

P089r: powder of ox bone and rock salt

87

Sable des de boeuf boufle
et sal gemme.

Je la ay pulvérisée & par un subtil sieve le porphyre & plus
qu'iair peul. L'usage ius mesme on le fait d'un qu'on doulce. On y applique
sur le porphyre Je lay apud Gmich d'ou on y papele & plus d'un
en pleins le monde. qui est plus tost fait que par le sang de la main
on a Gmich de la cause. On y ay point de tout qui d'effondre plus
net que assés & Je belle estor assés Gmich de Et si tu le biele gode.
fort tannu fait qui est plus Gmich Je de biele est ouis doulce fort
de le principal de sa substance plus biele gode. On le distant
deux qui n'y fault pour Je Je de melle. Et pour le plus fin
melle qui biele Gmich plus net que estant. On le de pied de
belle est tannu se arid tout plus. qui sont estor melle
en part on d'ile, & que qu'este Gmich cayan l'usage cor
le biele de la plus le foudle. le biele est de la plus biele
il n'y d'effondre par en melle par net melle car il est

French Transcription

- Sable dos de bœuf brusle et sal gemme
- Je les ay pulverises separem{ent} & subtilies sur le porphire le plus que jay peu Puys jay mesle aultant dun que daultre & repasse sur le porphire Je lay apres humecte dans un papier replie dans une serviette mouillee qui est plus tost faict quau serain de la nuit ou a lhumeur de la cave Et nen ay point trouve qui despouille plus net que cestuy cy Il veult estre asses humide Et si tu le veulx gecter fort tanvre fais quil soict plus chault Il est venu en estain doux fort net co{mm}e le principal Et ha soubstenu plusieurs gects Pour lestaim je croy quil nen fault point chercher de meilleur Ne pour le plomb fin aussy qui vient quasi plus net que lestaim ~~Tout~~ Los de pied de bœuf est tousjours si aride tout seul que sans estre mesle dune part ou deulx de quelque sable gras & ayant liaison co{mm}e le tripoly les sels le foeultre les cendres & choses semblables il ne despouilleroit pas & ne mouleroit pas net aussy car il sesmie.

English Translation

- powder of ox bone and rock salt
- 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.

Basic Understanding

- Ingredients:
 - Sand:
 - Powder of ox bone (ox hoof bone)
 - Rock salt (fatty sand?)
 - Casting metal:
 - tin or fine lead
 - Binder/Magistery:
 - Water
 - Moist from the napkin and the paper
 - Moist from the night or the cellar

Basic Understanding

- Process:
 - Grind the powder of bone and rock salt separately
 - Mix
 - Regrind
 - Moist
 - Cast

Questions and Skeptical Points

- What is the powder of ox bone? How to make it? Which part of the bone should we use?
- When mixing the two, what is the proportion?
- What serves as the binder? Can powder of ox bone and rock salt bind? Does rock salt serve as the binder?
- Why “re-grind” the sand?
- What is fatty sand? What does fatty and dry mean in terms of sand?

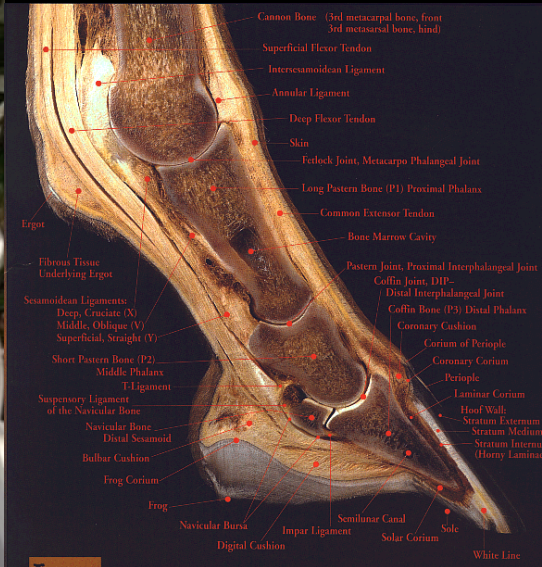
Powder of Ox bone

- Preparation:
 - P067v “well burnt two times and pulverized”
 - Cennini: “Put them into the fire; and when you see that they have turned whiter than ash, draw them out.”
 - Biringuccio: calcine using furnace
 - Charas: burn using “ordinary” fire
- Usage: casting, treating panels, styptic ointment
- Source: ox hoof, ram’s horn, leg bone of horses, sheep foot bones, **human bones**

Creating Powder of Ox bone

- Ox hoof

Ox leg bone



Creating Powder of Ox bone

- Boil the bone
- Remove the soft tissues (meat, cartilage)
- Put in oven at 300 F for 5 hours
- Calcine in the kiln at 1500 F for 1 hour
- Black smoke during 800 F to 834 F. Burn out the organic component



Rock Salt

- Source in early modern Europe:
 - Hungary (Biringuccio)
 - Saltmine Berchtesgaden, Rheinberg, Southern Germany
- Chemical Composition
 - Over 90 % sodium chloride (NaCl)

What we end up choosing:

- Himalayan Salt (Khewra Salt Mine in Pakistan)
- 95-96% NaCl, iron
- Grind with mortar

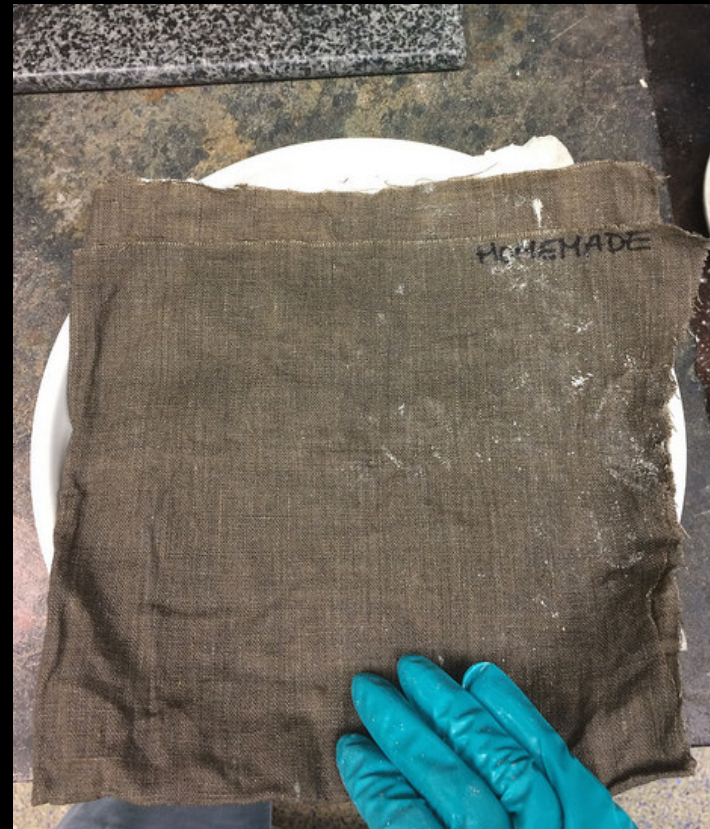


Proportion:

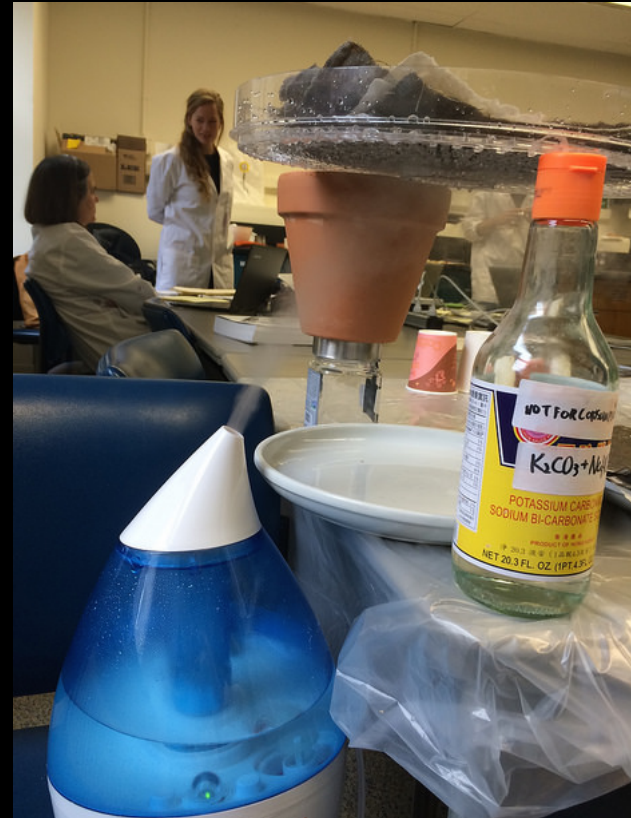
P088v: same quantity of rock salt and sand from mineral to make the molding material

Moist the sand

- Why moist? P088v “rock salt, like all other salts, dissolves in dampness.”
- Paper: 50% cotton and 50% linen, University of Iowa Center for the Book
- Napkin: Linen



Moist the sand Using Humidifier

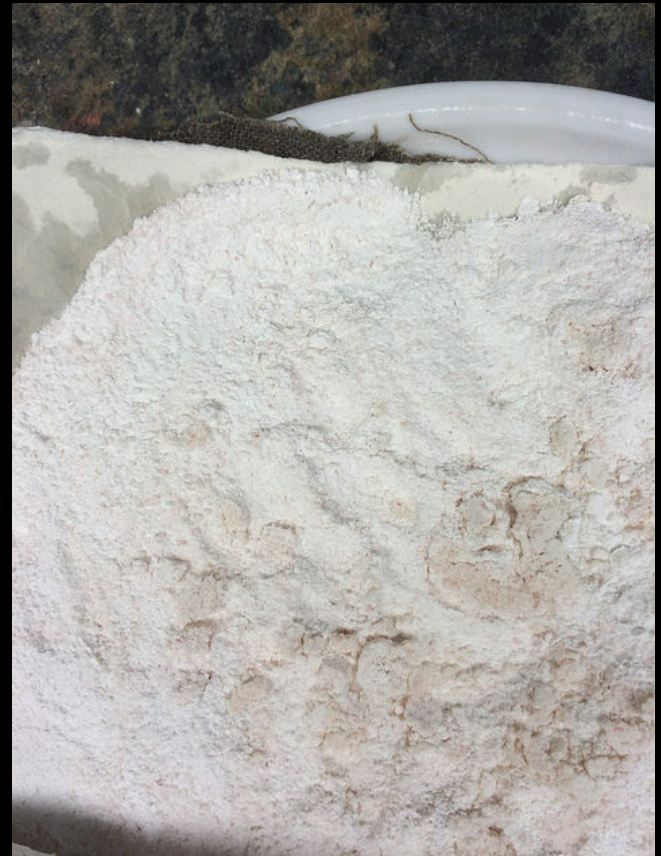


Homemade and Commercial Sand

Homemade sand: self-calcined bone ash and hand-ground organic rock salt



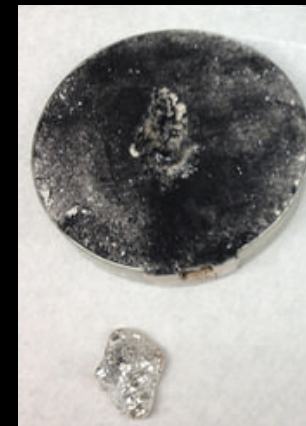
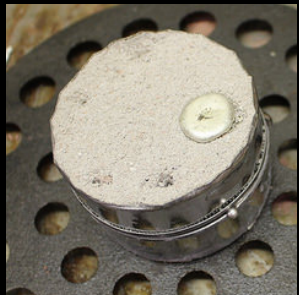
Commercial sand: commercial bone ash for bone china and hand-ground rock salt from Amazon



Variations

Mold No.	Sand type	Ground	Mold type	Cast Material	Imprint Model	SRN.
1	homemade	1	double	tin	key	brandy
2	homemade	3	one	tin	Portrait metal	charcoal
3	commercial	3	one	sulfur	Sea shell	brandy
5	commercial	3	one	tin	Sea shell	charcoal
6	commercial	3	one	tin	Portrait metal	charcoal

Mold 1	Mold 2	Mold 3	Mold 5	Mold 6
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Result

Mold 1



Mold 2



Mold 3



Mold 5



Mold 6



Mold 1

once ground homemade sand

- The mold binds well and is as hard as cement
- The cast is successful
- Rough surface due to the sand



Mold 3 and 5

thrice ground commercial sand

- Mold 3: sulfur + brandy



- Mold 5: tin + charcoal



Sulfur is not a good idea

Mold 2 and 6

- Mold 2
- Homemade sand
- Mold 6
- Commercial sand



Mold 6, the commercial bone ash one takes more details (ie. Feather, letters) than mold 2 the homemade one. So the how fine the sand is matters.

Conclusion

- Powder of ox bone is calcined bone ash. Ox hoof bone is better than ox leg bone. Bone ash is widely used in the early modern period and calcination is a common knowledge.
- The proportion should be 1:1.
- Bone ash and rock salt bind well with moist. Rock salt crystallizes when moistened and serves as the binder. In p084r, rock salt is one of the ingredients in magistery (binder).
- Regrinding sand makes sense in three ways:
 - Mix the bone ash and rock salt better
 - Make the sand finer so the cast will have more details
 - The sand hardens and binds together when moistened and pressed. So we need to regrind the sand each time before we fill in the mold with sand.

Fat and Dry

- Smith: Paradigm that originates from agriculture but widely used in mining and metal works.
- In terms of sand, fatty and dry are used to describe the property of sand. Fatty means the sand binds to itself and clumps (rock salt). Dry means the sand is crumbly, powdery, and won't bind well (bone ash).
- Dry sand takes fat metal well (ie. tin). But doesn't take other fat materials (ie. sulfur) well.