Societas Magica Newsletter

Ciphers and Secrecy Among the Alchemists: A Preliminary Report
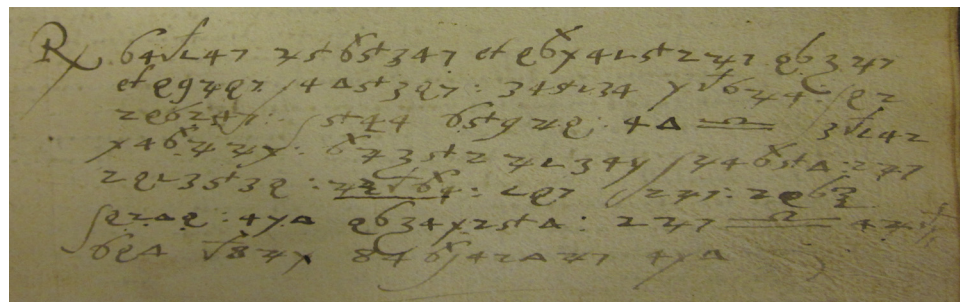
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Figure 1: New Haven, Beinecke Rare Book and Manuscripts Library, Mellon MS 27, f. 23r.

Around 1586 Martin Roesel of Rosenthal compiled an alchemical manuscript in northern Germany.[1] Now held in the Beinecke Rare Book and Manuscript Library as Mellon MS 27, the manuscript contains several widely circulating alchemical treatises, among them the *Semita recta* of pseudo-Albertus Magnus and Khalid ibn Yazid's *Liber Trium Verborum,* alongside alchemical recipes in both Latin and German. Martin annotated the three booklets that compose Mellon MS 27 extensively, copying recipes from other sources and writing down his own. Although otherwise unknown, Martin is notable for having hidden some of his notes in cipher. While alchemists were famous for their secretiveness, I will argue that Martin's use of ciphers represents a different sort of secret-keeping, one that stands to repay systematic study.

Like others in the books of secrets tradition, alchemical texts regularly warned their readers to protect the knowledge they contained.[2] This warning by pseudo-Albertus Magnus is typical: "I beg and I adjure you by the Creator of the world to hide this book from all the foolish. For to you I shall reveal the secret, but from the other I shall conceal the secret of secrets because of envy of this noble knowledge... Beware, then of revealing to anyone our secrets in this work."[3] In response to these calls for secrecy, alchemists developed endlessly varied symbols, encodings, and allegories.

Common alchemical substances and processes were assigned special symbols: mercury was represented by ☿ and sublimation by ♎. Equally common was the use of code words known as *Decknamen,* which replaced common names of substances with other, related words: thus, tin could be Jupiter. "Mercury" was a multivalent term referring both to the metal commonly known as quicksilver, as well as to the substance, sometimes called philosophical mercury,

that was necessary to make the philosopher's stone. To complicate matters further, *Decknamen* were often used inconsistently, even within the same text.

Alchemists regularly supplemented these word substitutions with allegories and figurative language. So for example, the transformations that mercury underwent as part of the great work were compared to Christ's death and resurrection. Mercury, when transformed into the Philosopher's stone, would heal baser metals into gold, just as the risen Christ would heal a fallen world.[4] From the fourteenth century, these verbal allegories were increasingly accompanied by allegorical images.[5]

The variety of these names, metaphors, and secret symbols is almost endless, but they all had one common goal: to keep alchemical knowledge away from the vulgar and uninitiated, trusting only those deemed worthy with the content of the texts. Alchemical knowledge was a secret reserved for the few.

As Lawrence Principe showed in his study of Robert Boyle's codes and concealments, by the

seventeenth century ciphers had become part of the alchemist's toolkit of secrecy. Boyle used ciphers in his correspondence with other alchemists in order to prove himself capable of keeping secrets and thus worthy of joining the circle of alchemical adepts.[6] Indeed, it is often assumed – both in the history of science and in the history of cryptography – that ciphers were not only common in Boyle's time, but that they had been a recognized part of alchemical language for centuries. In *Through Alchemy to Chemistry*, John Read writes that in the Middle Ages "the alchemical fraternity revelled in anagrams, acrostics, secret alphabets, and ciphers"; while David Kahn, in his monumental history of cryptography, states that "Cryptology ... even in the Renaissance was still disguising important parts of alchemical formulas."[7] According to the scholarship, then, ciphers were a natural extension or even a recognized form of the sort of secrecy that alchemists practiced not only in the seventeenth century, but also earlier in the medieval period.

Yet ciphers were never used with anywhere near the frequency of

Notes and Queries

Ars Magica: The Blog

Readers of this Newsletter are invited to read (and comment upon) the recently renewed Societas Magica blog. Three postings have been published since Issue 30 of this Newsletter appeared, with more on the way in the coming months. Please visit: www.societasmagica.org/blog

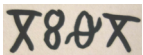If you are interested in writing for the blog, contact the Blog Administrator at ioana_georgescu@yahoo.com.

Ciphers cont'd

other methods of concealment. *Decknamen*, for example, were part and parcel of the language of alchemy from the times of the Greek alchemists. Ciphers, on the other hand, appear far more rarely in the manuscript record. Comprehensive figures are unavailable, but the Mellon Collection of Alchemy and the Occult housed at the Beinecke Library serves to illustrate the point. Of the thirty alchemical manuscripts in that collection written before 1600, only one – Mellon MS 27 – includes ciphers, while *Decknamen*, allegories, and figurative language appear in all thirty.[8]

2

Alchemical ciphers have yet to receive systematic treatment, so a brief survey would be useful at this point. The ciphers discussed here are all substitution ciphers; that is, each letter in the plaintext, i.e., the message to be enciphered, is replaced by a single other letter or symbol in the ciphertext. Most often, the texts being enciphered are short – usually individual words or phrases. A fourteenth-century copy of the *De separatione elementorum* attributed to Roger Bacon partially enciphers the *explicits* of each chapter of that text. The first chapter closes as follows: "Explicit mzmsmae et orhmum menezdhsm Rlierh Azdsn ze Hlgznne Ozrhđ," which conceals the line: "Explicit maximum et primum mendacium Rogeri Bacun ad Johannem Parisium." In this case, letters are substituted for letters, though the

enciphering is incomplete.[9]

More common was the practice of replacing letters with non-alphabetic symbols, as seen in Figure 1. A thirteenth century Czech example enciphers portions of Johannes Saponarius' *Elixir ad solem*, but also, rather curiously, index entries, which point to numbered and unenciphered passages in the text that follows that index.[10] A late medieval German miscellany uses ciphered section headings. In one case, "aqua" is represented as �XꝸꝊꝓ[11]

Extensive ciphered passages are less common and seem only to appear from the end of the Middle Ages. A single fifteenth-century copy of the *Libro del Tesoro* attributed to Alfonso the Wise (1221-1284) contains a prefatory cleartext followed by a long ciphered treatise on the philosopher's stone, both in Castillian.[12] A mid-fifteenth century German example known as *Alchymey Teuczsch* presents a long collection of alchemical recipes enciphered with three different alphabets.[13] In the sixteenth century, Martin Roesel of Rosenthal, who opened this paper, enciphered his recipes in Mellon MS 27.

3

The longest of the ciphertexts copied by Roesel appears on f. 23r (see *Figure 1*). Like the ciphers discussed above, it relies on substitution; Roesel maps each letter of the alphabet to a single symbol. There are also two other longer texts of 3-6 lines, as well

as a handful of individual words and short phrases enciphered in the manuscript.

The ciphertext on f. 23r hides a recipe that begins "Take the green lion and the white arsenic..." (*Recipe leonem viridem et arsenicum album*). The green lion refers either concretely to raw antimony ore or more abstractly to the "prima materia," the substance traditionally used as the base for the alchemist's great work. In subsequent steps the recipe moves the green lion towards the philosopher's stone through a progression of color stages leading up to albification, where the rainbow of colors has combined into perfect white and created a white stone capable of transmuting base metals into silver. Martin concludes his recipe, "the work is done" (*opus perfectum est*).

Martin's are rather standard recipes; nevertheless, he considered them worth hiding. The question then is why take the trouble to conceal them, both here and elsewhere in the manuscript? Green lions are hard enough to understand.

One possibility is that Martin used cipher simply to amuse himself;
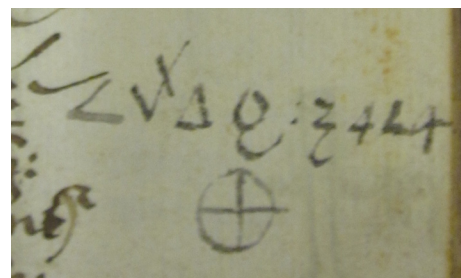
Figure 2: Beinecke, Mellon MS 27, f.44r.

his concealment of nota bene on f. 44r suggests as much. Yet he also enciphered full recipes in several places. The forethought that would have required suggests that Martin had reason to hide his recipes from specific people, most likely other alchemists. Who exactly that might have been is hard to say as he does not exist in other records. Although Martin's motivations are difficult to discover, a similar, though by no means identical, situation arises in the Heidelberg Codex Pal. Germ. 597. The manuscript, *Alchymey Teuczsch,* was composed over a number of years beginning in 1426. It was written by a group of alchemists who worked in eastern Bavaria possibly under the patronage of the bishop of Passau or some other local magnate. At the head of the group was a certain Nicholas Jankowitz, aided by at least two collaborators, Michael von Prapach and Michale Wülfing, as well as a laboratory assistant called Friedrich.

Alchymey Teuczsch also includes texts on medicine – some of it magical medicine – and astrology, but only the alchemical portions are ciphered. Jankowitz and his team used three different cipher alphabets to encode parts of their work, sometimes hiding individual words, sometimes whole recipes. Gerhard Eis has argued that they developed these ciphers to ensure that the recipes they had perfected never left their laboratory, and thus that they never fell into the hands of rival practitioners.[14] It is certainly possible that Roesel found himself in a similar position.

At first glance, Martin Roesel might seem like yet another case of an alchemist being secretive, concealing his knowledge in the way of centuries of alchemists before him. In fact, Martin's ciphers represent a entirely different tool than that commonly wielded in the service of alchemical secrecy. The other methods alchemists relied on to conceal their ideas –*Decknamen*, allegories, and others – were meant to exclude the great mass of the unworthy, but they were by design legible to those with the appropriate knowledge, that is, other adepts. When a text instructed the alchemist to "take the green lion" (*recipe leonem viridem*), he would know to reach for his supply of antimony ore.

Ciphers present an entirely different barrier to entry. Revealing their contents does not require a particular body of knowledge, but rather a single piece of information: the cipher key, whether obtained directly or figured out. Any reader can recover the text if he can get the key. Acquiring that key becomes much easier when an earlier reader
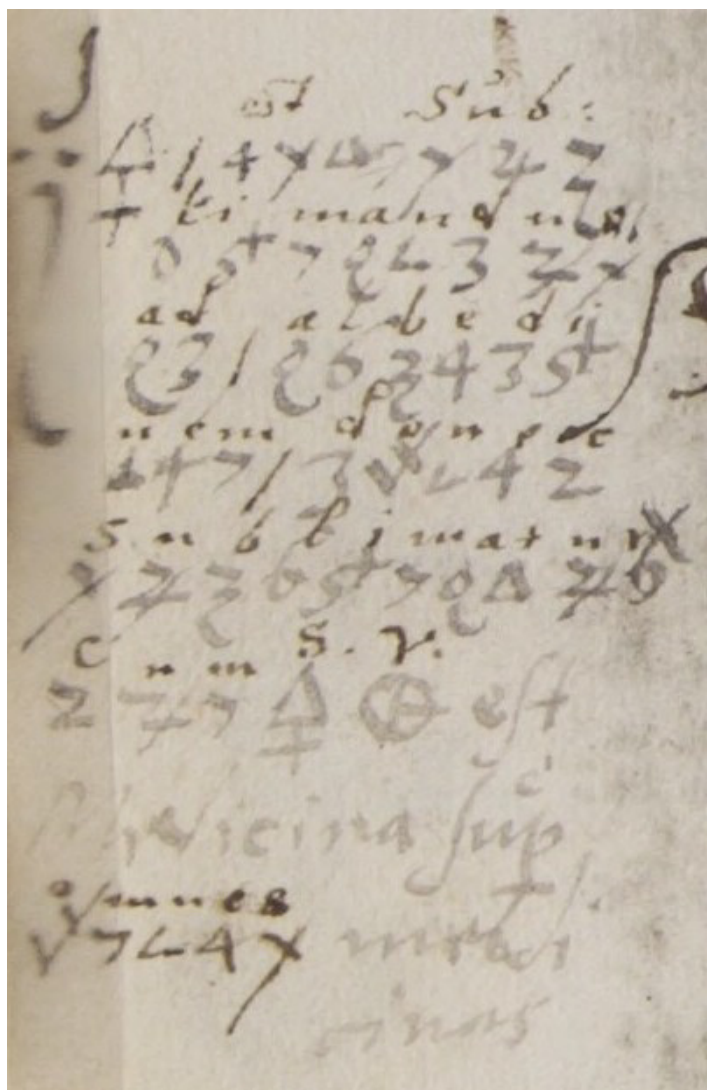

Figure 3: Beinecke, Mellon MS 27, f. 50v

Ciphers cont'd

writes in the solution next to the cipher, as happened with Mellon MS 27. A partial decryption of Martin's cipher appears on f. 50v, added by an unknown later owner of the manuscript. With some careful transcription and a bit of educated guessing, the code can be cracked, and this layer of secrecy simply evaporates. With ciphers, then, being worthy is entirely beside the point, and the alchemist very quickly loses control of his readership. It is precisely this quality that makes ciphers uncommon in alchemical manuscripts, which, as books of secrets, were meant to be written in a particular language understood by a chosen group.

Controlling for an entirely different readership, these ciphers served other purposes than the usual methods of secrecy. Alchemists often competed for the attention of wealthy patrons; indeed several alchemists could be working under a single sponsor.[15] These close quarters and this intense competition for funds and favor surely provided ample reason to protect laboratory secrets and alchemical ideas from unscrupulous rivals. Yet the alchemists turned to ciphers only exceptionally. By the early modern era ciphers were commonly used to protect claims of primacy in scientific discoveries, and indeed this is another motivation for Boyle's ciphering activities.[16] However, Martin Roesel and Nicholas Jankowitz operated in earlier periods when primacy was not a concern, and alchemists and natural philosophers

ascribed their texts to famous thinkers like Albertus Magnus or Raymond Lull. Investigating the circumstances in which alchemists turned to ciphers would thus nuance our understanding of these rivalries among practitioners.

Alchemical ciphers need systematic study, and most immediately, a comprehensive list of manuscript witnesses. Research on how their use changed over time would be particularly revealing, especially in the context of the sixteenth century popularization of cryptography through works like Trithemius's *Polygraphia* (1518) and the early modern transition from secrecy to openness.[17] Given alchemy's penchant for secrecy, studying alchemical ciphers provides an exceptional opportunity to study cryptography as "a complex system of social practices," in the words of Benedek Láng, and so to nuance our understanding of the role of secrecy among not just the alchemists, but among medieval and early modern natural philosophers and scientists more generally.[18]

Endnotes

[1] New Haven, CT, Beinecke Rare Book and Manuscript Library, Mellon MS 27. Roesel's ex libris appears on f.2r.

[2] On books of secrets, see William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994).

[3] Virginia Heines, ed. and trans., *Libellus de alchimia, ascribed to Albertus Magnus* (Berkeley: University of California Press, 1958): 3-4.

[4] Lawrence M. Principe, *The Secrets of Alchemy* (Chicago: The University of Chicago Press, 2013), 67.

[5] On the rise of alchemical images, see Barbara Obrist, *Les débuts de l'imagerie alchimique (XIVe-XVe siècles)* (Paris: Le Sycomore, 1982).

[6] Lawrence M. Principe, "Robert Boyle's Alchemical Secrecy: Codes, Ciphers and Concealments," *Ambix* 39, no. 2 (July 1992): 63–74.

[7] John Read, *Through Alchemy to Chemistry* (London: G. Bell, 1957), 43; David Kahn, *The Codebreakers: The Story of Secret Writing* (New York: Scribner, 1996), 91.

[8] Another manuscript, Mellon MS 29, includes a code that was used with the same intent to conceal as the ciphers discussed below. Written around 1525, Mellon MS 29 is a Latin and Italian copy of the *Lumen luminum* ascribed to the Franciscan Elias of Cortona. Since it does not use a cipher, the manuscript will not be discussed further in the present study. However it is worth emphasizing the technical distinction between a

Ciphers cont'd

"cipher" and a "code," because these terms are often used indiscriminately. In a code, the unit of encryption is a word. So, for example, the list of codewords on f.1r of Mellon MS 29 maps "Scorpio" to "prk∫yq∫7gp" and "Cancer" to "irgp∫hk∫cel." In a cipher, on the other hand, individual letters receive their own symbols, as will be discussed below. For an overview of the terminology of cryptology, see Kahn, *The Codebreakers*, xv–xviii.

[9] London, British Library, Sloane MS 1754, f. 63. Robert Steele, "Science in Medieval Cipher," *Nature* CXXII (1928): 563–65.

[10] Prague, Knihovna Metropolitní Kapituly, KMK M XVII, ff. 1r-v, 4r, 9r-v, 10r, 11v. A cipher alphabet is given in Bernhard Bischoff, "Übersicht über die nichtdiplomatischen Geheimschriften des Mittelalters," *Mitteilungen des Instituts für Österreichische Geschichtsforschung* 62 (1954): 1–27.

[11] Munich, Bayerische Staatsbibliothek, Clm 405, f. 129r.

[12] Madrid, Biblioteca Nacional, MS reservado 20. Juan Carlos Galende Díaz, "La criptografía medieval: el Libro del Tesoro," in *II Jornadas Científicas sobre documentación de la Corona de Castilla (siglos XIII-XIV)* (Madrid, 2003), 41–77; James V. Williams, "Recherches Sur Deux Traités Attribués Abusivement à Enrique de Villena: Del Tesoro et Libro de Astrologia" (IVe Section de l'École Pratique des Hautes Études, 1977); Fernando Fernández-Monzón de Altolaguirre and Alfredo de Cominges Bárcenas, "Descubrimiento de la clave de un códice cifrado del siglo XIII," *Punta Europa* 11 (1966): 44–52.

[13] Heidelberg Universitätsbibliothek, Codex Palatinus Germanicus 597.

[14] Gerhard Eis, "Alchymey teuczsch," in *Medizinische Fachprosa des späten Mittelalters und der frühen Neuzeit* (Amsterdam: Rodopi, 1982), 307–15.
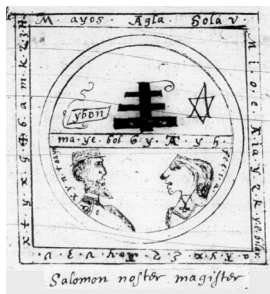
[15] See for example the practitioners described in Tara Nummedal, *Alchemy and Authority in the Holy Roman Empire* (Chicago: University of Chicago Press, 2007).

[16] Mario Biagioli, "From Ciphers to Confidentiality: Secrecy, Openness and Priority in Science," *The British Journal for the History of Science* 45, no. 2 (June 1, 2012): 213–33.
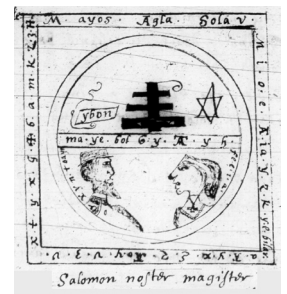
[17] On Trithemius see, Wayne Shumaker, *Renaissance Curiosa: John Dee's Conversations with Angels, Girolamo Cardano's Horoscope of Christ, Johannes Trithemius and Cryptography, George Dalgarno's Universal Language*, Medieval and Renaissance Texts and Studies 8 (Binghamton, NY: Center for Medieval and Early Renaissance Studies, 1982). On openness and secrecy, see Biagioli, "From Ciphers to Confidentiality"; Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001), esp. Ch. 5, 143–74.

[18] Benedek Láng, "Early Modern Ciphers as Sources of History," *Perspectives* 8 (Autumn-Winter 2012): 18–19.