

‘Alchemical’ Inks in the Syriac Tradition

Matteo Martelli

Abstract

This paper explores recipes for ink making preserved in three Syriac alchemical manuscripts. First, I shall provide an analytical description of the scanty material transmitted in two codices kept at the British Library (Egerton 709 and Oriental 1593); then, particular attention will be devoted to a treatise that opens the collection of alchemical writings in the Cambridge MS Mm. 6.29 (15th century AD). This treatise includes several recipes on the making of inks that reveal evident similarities both with the instructions preserved in the Graeco-Egyptian tradition (especially in the so-called Leiden Papyrus) and with early medieval technical handbooks. A selection of Syriac recipes is edited here for the first time and translated and commented on in order to better understand the mechanisms that regulated the transmission of this technical material in Christian Near-Eastern communities.

Keywords

gold inks – Syriac alchemy – *Mappae clavicula*

1 The Syriac Alchemical Collections and the Making of Inks

In terms of the Syriac language,* alchemy is primarily known through the writings preserved in three manuscripts that date between the fifteenth and the sixteenth centuries: (1) British Library, MS Egerton 709 (16th century); (2) British Library, MS Oriental 1593 (15th–16th century); (3) Cambridge University

* This publication is part of the research project *Alchemy in the Making: From Ancient Babylonia via Graeco-Roman Egypt into the Byzantine, Syriac, and Arabic Traditions*, acronym *AlchemEast*. The *AlchemEast* project has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (G.A. 724914).

Library, MS Mm. 6.29 (15th century).¹ These collections, which contain recipes describing a wide array of technical procedures (e.g. preparations of dyeing substances and various chemicals; metallurgical processes; purple dyeing; imitation of gemstones, etc.) also include instructions on how to prepare inks of various colours. An interest in this area of expertise is not necessarily an unusual feature of the Syriac alchemical tradition, since recipes on the making of inks are included in many pre-modern collections of technical recipes related to alchemy. As we shall see, both the Graeco-Egyptian and the Latin traditions preserve recipe books that feature various ink formulas, in particular for metallic inks that allow for writing with gold and silver letters without actually using the precious metals (or by using a very small amount of them).

As Robert Halleux pointed out,² metallic inks were often produced by following the same procedures that were used to prepare the gold and silver paints that ancient alchemists used in their attempts to dye base metals and thus transmute them into precious metals. It is clear, therefore, that ink making was part of the wide umbrella of technologies that might be encountered in an ancient collection of writings dealing with alchemy or *chymeia* in Greek, a discipline that Byzantine sources have defined as “the preparation of gold and silver” (ἡ τοῦ ἀργύρου καὶ χρυσοῦ κατασκευή; *Suda* χ 280 Adler). A similar definition of alchemy is reported in the lexicon of the tenth-century Syriac polymath Bar Bahlūl, who described the art called *kimiyo* (ܟܝܡܝܘܐ, Syriac transliteration of the Greek *χυμεία*) as “the work of the art of gold and silver” (ܟܝܡܝܘܐ ܕܥܝܢܐ ܕܟܝܡܝܘܐ ܕܗܘܐ ܕܥܝܢܐ ܕܟܝܡܝܘܐ ܕܗܘܐ ܕܥܝܢܐ ܕܟܝܡܝܘܐ).³ Indeed, like the Syriac alchemical collections that are the focus of this paper, various Late Byzantine alchemical compendia include recipes on the making of metallic inks. For instance, the Byzantine MS *Parisinus* gr. 2327 (15th century), one of the richest extant anthologies of late antique and Byzantine alchemical treatises, also includes a recipe book entitled “With the help of God, explanation of the most noble and illustrious art of goldsmiths.”⁴ This collection features three recipes for chrysography (i.e. writing with gold letters), which explain how to grind various metals (e.g. a bronze leaf that

1 See Rubens Duval and Marcelin Berthelot, *La chimie au Moyen Âge*, vol. 2. *L'alchimie syriaque* (Paris: Imprimerie Nationale, 1893), which includes a full edition and French translation of the collection preserved by the two British Library manuscripts along with a partial French translation of the texts transmitted in the Cambridge manuscript. See also Matteo Martelli, “L'alchimie en syriaque et l'œuvre de Zosime,” in *Les sciences en syriaque*, edited by Émilie Villey (Paris: Geuthner, 2014), pp. 191–214.

2 Robert Halleux, *Papyrus de Leyde, Papyrus de Stockholm, Recettes* (Paris: Les Belles Lettres, 1981), p. 42.

3 Rubens Duval, *Lexicon Syriacum auctore Hassano bar Bahlule*, 3 vols. (Paris: Leroux, 1888–1902), vol. 1, p. 901.

4 Text edited in Marcelin Berthelot and Charles-Émile Ruelle, *Collection des anciens alchimistes grecs*, 3 vols. (Paris: Georges Steinheil, 1887–1888), vol. 2, pp. 321–337.

looks like gold or a gold-silver alloy) and mix them with different kinds of gluey substances, such as honey, egg white, and gum arabic.⁵ Moreover, the same Byzantine manuscript also preserves formulas for different glues, which could be used in the preparation of metallic inks. For instance, a recipe preserved at the beginning of the manuscript describes the making of a cheese glue (fol. 7r; *περὶ τοῦ ποιῆσαι τυρόκολλαν*), which involves roasting old cheese, boiling it in water, and then mixing it with quicklime, in order to make a paste that can “glue whatever you want” (*καὶ κόλλα εἴ τι δ’ ἂν θέλῃς*).⁶

2 The British Library Collection

The two Syriac manuscripts kept at the British Library preserve the same collection of ten alchemical books followed by various excerpts in *garšūnī*, which appear in the second part of the codices. This collection contains only scanty references to inks along with two short recipes in *garšūnī*, which describe the preparation of gold inks. Both recipes are included in the second part of the manuscripts, which features various technical passages on a variety of subjects, from the treatment of different metals and minerals to the classification of substances and instruments used by ancient alchemists. The first recipes in the *garšūnī* section describe various metallurgical techniques, among which is a recipe that explains how to liquefy a gold leaf in gum arabic (MSS Egerton 709, fol. 57r6–10; Oriental 1593, fol. 30r19–23):⁷

8 *ملا الجهد. بم زعم زنت اوه زالمه. مسو الهصى الخنك مل بحفا*
 9 *ملا الهصل. ه اللهو حه الزعم. محهه حله هوم الجهد. ه مضم*
حلمهه ز مل عسل. ه/ملا حه.

5 Berthelot and Ruelle, *Alchimistes grecs* (cit. note 4), vol. 2, pp. 327 (rec. 19–20), 334–335 (rec. 49). On these recipes, see also Peter Schreiner and Doris Oltrogge, *Byzantinische Tinten-, Tuschen- und Farbrezepte* (Wien: Verlag der Österreichischen Akademie der Wissenschaften, 2001), pp. 50–51, 58–59, 67.

6 Berthelot and Ruelle, *Alchimistes grecs* (cit. note 4), vol. 2, p. 380; Schreiner and Oltrogge, *Byzantinische Tinten* (cit. note 5), pp. 77–78. See also Maria Leontisini and Gerasimos Marianos, “From Culinary to Alchemical Recipes. Various Uses of Milk and Cheese in Byzantium,” in *Latte e Latticini. Aspetti della produzione e del consumo nelle società mediterranee dell’Antichità e del Medioevo*, edited by Ilias Anagnostakis and Antonella Pellettieri (Lagonero: Grafica Zaccara, 2016), pp. 205–222 (pp. 216–217).

7 Syriac text edited in Berthelot and Duval, *Chimie* (cit. note 1), pp. 61–62; French translation on p. 142.

8 MS Oriental 1593.

9 MS Egerton 709 transmits the reading *مضم*, corrected in *مضم* (“it is watered with”).

Solution of gold (Ar. *ḥall al-dahab*). Take a porcelain bowl or a stone cutting board.¹⁰ Gum arabic is scratched until it becomes like honey. Rub the bowl with it. A leaf of gold is flattened on it and it is crushed with the gum until it gets thinner.¹¹ Write with it.

This recipe has been copied on fol. 57r of MS Egerton 709 (see Fig. 5.1), which also includes marginal notes written by a later hand. In the upper margin an anonymous copyist has specified (presumably with reference to the above-mentioned recipe): عمل ماء ذهب للكّابة, “The making of gold ‘water’ for writing.” Moreover, in the right margin, a second recipe has been added on the same subject. The text, difficult to interpret in various passages, reads:

صه ووت هللوسو هللوت هللوت صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا
 صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا صهلا
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Gold is taken [...] ¹², hammered, made really thin, curved [...] and pressed; then it is put in a crucible ¹³ near to the fire and mercury (? or mastic) is placed over it. Then a handful (?) ¹⁴ and a half (of this compound?) is

- 10 The term *صهلا* corresponds to the Arabic *صلاة*, “a stone upon which one bruises, or powders perfume or some other thing,” according to the definition in Edward William Lane, *An Arabic-English Lexicon*, 8 vol. (London: Williams & Norgate, 1863–1893), vol. 4, p. 1722; see also Rubens Duval, “Notes de lexicographie syriaque et arabe,” *Journal asiatique*, 1893, 9th series, 2: 290–358 (p. 348).
- 11 I interpreted the verb *صهلا* as equivalent to the Arabic *نخل*, ‘to be emaciated, grow thin.’ Likewise, Berthelot and Duval, *Chimie* (cit. note 1), p. 142, translated: “jusqu’à ce que la feuille se délaye.” We must note that the Syriac verb *صهلا* (like the Arabic *نخل*) means ‘to sift, to sieve out’; this verb occurs in a recipe on the making of a black ink preserved in MSS Mingana syr. 77 (fol. 10v) and Mingana syr. 324 (fol. 75v–76r): edition and translation in Jimmy Daccache and Alain Desreumaux, “Les textes des recettes d’encre en syriaque et garshuni,” in *Manuscripta syriaca. Des sources de première main*, edited by Françoise Briquel Chatonnet and Muriel Debié (Paris: Geuthner, 2015), pp. 195–246 (p. 212, rec. 34).
- 12 The term *صهلا* has been interpreted by Duval (who read *صهلا* in the MS) as a misspelled transcription of the Arabic *نارنج*, ‘bitter orange.’ He proposed the translation: “On prendra de l’or de teinte orange.” See Berthelot and Duval, *Chimie* (cit. note 1), pp. 104 and 201. The form *صهلا* (= Ar. *نارنجي*) is attested in a recipe on the making of an orange ink (*صهلا*) recently edited and translated by Daccache and Desreumaux, *Recettes d’encre* (cit. note 11), p. 217.
- 13 On the term *صهلا*, ‘crucible,’ see Duval, *Lexicographie* (cit. note 10), p. 342.
- 14 I tentatively read the term *صهلا* as a misspelled transcription of *الجماعة*. In another *garšūnī* recipe edited by Berthelot and Duval, *Chimie* (cit. note 1), p. 99, l. 10, we read

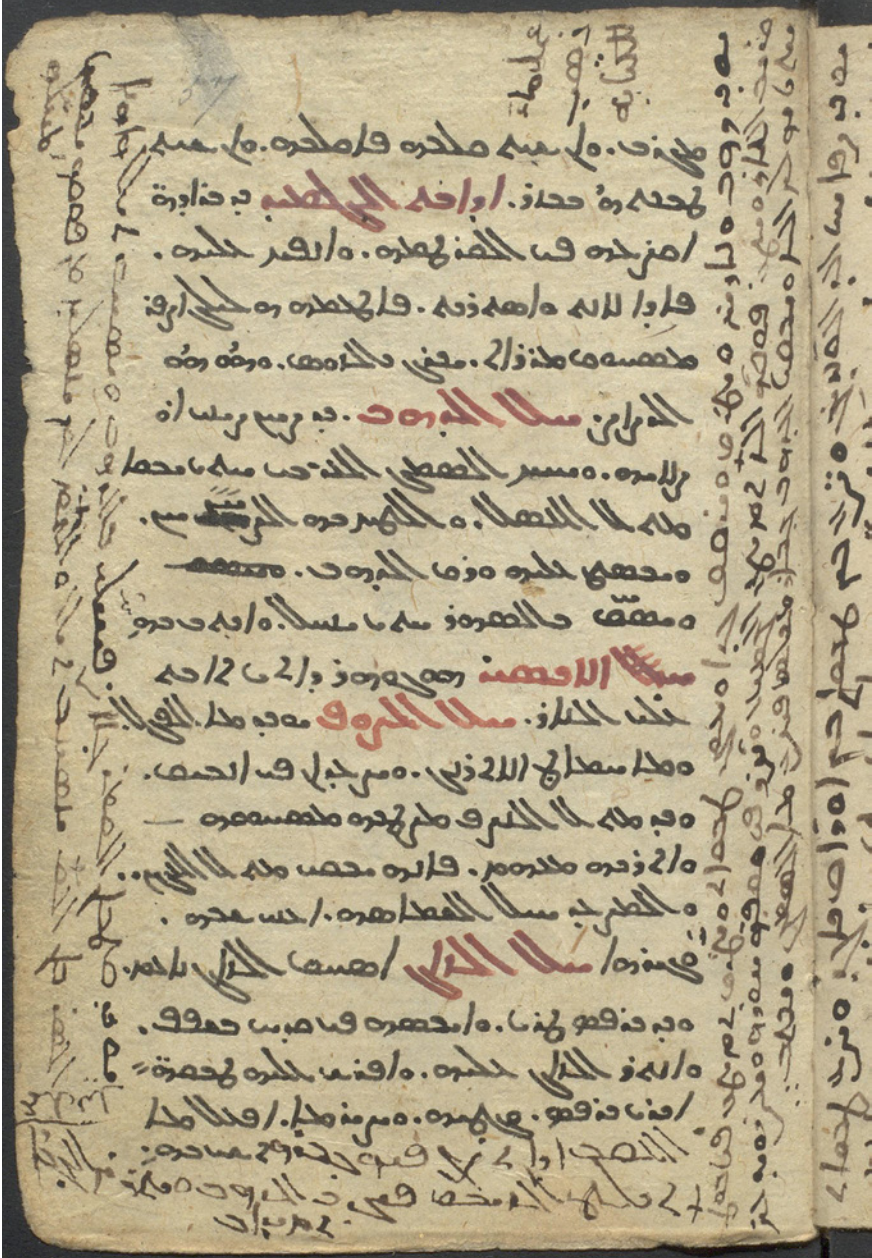


FIGURE 5.1 Garšūnī recipes on ink making, MS British Library, Egerton 709, fol. 57r

placed in [...],¹⁵ it is squeezed and crushed until the mercury (? or mastic) is destroyed and gold remains as a calcified dust; water of gum is then added, and you write.

At line 2, the term كحل is uncertain: it might simply mean ‘mastic,’ as suggested by Duval,¹⁶ or be interpreted as an abbreviated form for الزئبق الكحل (الزئبق), ‘mercury.’ In fact, a sign — namely, a little cross — after this term refers to a second note written in the lower margin, which specifies that mercury was added in the treatment:

الكحل. اولا لي فيه حده اصله الكحل فيجب الكحل ههنا؛ لم يهنا.

What follows. If you keep¹⁷ its dust (?) in it and mix mercury, the gold is attracted and increases, then it is dissolved.

The aim of this note is not entirely clear: the anonymous copyist seems to have recorded another section of the recipe, which explains how to dissolve gold by adding mercury. I have followed Berthelot and Duval’s reading and interpreted the term حده as a variant spelling of حداو (= Ar. عفار, ‘dust’):¹⁸ mercury, therefore, would be added to the gold, after its calcination. However, as already noted, in the manuscript this marginal annotation is linked to the term كحل , perhaps to clarify that mercury was already to be added at this point of the

كحل translated as: “une poignée de scories de ferre” (p. 194). See Duval, *Lexicographie* (cit. note 10), p. 310.

15 This expression remains obscure to me (it might refer to a vessel or a tissue). Berthelot and Duval left it untranslated.

16 See Duval, *Lexicographie* (cit. note 10), pp. 305 and 319 (s.v. كحل).

17 Berthelot and Duval, *Chimie* (cit. note 1), p. 201, n. 4, translated: “Si tu y mets de la poussière.” They probably interpreted لي (= Ar. تصين) as a misreading of لبي (= Ar. تصب). In this case, the copyist would have relied on a recipe written in Arabic script, where he read ن instead of ب .

18 Another possible interpretation would be to read حده (= Ar. غيراء), ‘rowan, mountain ash,’ a plant that appears among the ingredients of a gold ink in a recipe preserved by MSS Mingana Syr. 77 (fol. 13r), Mingana syr. 314 (fol. 78r), and Berlin Sachau 107 (fol. 48v) under the title سود الكحل , “ink made from rowan leaves”. Rowan leaves are mixed with gum and white lead; edition and translation in Daccache and Desreumaux, *Recettes d'encre* (cit. note 11), p. 215. See also Philippe Boutrolle and Jimmy Daccache, “Lexique commenté: les végétaux, les animaux et les minéraux des recettes d'encre en syriaque et en *garshuni*,” in *Manuscripta syriaca. Des sources de première main*, edited by Françoise Briquel Chatonnet and Muriel Debié (Paris: Geuthner, 2015), pp. 247–270 (pp. 258–259).

process. As we shall see in other recipes for the making of gold inks, gold leaves are often processed with mercury.¹⁹

The two short texts discussed above represent the main sources on ink making in the collection disclosed by the British Library manuscripts, both included in a *garšūnī* section that collates many procedures for ‘liquifying’ either metals or minerals. Some metals (e.g. tin or lead) were simply melted, while other minerals like sandarac and vitriol underwent more complex treatments. The production of inks was somehow assimilated to these techniques: gold was not simply melted but crushed to a ‘powder’ or ‘dust’ and then mixed with a gluey liquid. On the other hand, if we return to the first part of the British Library collection, the ten Syriac alchemical books do not include any recipe dealing with the production of inks. Black inks, however, do appear in these books, as ingredients used in alchemical procedures. The first explicit reference to writing practices is encapsulated in the list of alchemical signs and abbreviations that begins the ten alchemical books. This list records either alchemical symbols — signs referring to metals, plants and minerals (e.g. electrum, vinegar, lime, copper, realgar, alum, lac-dye, etc.) — or transcriptions of Greek terms, which are written in red ink and followed by an explanatory note in black (see MS Egerton 709, fol. 2r–5v and Oriental 1593, fol. 1r–3v). Although similar, this list reveals relevant variants within the two British Library manuscripts. Only MS Oriental 1593 features the following entry (fol. 1114):

ܡܚܣܒܐ . ܡܘܠܐ ܘܡܠܚܘܢܐ.

M'NYN (*lege MLNYN*): ink of the writers.

The lemma *M'NYN* seems to be a misspelled transcription of the Greek term *μελάνιον*,²⁰ the diminutive of *μέλαν* (lit. ‘black,’ ‘ink’), which is transcribed as

19 The margin of MS Egerton 709, fol. 56v, preserves a few lines of another recipe that describes how to hammer gold leaves: Berhelot and Duval, *Chimie* (cit. note 1), p. 103. Next to these lines, a note in Arabic reads: *عمل ورق ذهب للنقش*, “The working of gold leaves for the painting.”

20 The term is attested in a recipe on the preparation of a ‘magical’ ink (τοῦ μελανίου ἡ σκευή) included in *PGM I 253* (Karl Preisendanz, *Papyri Graecae magicae. Die griechische Zauberpapyri*, Stuttgart: Teubner, 1973, vol. 1, p. 14): see Miriam Blanco’s contribution in this volume (Chapter 2). A substance called *μελάνιον* is also mentioned in the *Libri medicinales* (*Medical books*) of the 6th-century Byzantine physician Aetius of Amida: in book *xvi* 146,12, *μελάνιον* appears among the ingredients of a scented drug to be used in fumigation (Skevos Zervos, *Gynaekologie des Aetios sive sermo sextus decimus et ultimus zum erstenmale aus Handschriften veröffentlicht*, Leipzig: Verlag von A. Fock, 1901, p. 170 = Roberto Romano, “Aezio Amideno libro *xvi*,” in *Medici bizantini*, edited by Antonio

MHL'WN (ܡܠܗܘܢ) or *MHL'N* (ܡܠܗܘܢ) in other Syriac texts:²¹ rather than *M'NYN*, here we should probably read *MLNYN* (ܡܠܢܝܢ), as already suggested by Duval and Brockelmann.²² This correction is confirmed by an entry included in a Galenic section preserved in the Cambridge University Library alchemical manuscript.²³ The manuscript, in fact, includes a summarized Syriac translation of Galen's treatise *On Simple Drugs*, books 9–11. The translation takes the form of a lexicon attributed to the Greek alchemist Zosimus of Panopolis. The Greek names of various minerals and animal products originally described by Galen are simply transliterated in Syriac script and briefly explained. In particular, in book 9 of *On Simple Drugs*, Galen devoted two entries to the medical uses of *μελαντηρία*, 'shoemakers' black' (book 9, chap. 3.19 = 12.226, 4–6 Kühn) and *μέλαν*, 'ink' (book 9, chap. 3.20 = 12.226, 7–10 Kühn).²⁴ These two substances appear to have been combined in a single entry in the Syriac summary, which reads (MS Mm. 6.29, fol. 121r24–25):

ܡܠܢܝܢܐ ܘܡܠܗܘܢܐ [ܡܠܢܝܢܐ] ܡܠܢܝܢܐ ܘܡܠܗܘܢܐ.

M'L'NTRY' (= Gr. *μελαντηρία*), that is *MLNYN* (= Gr. *μέλανιον*), [...] ²⁵ ink of the writers.

The term *MLNYN*, based on the Greek diminutive form *μέλανιον*, might have been used here to 'translate' the Greek *μέλαν*: indeed, as recently argued by

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- Garzya, Torino: UTET, 2006, p. 548). See also Erich Trapp, *Lexikon zur byzantinischen Gräzität besonders des 9.–12. Jahrhunderts* (Wien: vöAW, 2001–2017), vol. 2, s.v. *μέλανιον*.
- 21 Robert Payne Smith, *Thesaurus Syriacus* (Oxford: Clarendon Press, 1897–1901; hereafter *ThSyr*), p. 2025. For instance, the 10th-century lexicographer Bar Bahlūl provides the following explanation: *ܡܠܗܘܢܐ ܘܡܠܗܘܢܐ ܡܠܢܝܢܐ*, "*MHL'N* (= Gr. *μέλαν*), ink (Syriac *dyuto*), ink of the writers (Arabic *midād al-kuttāb*)," see Duval, *Lexicon Syriacum* (cit. note 3), vol. 2, p. 1022, l. 6.
- 22 Berthelot and Duval, *Chimie* (cit. note 1), p. 11, n. 1, and Carl Brockelmann, *Lexicon Syriacum*, 2nd ed. (Halis Saxorum: Sumptibus M. Niemeyer, 1928), p. 302. See Michael Sokoloff, *A Syriac Lexicon. A Translation from the Latin, Correction, Expansion and Update of C. Brockelmann's Lexicon Syriacum* (Winona Lake, IN–Piscataway, NJ: Eisenbrauns–Gorgias Press, 2009), p. 774.
- 23 MS Mm. 6.29, fol. 120v–121v + 148 + 122r–129v. See Matteo Martelli, "Medicina e alchimia. 'Estratti galenici' nel *Corpus* degli scritti alchemici siriaci di Zosimo," *Galenos*, 2010, 4: 207–228; Martelli, *L'alchimie syriaque* (cit. note 1), pp. 208–211.
- 24 Uncritical edition by Karl G. Kühn, *Claudii Galeni opera omnia*, vol. 12 (Leipzig: Knobloch, 1826).
- 25 The manuscript is damaged here and a word has been erased by humidity; Berthelot and Duval, *Chimie* (cit. note 2), p. 298, paraphrased the whole entry as follows: "*μελαντηρία* [*sic!*] ou *μέλαν*, c'est l'encre des écrivains."

Aaron Butts, in many cases “the diminutive serves as an input form for a number of Greek loanwords in Syriac.”²⁶ Moreover, both in the opening list of the MS Oriental 1593 and in the Galenic section ascribed to Zosimus, the term *MLNYN* is explained with *dyuto* (ܕܝܘܬܘܐ), a standard Syriac term for ‘ink,’²⁷ which is used with reference to inks of various colours in many recipes recently edited and commented on by Jimmy Daccache and Alain Desreumaux.²⁸ Our alchemical passages further specify that the ink was used by ‘writers’ (ܡܠܝܚܬܐ), presumably either private or professional copyists working in Christian *scriptoria*.

The inclusion of terms referring to inks and writing practices in a list of alchemical signs and Greek loanwords might astonish the reader. This apparently unexpected mention, however, does not seem out of the ordinary, especially when the Syriac list is compared with the Byzantine tradition. Byzantine alchemical manuscripts, indeed, also feature lists of signs that reveal many similarities with the opening sections of the two British Library codices. In particular, the Byzantine manuscripts *Parisinus gr.* 2327 (1478 AD) and *Laurentianus Plut.* 86, 16 (1492 AD) feature long lists of alchemical signs that include a reference to the Greek term μέλαν and its abbreviation.²⁹ Moreover, a Byzantine lexicon of alchemical terms entitled *Lexicon on the Making of Gold*, organized alphabetically, features the following entry under the letter μ: “Indigo is prepared with woad and chrysolite” (μέλαν Ἰνδικόν ἀπὸ ἰσάτιος γίνεται καὶ χρυσολίθου).³⁰ The expression clearly refers to a blue-dark colour; indeed, indigo (μέλαν Ἰνδικόν) also appears among the ingredients used to produce an artificial hyacinth in a Byzantine recipe book on the making of gemstones.³¹ On the other hand, the black ink of writers (μέλαν γραφικόν) is explicitly mentioned by the Graeco-Egyptian alchemist Pelagius to describe

26 Aaron Michael Butts, *Language Change in the Wake of Empire. Syriac in Its Greco-Roman Context* (Winona Lake, IN: Eisenbrauns, 2016) p. 101.

27 See, for instance, Bar Bahlūl explanation: ܕܝܘܬܘܐ ܡܠܝܚܬܐ, “Ink (Syr. *dyuto*), ink (Ar. *al-midād, al-hibr*);” see Duval, *Lexicon Syriacum* (cit. note 3), vol. 1, p. 562, l. 6.

28 Daccache and Desreumaux, *Recettes d'encres* (cit. note 11). See also Alain Desreumaux, “Des couleurs et des encres dans les manuscrits syriaques,” in *Manuscripta syriaca. Des sources de première main*, edited by Françoise Biquel Chatonnet and Muriel Debié (Paris: Geuthner, 2015), pp. 161–192 (p. 181).

29 For the list in the MS *Laurentianus Plut.* 86,16, see Zuretti, *Catalogue des manuscrits alchimiques grecs*, vol. 7. *Alchemistica signa* (Bruxelles: Union Académique Internationale, 1932), p. 16, l. 863; for the MS *Parisinus gr.* 2327, see Berthelot and Ruelle, *Alchimistes grecs* (cit. note 4), vol. 1, p. 114, l. 4.

30 Berthelot and Ruelle, *Alchimistes grecs* (cit. note 4), vol. 2, p. 11, l. 6. On this lexicon, see also Matteo Martelli and Stefano Valente, “Per una nuova edizione di un lessico alchemico bizantino,” *Eikasmos*, 2013, 24:275–296.

31 Berthelot and Ruelle, *Alchimistes grecs* (cit. note 4), vol. 2, p. 351, l. 29.

a black compound produced by treating chrysolite and *magnēsia*.³² Likewise, in the collection of Syriac alchemical books preserved in the British Library manuscripts, ink (*dyuto*) is introduced among the ingredients used for specific preparations. For instance, purified ‘Indian ink’ (ܐܘܪܘܩܐ ܕܝܢܘܨܐ), namely ‘Indigo’, ‘flower of copper’ (ܐܘܪܘܩܐ ܕܥܘܒܪܐ), verdigris (ܐܘܪܘܩܐ ܕܥܘܒܪܐ) and juice of leeks (ܐܘܪܘܩܐ ܕܥܘܒܪܐ) represent the main ingredients of a red alchemical ‘water’ whose preparation is described in the ninth book of the collection.³³

3 The Cambridge Alchemical Manuscript: An Overview of Ink Recipes

The scattered references to inks discussed so far are relics of a broader interest in ink making technologies (especially the making of gold and silver inks) that emerges more clearly in the collection of alchemical writings preserved by the Syriac MS Mm. 6.29. The first folia of the manuscript have been lost. In its current state, the collection opens with a series of recipes on metallurgical procedures that are difficult to read: fol. 1r, in fact, has been heavily damaged by humidity. The section is closed with the explicit: ܥܘܒܪܐ ܕܥܘܒܪܐ, “End of the first treatise on colours.”³⁴ Then, a second book begins (fol. 1v3), introduced by the title: ܥܘܒܪܐ ܕܥܘܒܪܐ [...] ܥܘܒܪܐ, “Second treatise, *hp*(...), letter *bēt* that deals with letters of any kind and paints (lit. ‘coating’) to write with gold.” The text — as we shall see, a collection of recipes — seamlessly continues until fol. 20v, where its end is marked by the explicit: ܥܘܒܪܐ ܕܥܘܒܪܐ, “End of the first treatise.” The inconsistency of this ending with the title is evident; indeed, we would have expected a reference to either book 2 or to the second letter of the Syriac alphabet (i.e. *bēt*). Hence, Berthelot and Duval supposed that this section actually merges two originally separate books: (1) a first treatise on gold inks and paints, which runs until fol. 9r, where it concludes with a recipe on how to write on iron with black letters (fol. 8v21–9r8: ܥܘܒܪܐ ܕܥܘܒܪܐ); (2) an untitled book on various metallurgical procedures and dyeing techniques, which ends with the above-mentioned explicit.³⁵ Indeed, after this first

32 *Ibid.*, p. 255, l. 20: γίνεται δὲ πᾶν μέλαν ὡς τὸ γραφικὸν μέλαν, “it becomes completely black as the ink for writing.” On Pelagius, see Jean Letrouit, “Chronologie des alchimistes grecs,” in *Alchimie: Art, histoire et mythes*, edited by Didier Kahn and Sylvain Matton (Paris–Milano: S.É.H.A.–Arché, 1995), pp. 11–93 (pp. 46–47).

33 Berthelot and Duval, *Chimie* (cit. note 1), p. 49 (see l. 8 in particular).

34 *Ibid.*, p. 203.

35 *Ibid.*, pp. 209–210.

treatise, the manuscript continues with other treatises progressively marked by Syriac letters in alphabetical order, from the second (*bēt*) to the eleventh letter (*kop*), which appear to be the Syriac translation of original Greek texts by the Graeco-Egyptian alchemist Zosimus of Panopolis (3rd–4th century AD).³⁶

The possible relationship of the first two books with the other treatises by Zosimus awaits a proper examination and, hopefully, the question will be better assessed after the publication of a complete edition of Zosimus’ Syriac books.³⁷ Here, it will suffice to note that these books include various references to the use of compounds or simple substances as inks. Book 9 (on mercury), for instance, contains a recipe on how to produce a “golden mercury” (Mm 6.29, fol. 58v19–20) by grinding nails of gold (ܡܥܥܠܐ ܕܗܘܪܐ) in a mortar and mixing it with water or liquid gum (? ܡܥܥܠܐ).³⁸ Thanks to this procedure, the author specifies (fol. 58v19–20), ܡܥܥܠܐ ܕܗܘܪܐ ܕܥܘܢܐ ܕܡܥܥܠܐ ܕܗܘܪܐ [...] “You will have the mercury of gold that is useful also for the books (i.e. for writing on books).” In book 11 (on iron), a recipe on the treatment of iron is introduced by the title: ܡܥܥܠܐ ܕܗܘܪܐ ܕܥܘܢܐ ܕܡܥܥܠܐ ܕܗܘܪܐ, “Preparation of iron with which you will write on glass” (Mm. 6.29, fol. 77v24–28).³⁹ Finally, a section of book 7 explains a gilding technique that could be applied to both metallic leaves and parchment (Mm. 6.29, fol. 48v13–21). The recipe describes how to prepare a golden paint without actually adding the precious metal: a wide variety of ingredients — such as lime (ܡܥܥܠܐ = Gr. γύψος), fish glue (ܡܥܥܠܐ ܕܦܝܫܐ), *MLYSYN* (ܡܥܥܠܐ = Gr. Μιλήσιον),⁴⁰ ochre (ܡܥܥܠܐ = Gr. ὤχρα) and minion (ܡܥܥܠܐ) — are mixed together in different steps and applied to metallic leaves. The same product could also be used to write on parchment (ܡܥܥܠܐ ܕܗܘܪܐ).⁴¹

The wide range of substances handled by ancient alchemists included ‘chemicals’ that could serve multiple applications. Similar paints were used both to

36 See also Martelli, *Alchimie en syriaque* (cit. note 1), pp. 199–209.

37 The edition is in progress as part of the ERC project *AlchemEast*.

38 Berthelot and Duval, *Chimie* (cit. note 1), p. 245, translate: “avec de l’eau ou de la gomme liquide.” See also Duval, *Lexicographie* (cit. note 10), p. 366. The usual meaning of ܡܥܥܠܐ is, however, ‘filings’.

39 Berthelot and Duval, *Chimie* (cit. note 1), p. 257.

40 According to ancient Greek medical literature, the adj. Μιλήσιος ‘Milesian’ was used to qualify a specific kind of ἀλκυόνιον (perhaps a type of coral or sponge). In his book *On Materia Medica*, for instance, Dioscorides writes (v 118): “You must know that there are five kinds of *alkyonia*. One kind is thick, sponge-like in structure and heavy; [...] the third is vermicular and of purplish colour; some call it Milesian (τὸ δὲ τρίτον σκωληγκοειδὲς ὑπάρχει τῷ τύπῳ, καὶ τῇ χροῖᾳ ἐμπόρφυρον, ὃ τινες Μιλήσιον καλοῦσι).” Translation by Lily Y. Beck, *Pedanius Dioscorides of Anazarbus, De Materia Medica*, 2nd edition (Hildesheim–Zürich–New York: Olms–Weidmann, 2011), p. 392.

41 Berthelot and Duval, *Chimie* (cit. note 1), p. 237.

to the Hellenistic period. In his *Compendium on Mechanics* (IV 77),⁴⁶ the 3rd-century BCE writer Philo of Byzantium mentions a special ink made of gall nuts dissolved in water, which enabled the writing of letters that became invisible as the mixture dried; however, the letter becomes legible again once it is washed with a sponge soaked in a solution of vitriol.⁴⁷

4 The Book on Inks in the Cambridge Manuscript

As already mentioned, the first section of the MS Mm. 6.29 preserves a treatise marked by the letter *bēt*, which collates more than 40 recipes on the making of inks.⁴⁸ The compiler's interest appears to be primarily focused on golden inks, which often include a quantity of gold. In some cases, however, cheaper ingredients — either metallic alloys or yellow plants and minerals — are used to prepare products that do not require the use of the precious metal. Methods for writing black letters on metallic surfaces are also described, along with those for the preparation of silver inks. Many of the recipes included in this book are based on earlier Greek texts that have been preserved in their original language in only a few cases. Indeed, the description of some procedures in the Syriac book matches the technical information conveyed by the Leiden Papyrus X (3rd–4th century AD), a Greek collection of (al)chemical recipes that also features various formulas on the preparation of gold and silver inks.⁴⁹ However, the most important alchemical source that overlaps significantly with the Syriac treatise is a Latin recipe book usually referred to as the *Mappae clavicula*. This has been identified as an early Medieval translation of a lost Late Antique alchemical treatise originally written in Greek.⁵⁰

46 Edition in Hermann Diels and Erwin Adelbert Schramm, *Exzerpte aus Philons Mechanik B. VII und VIII (vulgo fünftes Buch). Abhandlungen der preußischen Akademie der Wissenschaften, Philosophisch-historische Klasse Nr. 12.* (Berlin: Reimer, 1920), p. 79.

47 Robert J. Forbes. *Studies in Ancient Technology*, 9 vols (Leiden: Brill, 1966–1993), vol. 3, pp. 236–239; Thomas Christiansen, "Manufacture of Black Ink in the Ancient Mediterranean," *The Bulletin of the American Society of Papyrologists*, 2017, 54:167–195 (pp. 188–190).

48 Partial French translation in Berthelot and Duval, *Chimie* (cit. note 1), pp. 203–209.

49 See the recent edition and French translation by Halleux, *Papyrus* (cit. note 2), pp. 84–109 (see pp. 42–43 for an introduction to the recipes for ink making). A full English translation of the papyrus (although based on an earlier and less reliable edition) is available in Earle Radcliffe Caley, "The Leiden Papyrus X. An English Translation with Brief Notes," *Journal of Chemical Education*, 1926, 10:1149–1166.

50 For a recent edition and Italian translation of the *Mappae clavicula*, see Sandro Baroni, Giuseppe Pizzigoni, and Paola Travaglio, *Mappae clavicula. Alle origini dell'alchimia in*

Sir. Take filings of gold and put in a mortar. Grind them with vinegar until they become liquid. Then drip vinegar and add fish glue; grind with water, mix together, moisten with water, and write.

Here, gold is added to the preparation after being limed and reduced to filings. Indeed, filings were probably easier to grind in a mortar than gold leaves, which are very malleable and difficult to process. As we shall see, when gold leaves appear in ink recipes, they are often mixed with mercury to facilitate the grinding process.⁵³ In our recipe, vinegar seems to be used for the same purpose: the aim was to produce a gold powder in suspension in a liquid substance. Fish glue is mixed to make the ink stickier. A similar technique is already attested in the Leiden Papyrus, according to which a gold ink was produced by grinding a gold alloy with vinegar (rec. 44):⁵⁴

Χρυσογραφία. Χρυσᾶ γράμματα γράφειν· κολλῆ χρυσοχοικῆ γράφε δ̄ θέλεις σὺν ὄξει.

Chrysography. To write in letters of gold. Write what you desire with goldsmith's solder and vinegar.⁵⁵

Rather than pure gold, a gold alloy is used here. Indeed, the Leiden Papyrus also includes two different formulas for gold solders, in which gold (in different proportions) is alloyed with copper and silver.⁵⁶ According to Alexander's experiments, who used a gold-copper alloy (2 parts of gold, 1 part of copper) with a little of silver,⁵⁷ "the ink — made by filing the metal, rising the powder in vinegar and mixing with gum — is reddish brown when applied to the parchment, though discrete particles of metal give a decided lustre to the surface."⁵⁸ The Greek text, however, fails to specify the addition of a glue, like gum or fish glue.

In some cases, litharge — an orange-yellow lead oxide — was also mixed with gold, as described in the next recipe of the Cambridge manuscript:

53 Shirley M. Alexander, "Medieval Recipes Describing the Use of Metals in Manuscripts," *Marsyas*, 1964–1965, 12:34–53 (p. 38).

54 Halleux, *Papyrus* (cit. note 2), p. 96.

55 Translation by Caley, *The Leiden Papyrus X* (cit. note 49), p. 1157.

56 See rec. 30 and 32 of the Leiden Papyrus: Halleux, *Papyrus* (cit. note 2), pp. 92–93.

57 This is the formula given by rec. 32 of the Leiden Papyrus.

58 See Alexander, *Medieval Recipes* (cit. note 53), p. 40.

(R6) Fol. 2v3–7 (golden ink with the precious metal)

همن. هصعلا وحصا ححصلا سبأ. مهوؤطا [...] ههوي اوصبا سسحهوي. سحلاؤم هسسه
 هاهبي حصتا ححصلا وحصلا ههبي مهوؤطا. ه'ؤملا حد مصهني سحلاهت.

Sir. Take pure gold, 1 part; litharge, [...] and pour together and mix, then grind and wash with water until litharge is purified; add water of gum and write.

The addition of lead (in the form of litharge, i.e. a lead oxide) could make the gold brittle, so that it was more easily filed to a fine powder. Moreover, the yellow colour of litharge made the substance more suitable for the preparation of golden inks.⁵⁹ A gold-lead alloy is used, for instance, in recipe 68 of the Leiden Papyrus, which prescribes melting the alloy before grinding it in a mortar of jasper and adding vinegar and soda.⁶⁰ As we shall see, a similar alloy is also used in recipe 13 of the Cambridge manuscript (see below).

After this first section, which only include formulas that require the addition of gold, two recipes (R7–8) record the complex formulas of golden inks (or paints), which involve a set of vegetal, mineral, and animal ingredients. Only the second recipe (R8) prescribes adding a metallic leaf, without specifying which metal it is made from:

(R7) Fol. 2v9–14 (golden ink without gold used to write on paper, glass and marble)

ه'ؤملا. حنوؤلا وطلا. اؤهيمعه واهصا. زؤفلا زحصلا.⁶¹ هال وقحلا وؤمحصلا
 وحتعم. اؤملا وههصلا. ههؤمحصلا. حلاهه هت سبأ سبأ ححصلا. سسهؤا وسصه
 قدا سحب عتفا. سحلا زحصلا ولاءه واههه ححلا حصه حصه مصهني اه حصصلا
 وافي.

wʿršʿ (a yellow dye plant; see Ar. ورس),⁶² bile of a tortoise, golden orpiment (= Gr. ἀρσενικόν), scissile alum, inner part of the skin/peel of dried pomegranates, earth from Samos, saffron; for each of these (ingredients) take 1 part, and the white of 5 eggs, and reduce them to a paste. When you want to paint, mix it in water of gum or in reddish wine.

59 Rec. 34 of the Leiden Papyrus simply prescribes: “Another (recipe). Golden-coloured litharge, 1 part; alum, 2 parts.” Caley, *The Leiden Papyrus* (cit. note 49), p. 1156; Halleux, *Papyrus* (cit. note 2), p. 93.

60 Alexander, *Medieval Recipes* (cit. note 53), p. 39. Text edited in Halleux, *Papyrus* (cit. note 2), p. 100.

61 The ms has زحصلا.

62 Other spellings: هؤهه and هؤههه; see Duval, *Lexicographie* (cit. note 10), pp. 312–313; Sokoloff, *A Syriac Lexicon* (cit. note 22), p. 360.

(R8) Fol. 2v14–17 (golden ink)

هين. هوزعا. اوزيمصه. وهفنه مصحف. انيم حلالا. حذولا وحجالا. مصمص
 وهحبالا. مع حلب مصمص. سب سب انبا. انليم مصمص مصمص مصمص. فحلالا
 حلالا.

Sir. wʿršʿ (a yellow dye plant), orpiment of good quality, that has been purified, a bit of verdigris, bile of a calf, golden gum; for each of these (ingredients), 1 part; mix these (ingredients), pound a (metallic?) leaf with them and write.

These two recipes exhibit a number of similarities with other texts preserved in the Leiden Papyrus, the *Mappae clavicula*, and in the above-mentioned book of Democritus that is handed down in the same Cambridge Manuscript and that includes recipes on ink making.⁶³ In fact, this book contains the following formula (MS Mm. 6.29 fol. 100r7–13):

انبا. الكهرويه. حبالا انبا. اوزيمصه [...] وهنا حبالا انبا. حذولا وحجالا
 حبالا مصمص. مصمص وم حلالا. وو مصمص مصمص. مصمص وم حلالا حلالا.
 مصمص وم مصمصا. وو مصمصا. مصمص مصمصا حلالا وحبالا انبا.
 حقالا حلالا مصمصا حلالا حقالا حقالا.

Another (recipe). Celandine (= Gr. ἐλύδριον), 1 part; golden (?) orpiment (= Gr. ἀρσενικόν), 1 part; bile of a calf,⁶⁴ 5 parts. All these (ingredients) amount to 20 drachmae; this must be added to them: Saffron from Cilicia, 4 drachmae; with this write on whatever (surface) you want, on vessels, on paper as well as on stones and wood.

When read in parallel, these three recipes provide an almost complete repertoire, so to speak, of the “commonest non-metallic ingredients for supplementing metal powder,” as Alexander wrote in her overview of the recipes for metallic inks in the Western Middle Ages (an overview that did not consider the Syriac evidence):⁶⁵ gold-coloured orpiment (a shiny yellow arsenic sulfide); pomegranate; bile of various animals; yellow plants such as celandine juice (often substituted with a plant called *wʿršʿ* in the Syriac recipes); and saffron. The same set of ingredients is used in recipe 72 of the Leiden Papyrus

63 See above, p. 90.
 64 When compared with similar descriptions of the same technique preserved in Greek and Latin (see below), the text seems to be incomplete (perhaps a few words were lost in the transmission of the recipe). We would have expected to find a reference to 5 parts of egg white here.
 65 Alexander, *Medieval Recipes* (cit. note 53), p. 42.

as well as in recipes 47 and 50 of the *Mappae clavicula*. Texts and translations of these three recipes are provided below:

Leiden Papyrus, rec. 72⁶⁶

Ἄλλη. Χρυσογραφία χωρίς χρυσοῦ· ἔλυδρίου μέ(ρος) α', ῥητίνης καθαράς μέ(ρος) α', ἀρσενικοῦ χρυσίζοντος μέ(ρος) α' ὃ ἔστιν σχιστόν, κόμμεως καθαροῦ, χολῆς χελώνης μέ(ρος) α', ὠών τοῦ ὑγροῦ μέ(ρη) ε', ἦτω δὲ τῶν ξηρῶν πάντων ἢ ὀλκή Σ κ', εἶτα ἐπέμβαλε τούτοις κρόκου κιλικίου Σ δ'. Ποίει δὲ οὐ μόνον ἐπὶ χάρτου ἢ διφθέρας, ἀλλὰ καὶ ἐπὶ μαρμάρου ἐστιλβωμένου καὶ ἐάν τι ἄλλο καλὸν θέλης ὑποζωγραφῆσαι καὶ ποιῆσαι χρυσοειδές.

Another (recipe). To write in letters of gold without gold. Celandine, 1 part; pure resin, 1 part; golden coloured orpiment, the one that is scissile, 1 part; pure gum; bile of tortoise, 1 part; the liquid part of eggs, 5 parts; take 20 staters by weight of all these materials dried; then throw in 4 staters of saffron of Cilicia. Can be used not only on papyrus or parchment, but also upon highly polished marble, or also when you wish to make a beautiful design upon some other object and give it the appearance of gold.⁶⁷

Mappae clavicula, rec. 47⁶⁸

Auri alia scriptio sine auro. Elydrii partem 1, resinae frixae partem 1, ovorum v humores, gummi puri partem 1, auripigmenti scissilis partem 1, fellis testudinis partem 1. Sit autem eorum id est tunsorum omnium pondus ad dragmas xx. Deinde adicias croci ciliciensis dragmas 11. Fac autem hoc non solum in cartis et in membranis, verum etiam in marmore et in vitro.

Another writing in gold without gold. Celandine, 1 part; broken resin, 1 part; the white of 5 eggs; pure gum, 1 part; scissile orpiment, 1 (part); gall of a tortoise, 1 (part). The weight of them all, after they have been pounded, should be about 20 drachmae. Then add 2 drachmae of Cilician saffron. This works not only on papyrus and parchment, but also on marble and on glass.⁶⁹

66 Halleux, *Papyrus* (cit. note 2), p. 101. See also the recipe 56 of the Leiden papyrus, which records a list of similar ingredients: Halleux, *Papyrus* (cit. note 2), p. 98.

67 Translation (slightly modified) by Caley, *The Leiden Papyrus* (cit. note 50), p. 1159.

68 Baroni et al., *Mappae clavicula* (cit. note 50), p. 108.

69 Translation based on Cyril Stanley Smith and John G. Hawthorne, "Mappae Clavicula. A Little Key to the World of Medieval Techniques," *Transactions of the American Philological Society*, 1974, 64,4:1–128 (p. 34).

Mappae clavicula, rec. 50⁷⁰

Aurei coloris scriptura in cartis, in marmore et vitro ut videatur de auro. Elydrii partem 1, auripigmenti partem 1, fellis testudinis partem 1, aluminis scissilis partem 1 et de corio mali punici quod intus est aurei coloris 1, gummi 1, ova v. Sit autem eorum pondus dragmas IX et croci dragmas II.

Gold-coloured writing on papyrus, marble, and glass, so that it seems to be made of gold. Celadine, 1 part, orpiment, 1 part, gall of a tortoise, 1 part, scissile alum, 1 (part) and 1 part of the skin of a pomegranate that is gold-coloured inside, gum, 1 part, 5 eggs. The weight of all these should be 9 drachmae, and 2 drachmae of saffron.⁷¹

All these recipes, except for R8 of the Cambridge manuscript, emphasize the multiple applications of the produced ink, which could be used to write on different supports, from papyrus and parchment to metal, marble, wood, stone, and glass. In order to better compare the substances involved in the described procedures, I have listed the ingredients in Table 5.1.

The Syriac recipe included in Democritus' book overlaps in many respects with Leiden Papyrus, rec. 72, and *Mappae clavicula* (hereafter *MC*) rec. 47. Both the ingredients and their proportions are almost the same, and some variations can probably be explained with textual arguments. As for the amount of eggs, the Leiden Papyrus and *MC* 47 specifies taking 5 parts, while Democritus' Syriac text mentions the same quantity for the bile of a calf, but omits any mention of eggs: we cannot exclude that the term 'eggs' was originally in the Syriac recipe (or in its source), but was later omitted by a scribe who copied the text.⁷² Likewise, the variation between "bile of a tortoise" (both in the Leiden Papyrus and in *MC* 47) and "bile of a calf" (Democritus' recipe) can be explained by considering the transmission of the Syriac text: in Syriac, in fact, the terms for the two animals are very similar — 𐤀𐤂𐤋𐤍 (*galo*), 'tortoise' and 𐤀𐤂𐤋𐤍𐤀 (*'eglo*), 'calf' — and they can be easily interchanged. Philologists and critical editors, however, should be very cautious in handling similar texts, since lexical variations can also point to subtle changes in the selection of the ingredients. Indeed, the Leiden Papyrus (rec. 61) specifies that very bitter bile of a calf (μοσχεῖα χολή κατὰπικρός) could be used instead of tortoise bile (χολή χελώνης) in the making of a golden ink.⁷³

70 Baroni et al., *Mappae clavicula* (cit. note 50), p. 110.

71 Translation based on Smith and Hawthorne, *Mappae Clavicula* (cit. note 69), p. 35.

72 See also R7, where 5 eggs are recorded.

73 Halleux, *Papyrus* (cit. note 2), p. 99; see also Alexander, *Medieval Recipes* (cit. note 53), p. 42.

TABLE 5.1 Ingredients of the golden ink according to ancient texts

	R7	R8	Democritus	Leiden 72	MC 47	MC 50
<i>Plants</i>						
plant dye w'RŠ'	✓ (1 part)	✓ (1 part)				
plant dye 'celandine'			✓ (1 part)	✓ (1 part)	✓ (1 part)	✓ (1 part)
pomegranate (inner part)	✓ (1 part)					✓ (1 part)
saffron	✓ (1 part)		✓ (4 drach.)	✓ (4 stat.)	✓ (2 drach.)	✓ (2 drach.)
resin				✓ (1 part)	✓ (1 part)	
gum		✓ (1 part)		✓	✓ (1 part)	✓ (1 part)
<i>Minerals</i>						
orpiment	✓ (1 part)	✓ (1 part)	✓ (1 part)	✓ (1 part)	✓ (1 part)	✓ (1 part)
verdigris		✓ (1 part)				
alum	✓ (1 part)					✓ (1 part)
earth of Samos	✓ (1 part)					
metallic leaf		✓				
<i>Animal products</i>						
bile of a calf		✓ (1 part)	✓ (5 parts)			
bile of a tortoise	✓ (1 part)			✓ (1 part)	✓ (1 part)	✓ (1 part)
eggs	✓ (5 eggs)			✓ (5 parts)	✓ (5 eggs)	✓ (5 eggs)

A clear similarity in the ingredients and their quantities is also detectable between the Syriac recipe **R7** and *MC 50*: as for the dye plant used in the process, the Syriac text prescribes using *w'rš'* rather than celandine,⁷⁴ and it also includes the earth of Samos, which is not mentioned in the *Mappae clavicula*.

If we go back to the recipe book on ink making preserved by the Cambridge manuscript, we must note that recipes 8–9, which do not require the use of precious metals, are followed by a cluster of recipes that describe various treatments of gold for preparing inks and paints:

(**R9**) Fol. 2v17–3r11 (golden ink with the precious metal)

Inc.: ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ. ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ. *Sir*. Pour lead and copper etc.”

(**R10**) Fol. 3r11–3v2 (golden ink with the precious metal)

ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ
ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ ܡܘܫܥܝܘܢ ܕܥܘܒܪܝܢܝܘܢ 75

Sir. To write with gold. Good orpiment (= Gr. ἀρσενικόν), 2 parts; *w'rš'* (a dye plant), 1 part; litharge that we have gilded, 1 part; grind and mix with water. Then take 24 leaves (of gold?) and add a quarter of the mixture. Grind together in a clean mortar by adding a bit of salt. When it is well ground, add water until only pure gold remains. Then add what is left of the mixture and a bit of broken gum, by pouring a bit of water of saffron over it. Then you grind until it thickens like an ink (*dyuto*) and put it in a copper vessel. When you write with it, soak a reed (in) liquid alum, and write. When it gets dry, polish with pork rind.

This detailed recipe singles out the different passages of the procedure, at the same time specifying the right proportions of the various substances added to the preparation of the golden ink. Quite striking is the mention of 24 leaves of gold (l. 2), which seems to imply the use of a significant amount of the precious

74 The same substitution can be observed in **R10** (see below).

75 I added the prep. ܥ; the MS simply reads ܩܩܩܩܩܩ. See also below, **R13**.

metal. The same datum, however, appear to be confirmed by the Latin version of this recipe (clearly based on a common Greek source), which is included in the *Mappae clavicula* (rec. 38):⁷⁶

Auripigmenti scissilis partes II, elydrii partem I, spumae argenti cuius color sit aureus partem I. Haec, cum triveris, diffunde in vase. Postea accipe laminas aureas XXIIII ad quartam, quantum voles ex his tere in mortario mundo medicinali. Adice sal modicum et, cum tibi apparverit ut arena diligenter trita, adice aquam puram et tere et abluere, ita ut frequenter aquam effundas et aliam infundas donec tibi aurum purum appareat. Tunc adice de suprascripto medicamine quod sufficiat et modicum gummi triti, ita ut non sit glutinosum. Instilla destillationem croci et omnia simul tere, ut sit quasi atramenti pinguedo, et recipe aut in concam aut in vitreum vas. Cumque scribere vis, primum ungue cannam liquido alumine et tunc in aurum intingue et scribe et, cum siccaverit, dente frica diligenter.

Scissile orpiment, 2 parts, celandine, 1 part, litharge, whose colour must be golden, 1 part. After grinding them, pour them into a pot. Then take as fourth (part) 24 gold leaves, and grind as much as you want of these in a clean pharmacist's mortar. Add a bit of salt and, when it looks like well-ground sand, add fresh water, grind and wash it off, so that you continually pour out the water and add new water until you see that the gold is pure. Then add a sufficient amount of the above-mentioned drugs and a little ground gum, so that it does not get sticky. Drip onto it an extract of saffron and grind everything together, so that it has the consistency of ink. Place it in a shell or a glass pot, and when you want to write, first smear the reed pen with moist alum, then dip it in the gold and write. When it gets dry, rub it thoroughly with a tooth.⁷⁷

Only a few differences between the Latin and the Syriac text are detectable. As already noted in the comparison between R7 and MC 50, the dye plant called *wʾRšʾ* is used in the Syriac text (R10) instead of celandine (*elydrium* = Gr. ἐλύδριον), which is prescribed in the Latin recipe (MC 38). Moreover, according to the latter, the ink was to be placed in a shell or a glass pot rather than in a copper vessel as in the Syriac recipe. Here, pig skin is used to polish the written letters, while the Latin text mentions using a tooth.

⁷⁶ Baroni et al., *Mappae clavicula* (cit. note 50), p. 100.

⁷⁷ Translation based on Smith and Hawthorne, *Mappae Clavicula* (cit. note 69), p. 34.

Another six recipes for golden inks follow on from the above-mentioned formula (R10) in the Cambridge manuscript, some of which again reveal similarities with the *Mappae clavicula*.

(R11) fol. 3v2–12. (gold ink)

Inc.: ܐܢܝܢܐ ܘܥܦܝܢܐ, “Another beautiful (recipe).”

(R12) fol. 3v12–19 (gold ink)

Inc.: ܗܝܢܐ ܘܒܝܘܬܐ ܐܢܝܢܐ ܦܥܝܠܐܝܢܐ, “*sir*. To gild easily.”

(R13) fol. 3v20–4r3 (gold ink with the precious metal)

ܘܒܠܘܬܐ ܐܢܝܢܐ ܕܥܥܡܘܠܐ. ܗܝܬ ܡܘܠܐ ܫܥܩܝܘܢܐ ܘܩܥܝܢܐ ܩܥܝܢܐ ܕܗܝܬ ܕܥܥܡܘܠܐ ܘܒܠܘܬܐ ܐܢܝܢܐ. ܗܝܬ ܡܘܠܐ ܫܥܩܝܘܢܐ ܘܩܥܝܢܐ ܩܥܝܢܐ ܕܗܝܬ ܕܥܥܡܘܠܐ ܘܒܠܘܬܐ ܐܢܝܢܐ. ܗܝܬ ܡܘܠܐ ܫܥܩܝܘܢܐ ܘܩܥܝܢܐ ܩܥܝܢܐ ܕܗܝܬ ܕܥܥܡܘܠܐ ܘܒܠܘܬܐ ܐܢܝܢܐ. ܗܝܬ ܡܘܠܐ ܫܥܩܝܘܢܐ ܘܩܥܝܢܐ ܩܥܝܢܐ ܕܗܝܬ ܕܥܥܡܘܠܐ ܘܒܠܘܬܐ ܐܢܝܢܐ.⁷⁸

To write with gold. Take lead and melt it several times, while quenching it in cold water. Then grind gold with pure mercury (*nono*, lit. ‘cloud’) until it softens. Then, add water of gum in it and write, by dipping a reed (in) moist alum.

(R14) fol. 4r3–15 (Gold paint/ink)

Inc.: ܗܝܢܐ ܘܒܝܘܬܐ ܐܢܝܢܐ ܕܥܥܡܘܠܐ ܕܥܥܡܘܠܐ, “*sir*, so that a vessel looks like gold.”

The same technique described in R13 also occurs in the *Mappae clavicula*. The various manuscripts of the Latin compilation, however, preserve different versions of this recipe with different degrees of complexity in terms of explaining the procedure. Below, I have copied the version transmitted by MS Corning Museum of Glass, Philipps 3713, which shows close similarities with the Syriac version:

Mappae clavicula, rec. 44⁷⁹

Aliter. Plumbum conflas frequenter et intinguis in aquam frigidam et tunc conflabis aurum et restringuis in predicta aqua et fit fragile. Deinde teris diligenter aurum cum argento vivo, ipsam autem fecem cum quo scis diligenter purgas et misces gummi liquidum et scribe, ante in alumine liquido calamum tinguere. Et sale et aceto purges alumen.

78 I added the prep. ܘ; the MS simply reads ܘܩܥܝܢܐ. See also above, R10.

79 Baroni et al., *Mappae clavicula* (cit. note 50), p. 106.

Another way. You melt lead several times and quench it in cold water; then you will melt some gold and quench it in the above-mentioned water; it becomes brittle. Then you grind the gold thoroughly with quick-silver. You clean the dregs with the substance that you know and mix liquid gum, and write, after you have dipped the reed in liquid alum. Clean the alum with salt and vinegar.⁸⁰

As already noted with reference to R6, the addition of lead makes the gold brittle and facilitates the grinding process. In this case, the procedure is combined with the standard use of mercury for reducing gold to powder. On the basis of laboratory experiments, Alexander explains that, if added in the right proportion, “gold leaf readily amalgamates with mercury to form a pulverulent mass.”⁸¹

The following cluster of two recipes (R15–16) corresponds to two texts that also appear consecutively in the *Mappae clavicula* (MC 34–35), further confirming the close link between the Syriac and the Latin compilations, which probably drew on common sources.⁸²

(R15) fol. 4r15–18 (Gold paint/ink).

ܠܗܘܢ ܘܢܚܒ ܐܘܪܝܢܐ ܘܘܠܗܘܝܬ. ܘܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ. ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ ܘܘܠܗܘܝܬ.

Sir. To make gold liquid. Take cinnabar, sand of a mountain, filings of gold, alum, and vinegar, grind them together, boil in a vessel of copper and stir until it is melted.

Mappae clavicula, rec. 34.⁸³

Aurum liquidum facere. Minium et arenam montanam, auri limaturam et alumen cum aceto simul tere et coque in vase aereo et commove. Huius scripturae color per annos durat.

80 Translation based on Smith and Hawthorne, *Mappae Clavicula* (cit. note 69), p. 34.

81 Alexander, *Medieval Recipes* (cit. note 53), p. 38.

82 We must note that, according to Baroni's analysis, the second part of the Syriac treatise includes three recipes that appear in the same order in the *Mappae clavicula*: Mm. 6.29, fol. 7r10–21 *How (to treat) silver, copper or gold for writing* = MC 122; Mm. 6.29, fol. 7r21–7v2 *To write letters on Cyprian copper* = MC 123; Mm. 6.29, fol. 7v3–10 *To write black letters on a copper vessel, which cannot be erased* = MC 124. See Baroni et al., *Mappae clavicula* (cit. note 50), pp. 157–158 and 240.

83 Baroni et al., *Mappae clavicula* (cit. note 50), p. 96.

5 Concluding Remarks

A galaxy of recipes on ink making emerges from the comparison of the instructions preserved by multiple traditions, which, despite their own peculiarities and different ramifications, appear to be firmly rooted in a shared and rich Late Antique material. In particular, the close similarities between Syriac and Latin recipes cannot be properly assessed without supposing common Greek sources that were independently translated into either language by scholars working in distinct cultural settings and operating in different periods. Traces of this Greek Late Antique heritage can be detected in Graeco-Egyptian papyri, such as the Leiden Papyrus, which represents a crucial source for reconstructing ancient procedures used to prepare gold or silver inks and paints. Other relics of this ancient technology are detectable in the collection of Greek alchemical treatises transmitted by Byzantine manuscripts, which share various features with the Syriac sources under examination.

On the other hand, the Syriac manuscript Mm. 6.29 includes a variety of procedures for the making of metallic inks, which substantially enriches the scanty information that can be extracted from the material preserved in Graeco-Egyptian papyri as well as in Byzantine alchemical sources. Gold and silver inks were important tools belonging to a broader umbrella of techniques that aimed at changing the colours of different materials, from metals and stones to papyrus and parchment. As already seen, commenting on the recipes included in the Leiden Papyrus, Robert Halleux rightly emphasized that: “La composition des encres est rigoureusement parallèle à celle des dorures et des vernis.”⁸⁷ After all, Late Antique alchemical theories and practices developed around the effort to select and conceptualize a broad spectrum of techniques dealing with chromatic transformations. The Syriac tradition testifies to the centrality of colours and dyes in the ancient alchemical discourse, which included the making of inks among the areas of expertise to be explored, organized, and handed down over centuries.

87 Halleux, *Papyrus* (cit. note 2), p. 42.