

Alexandre M. Roberts

## Islamicate alchemy in Greek letters on the first page of *Marcianus graecus* 299

**Abstract:** The famous middle Byzantine alchemical manuscript *Marcianus graecus* 299 contains annotations from the late Byzantine period, most prominently in its opening quire. This article examines a text on the very first page of the manuscript, a text written in a late Byzantine Greek script, but in a language other than Greek. A number of words in this undeciphered text can be correlated with Arabic technical vocabulary that would also have been used in other Islamicate languages such as Persian and Ottoman Turkish. Certain features such as accentuation on the final syllables of words make Turkish or Persian the most likely candidates.

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**Adresse:** Dr. Alexandre Roberts, Department of Classics, University of Southern California, 3560 Watt Way, PED 130, Los Angeles, CA 90089–0652, USA; robe941@usc.edu

The Greek-Arabic translation movement of the eighth to tenth centuries, in which the Greek philosophical, scientific, and technical literature preserved and cultivated in the Byzantine Empire and former Byzantine territories was translated into Arabic, is fairly well known.<sup>1</sup> Less well known among non-specialists is the reverse phenomenon, in which Arabic philosophical, scientific, and technical literature were translated into Greek by and for Byzantine scholars, who were no less keen to have access to the latest work in their fields than their Arabic-speaking counterparts. Pioneering work by Maria Mavroudi and other Byzanti-

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<sup>1</sup> D. GUTAS, Greek thought, Arabic culture: the Graeco-Arabic translation movement in Baghdad and early ‘Abbāsīd society, 2nd–4th/8th–10th centuries. London 1998; M. MAVROUDI, Translations from Greek into Latin and Arabic during the Middle Ages: searching for the classical tradition. *Speculum* 90 (2015), 28–59. Other Greek-Arabic translation activity, not restricted to “secular” texts or to this early period, has recently become better known as well: A. TREIGER, Christian Graeco-Arabica: prolegomena to a history of the Arabic translations of the Greek Church Fathers. *Intellectual History of the Islamicate World* 3 (2015), 188–227; B. ROGGEMA / A. TREIGER (eds.), Patristic literature in Arabic translation. *Arabic Christianity: Texts and Studies*, 2. Leiden 2020; A. TREIGER, The beginnings of the Graeco-Syro-Arabic Melkite translation movement in Antioch. *Scrinium* 16 (2020), 306–32.

nists and Arabists has shown that such translations from Arabic into Greek – and the accompanying Byzantine engagement with science from abroad – was a significant part of middle and late Byzantine intellectual activity.<sup>2</sup>

In *A Byzantine book on dream interpretation* (2002), Mavroudi demonstrated that the *Oneirocriticon of Achmet*, on the prognostic science of dream interpretation, was translated from the Arabic tradition on dream interpretation. She then concluded her monograph by presenting significant evidence of other Arabic-to-Greek translations in the fields of astronomy-astrology, alchemy, meteorology, agriculture, geomancy, other divination, and magic.<sup>3</sup> In the case of alchemy, she highlighted the previously known but often ignored fact that the middle Byzantine alchemical codex *Marcianus graecus* 299 contains two chemical recipes that refer to Arabic terms for particular ingredients.<sup>4</sup> One of the recipes makes prominent use of a substance called θουθία.

It is my purpose here to return to this manuscript and to this substance, θουθία or τουτρία. Later Byzantine scribes added marginalia to this manuscript's first quire on various topics, including alchemy, astrology, dream interpretation, and agricultural prognostication.<sup>5</sup> One of these later additions has so far eluded interpretation for the simple reason that it is not Greek. In the present article, I will argue that it is an alchemical text in an Islamicate language, probably Turkish, here represented using Greek script.

*Marcianus graecus* 299 (= **M**) at the Biblioteca nazionale Marciana in Venice is the oldest and most important surviving manuscript witness to the Greek Alchemical Corpus. Dating to the middle Byzantine period, probably the tenth century,<sup>6</sup> this parchment codex contains a wide-ranging collection of ancient,

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2 M. MAVROUDI, *A Byzantine book on dream interpretation: the Oneirocriticon of Achmet and its Arabic sources*. Leiden 2002; M. MAVROUDI, *Occult sciences and society in Byzantium: considerations for future research*, in P. Magdalino / M. Mavroudi (eds.), *The occult sciences in Byzantium*. Geneva 2006, 39–95; M. MAVROUDI, *Exchanges with Arabic writers during the late Byzantine period*, in S.T. Brooks (ed.), *Byzantium: Faith and power (1261–1557)*. Perspectives on late Byzantine art and culture. New York 2006, 62–75. See also the workshop organized by Joe Glynnias and Johannes Pahlitzsch on this subject, “The translation of Arabic scientific texts into Greek between the 9th and 15th centuries,” Johannes Gutenberg-Universität Mainz, February 2021.

3 MAVROUDI, *Byzantine book*, ch. 10.

4 *Ibid.*, 401–2.

5 E. MIONI, *Thesaurus antiquus, codices 1–299. Bibliothecae Divi Marci Venetiarum codices graeci manuscripti*, 1. Roma 1981, 427–433, esp. 428 = nos. 1–9; MAVROUDI, *Byzantine book*, 107.

6 For the date, based on the paleographical observation of an anonymous reader, see A.M. ROBERTS, *A Greek alchemical epigram in its middle Byzantine context. Journal of the Warburg and Courtauld Institutes* 83 (2020), 1–36.

late antique, and medieval Greek texts on the theoretical interpretation of chemical reactions, especially those used to reproduce the properties of precious metals and other expensive substances like purple dye, as well as practical instructions for how to effect such chemical reactions.<sup>7</sup> Most of its texts are difficult to date precisely. Some of them must have been composed after the Arab conquests of the seventh century, since, as just mentioned, they refer to Arabic terminology.<sup>8</sup>

The manuscript's initial and highly irregular quire (fols. 1–7) is a particularly rich source for understanding the cultural and intellectual context in which this manuscript was first produced and read and how it was used in later centuries, including when it ended up in the library of Cardinal Bessarion (d. 1472), who donated it with the rest of his library to the Republic of Venice.<sup>9</sup> This includes the original manuscript's table of contents (fols. 2<sup>r-v</sup>),<sup>10</sup> a dedicatory epigram (fol. 5<sup>v</sup>),<sup>11</sup> a list of signs used in the manuscript (fols. 6<sup>r-7<sup>v</sup></sup>), and, at the bottom of the last page, a list of alchemical authors (fol. 7<sup>v</sup>). (This may not have been the original order of these folios.)<sup>12</sup> Most of these pages bear later marginalia; this initial quire also includes folios that were added later and filled with writing by late Byzantine scribes.

The very first page of this initial quire is one such later addition (fol. 1<sup>r</sup>; Figure 1). The folio is a flyleaf attached to a stub; together, the folio and stub embrace the first two quires.<sup>13</sup> It was clearly not part of the original manuscript; made of lower-quality parchment, the folio's verso (fol. 1<sup>v</sup>) bears the traces of a text that was scraped off.

This first page, written by a single late Byzantine scribe of the fourteenth or fifteenth century,<sup>14</sup> contains (1) a chemical recipe attributed to Emperor Justi-

7 A.M. ROBERTS, Framing a middle Byzantine alchemical codex. *DOP* 73 (2019), 69–102.

8 See above, note 4; and J. LETROUT, Chronologie des alchimistes grecs, in D. Kahn/S. Matton (eds.), *Alchimie: art, histoire et mythes. Textes et Travaux de Chrysopœia*, 1. Paris/Milan 1995, 65–68.

9 L. LABOWSKY, Bessarion's library and the Biblioteca Marciana: six early inventories. Rome 1979; ROBERTS, Framing, 75 note 45.

10 See ROBERTS, Framing, 88–90.

11 See ROBERTS, A Greek alchemical epigram (as footnote 6 above).

12 ROBERTS, Framing, 83–85.

13 *Ibid.*, 77–78.

14 Ruelle initially judged it to be a fourteenth-century hand (with reference to the symbolic formula with captions appearing immediately below the three lines of non-Greek text): M. BERTHELOT/C.-É. RUELLE (eds. and trans.), *Collection des anciens alchimistes grecs*, 3 vols. Paris 1887–88, I 152 (hereafter CAAG). He seems to have modified this opinion because in



Fig. 1. Marc. gr. 299, fol. 1'

nian;<sup>15</sup> (2) three lines of non-Greek words; (3) a series of shorthand symbols for various “metallic alloys and oxides” (as Berthelot described them), copied from

the subsequent volume, he wrote that the last text on **M 1'** was written in a fifteenth-century hand: CAAG, II 104. Letrouit dated it to the fifteenth century: LETROUIT, Chronologie, 57.

15 Berth. II.IVbis Appendix I; ed. CAAG, II 105; trans. BERTHELOT/RUELLE, III 114. See ROBERTS, Framing, 97 note 161; LETROUIT, Chronologie, 57 (§10). BERTHELOT/RUELLE (CAAG, I 152) viewed it as “the description of the treatment of slags” (slag is a byproduct of smelting ore to produce a pure metal); in particular they thought that it “seems to relate to changing a

one of the original pages of this manuscript, and here labeled with their meanings;<sup>16</sup> and (4) a passage on slags extracted from a text appearing in the original collection gathered by this manuscript.<sup>17</sup> In what follows, I will focus on the second of these: the three lines of non-Greek words in Greek script.

In the late nineteenth century, Berthelot and Ruelle transcribed these three lines.<sup>18</sup> The following transcription corrects errors in their transcription and is more attentive to the manuscript's punctuation:

– τουτία, μαραζῆ, ασενκήρ, ἄζῆ. – νατρά τεχ[?]μήρη χαντήτ, χαντήτ, μουχάγ[?]εαρ. / – πουνᾶν ταί μαριχ, τεχμήρι ζοχρά, ροσουχ ταρήτ, κουσι [οι: κυσι] κησρι, τζιάλλησινπαρά, / κολλαχσρι.

Only one word of this is easily understood by a Greek reader, the very first, τουτία, referring to a chemical substance. Berthelot and Ruelle thought that these three lines of text were magic words to be pronounced while chemically treating τουτία, which they identify as impure zinc ore.<sup>19</sup>

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black and metallic slag, such as that of lead, into a white composite (carbonate or sulfate), under the prolonged influence of water and air.” It was probably adapted from a text in Parisgr. 2327 (= A, copied 22 June 1478), fols. 240<sup>v</sup>–242<sup>r</sup> = Berth. V.xxiv, ed. CAAG, 2:384–387; see ROBERTS, Framing, 97 note 161.

**16** The symbols were copied from a text by Zosimos appearing in **M** itself, as mentioned by CAAG, I 152. The text is **M** no. 41 (*On instruments and furnaces, authentic memoirs*). This series of symbols appears at **M** 193<sup>r</sup>. BERTHELOT/RUELLE (CAAG, 1:153–154) transcribe the labels as follows (while interpreting several of the signs slightly differently from how they are labeled), (1) σημείωσαι παῖ (2) τὸ πᾶν (3) χαλκοῦ ἰός (4) μολιβόχαλκος κεκαυμένος (5) ἀργυρόχαλκος κεκαυμένος καὶ (6) πεπηγμένος (7) ἐμέριτος (8) δραγμαὶ (9) ἰδ (10) τίτανος χαλκὸς τὸ πᾶν ὄστρακον (11) τὸ πᾶν ὄστρακον (12) τίτανος (13) χαλκοῦ. (Then spelled out: ὁ νοήσας μακάριος.) Finally, they offer their interpretation of this text (BERTHELOT/RUELLE, I 54–155), “This formula is concerned with various metallic alloys and oxides, as well as the philosophical egg. But on its own it does not present a definite sense. It was without a doubt a hieroglyphic memento, meant to be completed by oral explications” (“Dans cette formule, il s’agit de divers alliages et oxydes métalliques, ainsi que de l’œuf philosophique. Mais elle ne présente pas par elle-même un sens défini. C’était sans doute un memento hiéroglyphique, destiné à être complété par des explications orales”).

**17** That text is by Olympiodoros, *On Zosimos’s concerning action* = **M** no. 33 (fols. 163<sup>r</sup>–179<sup>r</sup>) = Berth. II.iv. The extracted passage is at **M** 173<sup>r</sup><sub>16-24</sub>, ed. CAAG, II 92<sub>1-7</sub>. A marginal mark in **M** highlights this as a passage of interest: ση(μείωσαι), at **M** 173<sup>r</sup><sub>17</sub>.

**18** CAAG, I 152–153: Τουτία. μαραζῆ. ασενκήρ. αζῆ. ναπράτετ. μηρηχαντήτ. χαντήτ. μουχάναρ. πουμάν. ναμαριχ. τεχμηριζοχρά. ροσουχ. ταρήτ. χησι. χησρι. τζιάλλησιν. παρά. κολλαχσρι.

**19** BERTHELOT/RUELLE, I 152–153: “Puis viennent le nom de la tutie, ou oxyde de zinc impur, suivi par des mots magiques.... Il semble que ce soient là des formules que l’on récitait au mo-

This text, however, does not seem to be a magical incantation at all. Instead, I argue that it is a recipe or list of ingredients transcribed from a language related to Arabic and Persian, most probably Turkish. This is because several words and phrases are clearly transliterated from a language with Arabic vocabulary and Persianate syntax.

First, there is τεχμήρη χαντήτ, which looks very much like a Greek transliteration of Persian *takhmīr-ī ḥadīd*. In Arabic, *takhmīr* is “fermentation,” and *ḥadīd* is “iron”; in Persian these words, combined with the particle *-ī* between them – *takhmīr-ī ḥadīd* – would mean “the fermentation of iron.” In Arabic metallurgy, “fermentation” is a technical term; in modern terminology, it can mean “annealing.”

Next, we have χαντήτ, μουχάγεαρ, which might be a transliteration of *ḥadīd muḥajjar*, where *ḥadīd* is again iron, and *muḥajjar* means “petrified”; perhaps it refers to something like iron ore. One letter of the second word is difficult to read; if we were to read it as μουχάνεαρ or μουχάμεαρ, we might then identify it with the Arabic word *mukhammar*, or “roasted.”

Then perhaps the most telling word: μαριχ. This word appears in a late Byzantine manuscript at Columbia University as a Greek transliteration of the Arabo-Persian name for the planet Mars: *Mirrikh*.<sup>20</sup> The context there is astronomical, but the word is unmistakable. In Greek and Arabic alchemy, the planets are correlated to metals; Mars corresponds to iron. Likewise, Venus corresponds to copper. So perhaps the phrase τεχμήρη ζοχρά transliterates *takhmīr-ī Zuhara*, where *Zuhara* is the Arabic name for the planet Venus; the phrase, then, would mean “fermentation of copper.”<sup>21</sup>

Then there is ποσούχ(?), which might transliterate Arabic *rusūkh*, the word for “dyeing,” as in dyeing cloth a certain color or, in a metallurgical context,

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ment du traitement de la tutie, minerai de zinc (mêlé de plomb et de cuivre) employé dans l'opération de la diplosis, c'est-à-dire de la transmutation.” For Arabic *tūtiyā*, see F. KÄS, *Die Mineralien in der arabischen Pharmakognosie*. Wiesbaden 2010, I 361–369.

**20** New York, Columbia University, Smith Western Add. 10 (main text completed 1296, annotations by George-Gregory Chioniades completed 1301–02), fol. 113<sup>v</sup>; transcribed by D. PINGREE (ed.), *The astronomical works of Gregory Chioniades. Corpus des Astronomes Byzantins*, 2/1. Amsterdam 1985, 19. The word μαριχ (with no accent) appears in Chioniades' hand. For the manuscript, see A. M. ROBERTS, *Byzantine-Islamic scientific culture in the astronomical diagrams of Chioniades on John of Damascus*, in J. F. Hamburger/D. J. Roxburgh/L. Safran (eds.), *The diagram as paradigm: cross-cultural approaches. Dumbarton Oaks Byzantine Symposia and Colloquia*. Washington, DC, forthcoming 2022, fig. 6 and pp. 121–124.

**21** Chioniades' diagram cited in the previous note transliterates *Zuhara* as ζώρα. Nevertheless, ζοχρά is a plausible transliteration of *Zuhara* for someone seeking to preserve the sound /h/ and working in a language like Turkish or Persian where the emphasis usually falls on the final syllable.

changing the color of a metal by applying some sort of reagent – a common procedure used to reproduce the appearance of precious metals using relatively inexpensive ingredients. The Greek word, commonly appearing in alchemical texts, including in **M**, is βαφή. Alternatively, the word ροσούχ could be related to the Persian term *rāsukht*, “calcinated copper.”<sup>22</sup>

I will hazard one more guess: κυλοῖ κησὶ could transliterate *kils-ī kisrī*, meaning something like “powdered quicklime.” And of course I should note that the first word, τούτια, is frequently used in Arabic as well, *tūtiyā*.

The text’s phonetics may also hold a clue. The accentuation (on the final syllable except before certain suffixes) is consistent with Turkish.<sup>23</sup> This same observation also applies to Persian. Certain letter combinations seem to represent sounds not found in Greek. Thus the τζι in τζιάλλησινπαρά probably represents the sound made in Persian by the letter *jīm*. (In Arabic the same letter is less specific, pronounced by some speakers as /j/ but by others as /zh/ or /g/.) The letter combination χσ may likewise represent the sound /sh/ as in English “shilling”; I base this conjecture on the use of the reverse combination σχ to represent this sound in the name for the planet Jupiter (*Mushtari*) in the same Columbia manuscript already mentioned.<sup>24</sup> This would make the last word of the three-line text something like *pašrī* or *bašrī* or *bašarī*.<sup>25</sup>

Then there is the text’s punctuation in the manuscript. The dots, which I have transcribed as commas, and the colons, which I have transcribed as full stops, along with the short horizontal lines, suggest that the text consists primarily of lists, perhaps each prefaced by some instructions (such as “take,” “mix,” “roast,” and the like).

In short, enough of this brief text corresponds to linguistically and contextually plausible Arabo-Persian words and phrases to make it highly plausible that this is a transliteration of an Islamicate text.

A final piece of evidence clinches the case: the very beginning of the two-line text, τούτια μαραζῆ, appears in a list of Turkish chemical vocabulary in a

<sup>22</sup> See A. COLINET (ed. and trans.), *Recette alchimiques* (Par. gr. 2419; Holkhamicus 109). Cosmas le Hiéromoine: Chrysopée. *Les alchimistes grecs*, 11. Paris 2010, XLVI. This discussion of Turkish vocabulary is cited by G. MERIANOS, *Alchemy*, chap. 14 in A. Kaldellis/N. Siniossoglou (ed.), *The Cambridge intellectual history of Byzantium*. Cambridge 2017, 236 note 25. See also J. RUSKA (ed. and trans.), *Das Buch der Alaune und Salze*. Berlin 1925, 24; Käs, Mineralien, I 594–598 (s.v. *rūsahtağ*). This term, spelled ροσούχτ, appears in a marginal note in **M**; see A. M. ROBERTS, *Byzantine engagement with Islamicate alchemy* (forthcoming), note 155.

<sup>23</sup> As Maria MAVROUDI pointed out to me in discussing the possible language of this text.

<sup>24</sup> See note 20 above. This transliteration too appears on fol. 113<sup>r</sup>: μουσχαρί. (On the same page it also appears as μουσχαρι, with no χ or accent.)

<sup>25</sup> The last of these being the Arabic adjective “human.”

seventeenth-century manuscript, where it is glossed as *τουτία αλεξανδρεία*, “Alexandrian tutty.”<sup>26</sup> Not only does this confirm that the three-line text in **M** is Islamicate; it also further suggests, in light of the other evidence, that the entire text is written in Turkish.

In order to facilitate future work on this text, I offer the following partial transliteration of the text, with words that I have some reason to believe I have deciphered italicized and glossed:

– *tūtiyā* [tutty or zinc ore], *marazī* [of the Alexandrian sort], *asengīr*, *azī*. – *natra takhmīr-ī ḥadīd* [fermentation of iron], *ḥadīd* [iron], *muḥajjar*. / – *punān te Mīrīkh* [Mars, i.e., iron], *takhmīr-ī Zuhara* [fermentation of Venus, i.e., of copper], *rusūkh* [dyeing]/*rāsukht* [calcinated copper] *tarīt/ṭarīd*, *kils-ī kisrī* [powdered quicklime?], *jalpīsīn bara*, / *kol pašrī*.

However these lines of text may ultimately be deciphered, it is clear that they are part of a larger story of Byzantine interest in and engagement with science from abroad. This casual page of a scholar’s notes suggests that we should think of this engagement not as coming in little bursts, the exceptions to a rule of Byzantine parochialism and obsession with rereading the ancient heritage over and over again, but as a standard part of Byzantine scientific practice. This challenges traditional narratives holding that the Byzantine Empire, especially as its territory and power declined, was singularly insular and resistant to cultural exchange. We see here quite the opposite.

Modern scholars may choose to look at a manuscript like *Marcianus graecus* 299 and ignore all but the ancient texts at its core, if they wish. But to judge from this first folio, Byzantine readers took a different approach. This anonymous Byzantine scholar excerpted a text, from this very manuscript, on slags (the by-products of smelting ore to produce pure metal), perhaps to help make sense of a set of symbols copied from another part of this same manuscript (fol. 1<sup>r</sup>, text no. 4). The text at the top of the page (no. 1) describes how to treat slags and is a condensed version of a recipe known from a different, later Byzantine alchemical manuscript. But these notes on the nature and use of the byproducts of smelting, as we have seen, are not restricted to the Greek tradition. As if it

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<sup>26</sup> Paris suppl. gr. 1027, fol. 438<sup>r</sup>; as transcribed by R. FRANCKOWIAK, Athanasius Rhetor and the Greek chemistry in the 17<sup>th</sup> century Ottoman Empire, in E. Nicolaidis (ed.), *Greek Alchemy from late Antiquity to early Modernity*. Turnhout 2018, 137 note 39. I have not yet been able to consult this manuscript myself. The phrase *τουτία μαραζή* is thus apparently a single phrase, despite the “comma” dividing the two words in **M**. See also the reference to *tutia alexandrina* in Paris lat. 7161 (15<sup>th</sup> century), fol. 3<sup>r</sup>; cited by CAAG I 268, note 1 (for “f. 13” read “f. 3”).



were the most natural thing in the world, this Byzantine scholar jotted down a few lines in a different language (no. 2). Unlike the symbols below it (text no. 3), these foreign words required no explanation.

