The Philosopher's Stone: Art and Nature in Eighteenth-century European Porcelain Production

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The mastery of a kaolinic porcelain technology in Dresden in 1709 and the subsequent founding of the royal Meissen factory in 1710 is one of the outstanding technical scientific achievements of the European eighteenth century. From the outset, the new material assumed an important representative function at the Saxon court, where it symbolised the cultural achievements of the Wettin King-Electors. It was deployed in architectural projects like the Japanese Palace, and disseminated as diplomatic gifts to courts the Saxons wished to influence.[1] This representative function had much to do with the context in which the secret of porcelain production was rediscovered. European porcelain was not a product of traditional ceramic industries. The persons responsible for perfecting a formula for hard-paste porcelain where not potters; instead they were natural philosophers, and the milieu in which they worked was that of the court-sponsored laboratory.

Natural philosophy in the sixteenth to eighteenth centuries encompassed a broad range of disciplines, all concerned with understanding the natural world. Some of these intellectual endeavours would be embraced by the enlightenment academy, becoming the foundations of modern scientific knowledge. Other aspects of natural philosophy – like astrology for example – would find themselves excluded from the realm of science and relegated to the realm of the occult. Porcelain occupies a position on one of these fault lines in the historiography of science. Porcelain production was for much of the eighteenth century closely associated with alchemy, that field of natural philosophy that concerned itself with revealing the nature of matter and discovering means to manipulate and transform it.[2] The modern historiography of science has, until very recently, drawn a firm distinction between alchemy – characterised as a fraudulent pursuit practiced by charlatans, conventionally deemed to have been banished from the canons of rational learning of the academy by the end of the first quarter of the eighteenth century – and chemistry, the system of rational knowledge about the nature of the material universe pursued through experimental laboratory-based procedures. Historians of science like William Newman and Lawrence Principe, however, have shown how the search for a clear-cut distinction between alchemy and chemistry in the eighteenth century is anachronistic and that many natural philosophers engaged in laboratory investigation and associated by later historiography with the enlightenment science of chemistry in fact spent much of their careers simultaneously pursuing activities conventionally associated with alchemical knowledge.[3] Indeed, alchemy was characterised, first and foremost, by its laboratory-based procedures which encompassed a broad range of undertakings, all of which involved the transformation of materials, including the manufacture of pharmaceutical products, metallurgical refinement, glass production and dye formulation,

Fig. 1. Meissen Porcelain Factory,*Teapot*, 1710-15. Böttger red stoneware, cut and wheel-polished, 9.6 cm high, Victoria and Albert Museum, London (C.274&A-1921). © London, Victoria and Albert Museum.

and not just the pursuit of *chrysopoeia* – the transmutation of base metals into gold – with which alchemy is most commonly associated today.[4]

This ambiguous historiography of chemical knowledge in the eighteenth century inflects accounts of the events leading to the discovery of a porcelain formula in Saxony. Ehrenfried Walther von Tschirnhaus, mathematician, physicist, physician, philosopher, *Académicien* and correspondent of Leibniz and Spinoza was, along with Johann Friedrich Böttger, one of the two investigators responsible for the discovery of a method for producing hard-paste porcelain.[5] Von Tschirnhaus had experience in glass production and the smelting of a wide range of materials, and his sophisticated work on focusing mirrors and burning lenses, in particular, was critical to investigating the high temperatures required for the successful firing of a kaolin porcelain paste. But if von Tschirnhaus – remembered by historians as a physicist and chemist – was a key figure in this discovery, so was his compatriot Böttger, an apothecary, metallurgist and professional alchemist, who was being held under house arrest in Dresden after coming to the attention of Augustus the Strong, the Saxon elector, for purported success in transforming base metals into gold.[6]

There is dispute over which of this pair, von Tschirnhaus or Böttger, was ultimately responsible for the breakthrough that led to a successful kaolinic porcelain formula. While Böttger has traditionally been identified as the inventor of Saxon porcelain, there has been a growing tendency in recent literature to attribute the discovery to von Tschirnhaus, claiming that his sudden death in 1708 left the way open for Böttger to claim the success.[7] But this narrative rehearses the historiographic trope that Böttger the 'alchemist' – and therefore a fraud – cannot possibly have succeeded and that it must have been von Tschirnhaus the 'scientist' who was ultimately responsible for the discovery. If we remove this false dichotomy between alchemist and scientist and instead recognise both men as natural philosophers dedicated to investigation of nature's secrets, then the possibility of their joint responsibility for the discovery comes into focus. Indeed, it seems likely that Böttger's technical laboratory skills – characteristic of the 'alchemical' enterprise – and his commitment to the *possibility* of material transmutation were major contributors to the success of the undertaking. It was the cooperation between these two natural philosophers, von Tschirnhaus and Böttger, that resulted in success were so many others had failed.[8]

That it was students of natural philosophy, not ceramic craftsmen, that achieved success in replicating Chinese porcelain is a point worthy of closer attention. Since the time of Marco Polo, reports about the fabrication of Chinese porcelain had circulated in Europe – all of them impressive for their inaccuracy.[9] They betray little real knowledge of either raw materials or methods involved in porcelain production. By the time an accurate description of the making of Chinese porcelain was recorded by the Jesuit Père Francois Xavier d'Entrecolles in 1712, based on first-hand observation at the imperial kiln complex at Jingdezhen, the Meissen factory had already been established, so these earlier European speculations about porcelain manufacture provide a context within which early experimentation took place.[10]

A regular feature of European accounts of porcelain manufacture was the construal of the material's creation in terms of natural processes, with raw materials being exposed to the elements or buried in the earth in order to achieve the final translucent, white product. The late thirteenth-century *Description of the World* (*Divisament dou Monde)* attributed to Marco Polo provides perhaps the earliest written European description of Chinese porcelain and its manufacture.[11] Polo claims to have had a chance to view porcelain production in a city called Tinju, a site that has been associated with the great southern kiln complex of Dehua in Fujian province.[12] It is this text that gives us the word porcelain – Marco Polo linked this class of Chinese ceramic to the white cowrie shell (*cypraea moneta*), '*porcella*' in Italian, on the basis of its appearance.[13]

> These dishes (*porcellana*) are made of a crumbly earth of clay which is dug as though from a mine and stacked in huge mounds and then left for thirty or forty years exposed to wind, rain, and sun. By this time the earth is so refined that dishes made of it are an azure tint with a very brilliant sheen [...] when a man makes a mound of this earth he does so for his children; the time of maturing is so long that he cannot hope to draw any profit from it himself [...].[14]

Here the method of porcelain production involves a transformation of earth through the agency of

natural forces – exposure of clay to sun, wind and rain. It is a change that takes place on a timescale more akin to natural processes than the techniques of industry – the periods of time involved are generational in length.

Another account of Chinese porcelain production is contained in the 1516 travelogue of the Portuguese India officer Duarte Barbosa that was widely circulated throughout the 1550s in the collection *Delle Navigationi et Viaggi* published by Ramusio.[15] Barbosa writes:

> They take the shells of sea snails and eggshells and pulverize them and, with other materials, make a paste which they put under the earth to become refined for a space of eighty or a hundred years [...] they then dig it out and work it into vases of various shapes, large and small, paint them, glaze them [...].[16]

We find here repeated the association of seashells with porcelain, but now as an ingredient of the paste, and the notion that an extended period of time, more than the average human lifetime, is required for the paste's refinement. But Barbosa's account introduces a trope that will be repeated in other early modern accounts of Chinese porcelain production – namely that porcelain was formed underneath the ground. So, in 1547 the Italian polymath Gerolamo Cardano wrote that:

> It is certain that porcelain is likewise made of a particular juice which coalesces underground and is brought from the East.[17]

The author here evokes the notion found in Pliny the Elder of liquids solidifying underground through natural heat.[18] Similarly, in 1557, noted scholar and rhetorician Julius Caesar Scaliger proposed that porcelain was made from shells that were pounded into dust, reformed, and then buried. Like Barbosa, Scaliger hypothesized that the maturation process for porcelain takes longer than a human lifespan:

> Eggshells and the shell of umbilical shellfish (called porcelains, whence the name) are pounded into dust, which is then mingled with water and shaped into vases. These are then hidden underground. A hundred years later they are dug up, being considered finished, and are put up for sale.[19]

Scaliger describes a process that attributes porcelain's creation to a subterranean transformation that defies human observation and comprehension. Vessels formed of a porcelain paste are buried in the earth and when dug up after the appointed period, have been transformed into finished porcelains.

Not all early descriptions of porcelain production agreed that porcelain required lengthy periods of time to mature. Gaspar da Cruz, Portuguese Dominican, had been to China and in 1569 wrote a treatise on his travels in which he issued a corrective to some of the common musings on porcelain production. Da Cruz debunks reports of porcelain paste being made of materials like oyster shells or rotten dung:

> The substance of the porcelain is a white and soft stone, [...] or in better speaking is a hard clay, the which after well beating and grinding it, and laying in cisterns of water [...] they make the very fine porcelain [...] in this clay, as the potters do any other vessel [...].[20]

Here the connection with shells, and the idea of transgenerational maturation times, is explicitly rejected. But what remains evident is the idea that porcelain was extracted from the ground as a substance ready to be processed and turned into vessels. The porcelain paste was produced within the earth, not mixed from raw materials by craftsmen. A similar theory of porcelain paste being extracted from the earth is repeated in the popular China travelogue of Johan Nieuhoff first published in 1665.[21]

Interestingly, subterranean generation and transformation is an idea common in European natural philosophical speculation. From the middle ages until the eighteenth century, theories of metallic generation suggested that metals grew within the earth. The mercury-sulphur theory of metals, ultimately Aristotelian in origin, proposed that all metals are compounds of two principles, mercury and sulphur. These substances combined in different proportions and purities, condensing in the earth to form various metals.[22] Of classical origin too was the notion of the fertility of metals – that they increased within the earth.[23] Other minerals were also believed to incubate within the earth, developing slowly in subterranean regions. Paracelsian alchemy of the sixteenth century proposed that metals and minerals grew un-

derground in the form of huge stalks that formed the branches of vast subterranean trees, no doubt reflecting the practical observation of the occurrence of metals and other minerals in veins.[24]

Early speculation about porcelain's creation suggests that the material was construed as a mineral substance, one whose creation echoed that of other minerals – formed beneath the ground over extended periods of time. This idea is perhaps suggested by one of the earliest surviving depictions of Chinese porcelain in European painting: Mantegna's *Adoration of the Magi* (c. 1495-1505). Here we find depicted the three Kings from the East offering their gifts to the Christ Child in luxurious vessels of agate (Persian cup), jasper (Turkish censer) and porcelain (the stylised, scrolling cobalt–blue floral ornament on the cup is reminiscent of the decoration of early fifteenth–century Ming porcelain wares). Porcelain appears here to be construed as a mineral, comparable with the other precious hardstones on display. The idea that porcelain was somehow a mineral product of natural processes has important implications for how we understand the circumstances surrounding the successful fabrication of a kaolinic porcelain in early eighteenth-century Saxony. The production of a porcelain in Dresden in 1708 was achieved by natural philosophers – alchemists – who understood their task to be, through observation of the natural world, the discovery of how nature worked, and the emulation, acceleration and perfection of her practices in the laboratory.[25] Even though the various accounts of porcelain production circulating in Renaissance Europe were inaccurate, the framing of porcelain's creation in terms of natural processes rendered it an obvious object of alchemical investigation.

The attempt to create porcelain by Grand Duke Francesco di Medici at the Casino di San Marco in Florence is an instructive comparison here. Natural philosophy had long been an interest of the Medici court – Francesco's grandfather Lorenzo had retained the Neoplatonic philosopher Marsilio Ficino – and Francesco continued this tradition, pursuing a personal interest in alchemy, a discipline which had become established at the court during the reign of his father Cosimo I.[26] Much of Francesco's alchemical experimentation focused on glassmaking, an endeavour that demonstrated alchemical processes of material transmutation.[27] Francesco took special pride in the creation of artificial precious stones with glassmaking techniques, instantiating the quest to create mineral products through alchemical procedures. The same interest in transmutational practices must have motivated Francesco's experiments in the production of porcelain, resulting in the so-called Medici porcelains; essentially an opacified glass formula, more like a Middle Eastern frit ware than Chinese kaolin porcelain.[28] Of note is the fact that this earliest of European attempts to fabricate porcelain proceeded without the involvement of traditional ceramicists – there are no potters mentioned in descriptions of the Florentine project. Questions concerning the nature of porcelain were construed, not within the tradition of utilitarian ceramics, but as part of the quest to understand the secrets of nature. The taking of raw earth and subjecting it to fire to create glass or porcelain mimicked what were understood to be geological processes at play beneath the earth generating metals and minerals.

These considerations – the manipulation of natural processes to generate a mineral substance – remained current in Dresden at the turn of the eighteenth century. When in 1706, in the course of experiments in pursuit of a porcelain formula, Böttger and Tschirnhaus achieved a high-fired red stoneware inspired by Chinese *Yixing* wares, it was dubbed *Jaspisporcelain*. Its principal ingredient was red bolus or Nuremburg earth, a red earth that since the sixteenth century was believed to possess healing properties and was taken medicinally. Böttger, whose career began as an apothecary's apprentice, would no doubt have been familiar with this material, a mineral that Rudolph II's personal physician, Johannes Scultetus Montanus had identified as 'gold fat', *Axungia Auri*, gold transformed by the influence of the sun.[29] The bolus not only had alchemical transmutational associations – it naturally occurred as veins in the volcanic rock in which jasper was found. It is highly likely that Böttger believed he had achieved the transmutation of the bolus into an imitation jasper by emulating the natural forces at play in the earth – sealing the material in a kiln and exposing it to extremely high temperatures.[30] And the completed *Jaspisporcelain* was subjected to grinding and polishing, cutting and engraving like a hardstone – something impossible with other European ceramic bodies – creating artworks that Augustus gave pride of place within his *pretiosen* collection in the Green Vaults.[31]

The eventual production of a white porcelain in 1709 – realizing the transmutation of raw earth

into the long sought after 'white gold' – could be understood as a resounding affirmation of the transmutational goals pursued by alchemy. And that Böttger's work for Augustus the Strong took place in the context of ongoing alchemical investigations is emphasised by the fact that, even after arriving at a formula for a hard-paste porcelain, on 20 March 1713 Böttger performed a transmutation experiment in the presence of the King, producing a gold and a silver regulus, still retained in the Dresden Porzellansammlung.[32]

This intimate connection between porcelain production, the mineral realm and the manipulation of natural forces remained current in Europe long past the publication of Etienne-Francois Geoffroy's 1722 paper 'Some cheats concerning the Philosophers' Stone', traditionally deemed as marking the end of transmutational experimentation as a respectable enterprise.[33] Indeed, many of the leading technicians associated with the most important European porcelain factories continued to conduct transmutational investigations: for example, Jean Hellot, Académicien and Fellow of the Royal Society, was from 1751 until his death in 1766 the chief technician at first the Vincennes and then the royal porcelain factory at Sèvres, formulating glazes, enamel colours and porcelain pastes. But in addition to these activities, as Laurence Principe has shown, Hellot, the so-called father of French industrial chemistry, actively pursued alchemical, and in particular, chrysopoeiac experiments throughout his career.[34] And Hellot was not alone in his alchemical interests; academy chemists like Macquer and Rouelle were discussing transmutation at least into the 1770s.[35]

Even the decoration of Sèvres porcelain reflected the mineral and natural philosophical associations that the medium clearly held well into the second half of the eighteenth century. Juliet Carey has drawn attention to the way in which the decoration of Sèvres porcelain often references contemporary mineralogical knowledge. So, for example, the *caillouté* decoration employed on Sèvres useful wares from the 1760s onwards reflects elite interest in and knowledge of the mineralogical world revealed by natural philosophers.[36]

But what is the significance of all this effort to recover the transmutational context of European porcelain's creation in the eighteenth century – the idea that porcelain is a mineral product achieved by artificial manipulation of natural forces and materials? The significance lies in the way in which these associations allowed porcelain to function as, not merely an emblem, but a physical manifestation of power. At the ruler's command, raw earth was transmuted into precious mineral. Porcelain production was proof that an anointed prince shared in divine creative power. The scramble by courts across Europe to establish porcelain factories in the wake of the successes in Dresden was not primarily driven by economic concerns – porcelain production was prohibitively expensive and virtually none of the great eighteenth-century manufactories were truly viable as commercial concerns. They relied on state subventions to survive. Instead, a porcelain factory manifested princely power. "For a prince of my rank, a porcelain factory is an essential attribute of splendour and dignity". So declared Herzog Carl Eugen von Württemberg in the 1753 founding decree of his porcelain factory at Ludwigsburg.[37] Familiar today as a purely utilitarian material, in the eighteen century, European porcelain was art that emulated nature and confirmed princely mastery of matter.

Notes

[1] M. Cassidy-Geiger, ed., *Fragile Diplomacy: Meissen Porcelain for European Courts ca. 1710-63* (New Haven and London: Yale University Press, 2007).

[2] On the history of alchemy in European thought see L.M. Principe, *The Secrets of Alchemy* (Chicago and London: Chicago University Press, 2013).

[3] L.M. Principe, "The End of Alchemy? The Repudiation and Persistence of Chrysopoeia at the Académie Royale des Sciences in the Eighteenth Century", *Osiris* 29, no. 1 (2014): p. 114.

[4] W. Newman, "What have we learned from the recent historiography of alchemy", *Isis* 102, no. 2 (2011): pp. 313-321.

[5] M. Schönfeld, "Was there a Western Inventor of Porcelain?", *Technology and Culture* 39, no. 4 (1998): pp. 716-27.

[6] For an overview of the discovery of the Arcanum in Dresden see C.H. Nelson, L. Roberts, *A History of Eighteenth-Century German Porcelain: The Warda Stevens Stout Collection* (Memphis: Dixon Gallery and Gardens, 2013), pp. 117-83.

[7] M. Schönfeld, "Was there a Western Inventor", cit., pp. 716-727.

[8] R. Hoffmann, "Meissen Chymistry", *American Scientist* 92, no. 4 (2004): pp. 312-315.

[9] Interestingly, Arab accounts of Chinese porcelain production, like the one found in Ibn-Battuta's *Travels* of 1355, record reasonably accurate descriptions of the materials and method involved M.F. West, "Arab Sources of European Notions about Chinese Porcelain Clay", *Folklore* 88, no. 1 (1977): p. 66.

[10] M. Pollard, "Letters from China: A History of the Origins of the Chemical Analysis of Ceramics", *Ambix* 62, no. 1 (2015): pp. 57-58.

[11] P. Jackson, "Marco Polo and his 'Travels'", *Bulletin of the School of Oriental and African Studies*, University of London 61, no. 1 (1998): pp. 82-101.

[12] L. Meicun, R. Zhang, "A Chinese Porcelain Jar Associated with Marco Polo: A Discussion from an Archaeological Perspective", *European Journal of Archaeology* 21, no. 1 (2018): pp. 39-56.

[13] F. Hamer & J. Hamer, *The Potter's Dictionary of Materials and Techniques* (Philadelphia: University of Pennsylvania Press, 1975), p. 229.

[14] Marco Polo, *The Travels*, tr. R. Latham (London: Penguin, 1958), p. 238.

[15] M.F. West, "Arab Sources of European Notions", cit., p. 66.

[16] D. Barbosa, "Libre di Odoardo Barbessa", in Gio. Batt. Ramusio, ed., *Delle Navigationi et Viaggi* (Venezia 1550), vol. 1, p. 345f. The MS tradition also includes accounts of eggwhites, as well as the shells, being added to the paste. M.F. West, "Arab Sources of European Notions", cit.

[17] Gerolamo Cardano, *De subtilitate rerum* (Nuremberg 1550), pp. 100v-101r. Quoted from R.W. Lightbrown, "Oriental Art and the Orient in Late Renaissance and Baroque Italy", *Journal of the Warburg and Courtauld Institutes* 32 (1969): p. 230.

[18] Pliny, *Natural History, Volume X: Books 36-37.* Translated by D.E. Eichholz. Loeb Classical Library 419 (Cambridge, MA: Harvard University Press, 1962), p. 180.

[19] Scaliger, *Exotericum exercitationum* (Paris 1557), pp. 135v-136r. Quoted in R.W. Lightbrown, "Oriental Art", cit., p. 231.

[20] Gaspar da Cruz, in C.R. Boxer, ed., *South China in the Sixteenth Century*, Hakluyt Society, Series 2, no. 106 (London 1953), pp. 126-127.

[21] Johannes Nieuhoff, *An Embassy from the East-India Company of the United Provinces, to the Grand Tartar Cham, Emperour of China, Delivered by Their Excellencies Peter de Goyer and Jacob de Kayser, at his Imperial City of Peking*..., tr. J. Ogilby (London: John Macock, 1669), p. 71: "The Earth whereof this Purceline is made, is digged in great quantity out of the Mountains situated near the chief City Hoeicheu, in the Province of Nanking [...] The Earth is not Fat, like Clay, or Chalk, but like to our fine Sand, which they mingle with water, and so to make it into four-square Clods [...] The Earthen Clods which are thus brought from the Mountains, are afterwards framed into what fashions they please, after the same manner as our Potters in Europe form their Earthen Ware [...]".

[22] L.M. Principe, *The Secrets of Alchemy* (Chicago and London: The University of Chicago Press, 2013), pp. 35-37.

[23] On the classical ideas concerning the fertility of mines see R. Halleux, "Fécondité des mines et sexualité des pierres dans l'Antiquité greco-romaine", *Revue belge de philologie et d'histoire* 49 (1970): pp. 16-24.

[24] W. Newman, "What Alchemists knew: early modern chemistry", in D. von Kerssenbrock-Krosigk, ed., *Glass of the Alchemists: Lead Crystal – Gold Ruby, 1650-1750* (Corning, NY: The Corning Museum of Glass, 2008), p. 45.

[25] W. Newman, *Atoms and Alchemy: Chymistry and the Experimental Origins of the Scientific Revolution* (Chicago: University of Chicago Press, 2006). C. Stanley Smith, M. Teach Gnudi, eds. and tr., *The Pirotechnia of Vannoccio Biringuccio* (New York: Dover Publications, 1943), pp. 396-398.

[26] A. Perifano, *Alchimie à la court de Côme Ier de Médicis: Savoirs, culture et politique* (Paris: Honoré Champion, 1997).

[27] M. Beretta, *The alchemy of glass: Counterfeit, imitation and transmutation in ancient glassmaking* (Sagamore Beach, MA: Science History Publications, 2009).

[28] A. Lane, *Italian Porcelain, with a note on Buen Retiro* (London: Faber & Faber, 1954), p. 3; W.D. Kingery, P.B. Vandiver, "Medici Porcelain", *Faenza* 70 (1984): pp. 441-453.

[29] J. Horschik, "Die deutschen Terra-Sigillata-Gefässe des 17. und 18. Jahrhunderts und ihre Siegelmarken", *Keramos* 33 (1966): p. 13, citing G.A. Volkmann, *Silesia subterranea* (Leipzig 1720), pp. 277f.

[30] *Ibid*., p. 16.

[31] D. Syndram, U. Weinhold, eds., *Böttger Stoneware. Johann Friedrich Böttger and Treasury Art* (Berlin/Munich: Deutscher Kunstverlag, 2009).

[32] M. Bothe, "Johann Friedrich Böttger – "vir honestus excellentissime ingenii"", in D. Syndram, U. Weinhold, eds., *Böttger* Stoneware, cit., pp. 27-28.

[33] É.-F. Geoffroy, "Des supercheries concernant la pierre philosophale", *Mémoires de l'Académie Royale des Sciences* 24 (1722): pp. 61-70.

[34] Work by scholars like Laurence Principe and Marco Beretta has demonstrated that a gap existed between the public denouncement of alchemy and the actual practices of leading chemists of the period. Hellot's library contained a large number of important sixteenth and seventeenth alchemical treatises – and we know this through the records of his estate sale where, interestingly enough, Antoine Lavoisier purchased a number of these alchemical texts. L.M. Principe, "The End of Alchemy? The Repudiation and Persistence of Chrysopoeia at the Académie Royale des Sciences in the Eighteenth Century," *Osiris* 29, no. 1 (2014): pp. 96-116; M. Beretta, "Transmutations and Frauds in Enlightened Paris: Lavoisier and Alchemy", in M. Beretta, M. Conforti, eds., *Fakes!? Hoaxes, Counterfeits and Deception in Early Modern Science* (Sagamore Beach: Science History Publications, 2014): pp. 69-108.

[35] C- Lehman, "Alchemy Revisited by the Mid-Eighteenth Century Chemists in France: An Unpublished Manuscript by Pierre-Joseph Macquer", *Nuncius* 28 (2013): pp. 165-216; L.M. Principe, "The End of Alchemy?", cit., p. 114.

[36] J. Carey, "The riches of the Earth: Mineralogy, microscopes and caillouté patterns on Sèvres porcelain", *The French Porcelain Society Journal* 5 (2015): pp. 117-131.

[37] "[...] ein notwendiges Attribut des Glanzes und der Würde". 5 April 1758, Hauptstaatsarchiv Stuttgart A 248 Bü 2430. The Württemberg court at Stuttgart had a long-standing association with alchemical research. T. Nummedal, *Alchemy and Authority in the Holy Roman Empire* (Chicago: University of Chicago Press, 2007), p. 32, pp. 122-140.