Wood
Charcoal

Tools:
A Little Piece of Paper
Fire hot enough to melt gold
Some even piece of wood
Charcoal grater (?)
Medal

Large square file
Sand

Experiments:
The recipe suggests we may wish to do several trials, experimenting with the different ways he suggests pressing the master into the cuttlefish bone. We may also need to experiment with drying cuttlefish bone the prescribed manner. We may also need to pour three (or more) times based on the different methods described in 106r.

Initial questions arising from the recipe:

-What does he mean when he says gold and silver "never comes out clean"? Does this mean it doesn't come out easily from the mold (and therefore the mold can't be reused), or does it mean it doesn't take a good impression and therefore is not a good medium for casting gold or silver (seems unlikely as this method is still used today)?
-Will it really make a difference how we press the medal into the cuttlebone, and will using our feet actually be helpful?

Subsidiary recipes from the manuscript we also intend to consult:

Cuttlefish: 072v; 091r; 139r; 157r

Gold: 015r; 047r; 047v; 106r; 106v; 107r; 108r; 116r; 116v; 117v; 119v; 120r; 124v; 134v; 135v; 138v; 145r; 156r; 156v; 157r

The most important of these recipes for the cuttlefish casting will be 157r, because it also explicitly mentions gold, and 091r, because it goes into great detail about the molding process, some of which is not mentioned in 145r. Many of the recipes for casting gold are of great interest for our process because they comment on parts of the process not mentioned in 106r, such as 124v, 134v and 135v.

Preliminary additional sources from outside the manuscript include:

Videos of the casting process:
https://www.youtube.com/watch?v=5V6hiF2LB5s (Signet Ring)
https://www.youtube.com/watch?v=dAdBlHukh8I (Roman style Bronze Ring)
https://www.youtube.com/watch?v=Mr1kZ5RN42s (Cuttlefish casting at home)
https://www.youtube.com/watch?v=7bOrymKS4Gk (Casting silver in cuttle)

"…Rubbed and smoothed down with cuttle such as the goldsmiths use for casting…" - Cennino Cennini, The Craftsman's Handbook, p.4

“To save time, they cast all metals in cuttlebone, having first molded in halves the object they are to make.” Vannoccio Biringuccio, Pirotechnia, p. 364

“When you meane to cast any golde or silver, you must neale the moldes red hot again, & cast presently. But if in pewter or lead, a lesse heate will serve, and osme use no heat at all, but cast the saide mettals in the moulds being cold.” Hugh Plat, The jewell house of art and nature (1594), p. 54-55

“And some use to cast copper, & latten works in high-gate sand, some in lome only, some in cuttle bone, and divers other substances, which because they are more common than the rest, I pass them over in silence.” Hugh Plat, The jewell house of art and nature (1653), p. 203-204