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MB_The Byzantine Alchemist Christianos and his Procedures on Indian Lac

MARCO BELLINI

Alma Mater Studiorum - Università di Bologna

In the present article, I analyse a text attributed to a Byzantine alchemist, the so-called Christian Philosopher or Christianos. I argue that within this text it is possible to find one of the earliest descriptions, in the Mediterranean world, of lac dye and shellac manufacturing. The text is also useful for establishing a more precise chronology within the debate concerning the date of Christianos, placing him in the early seventh century CE, during the reign of the emperor Heraclius. **Keywords**: shellac, lac dye, alchemy, Byzantine science, Indo-Mediterranean trade

INTRODUCTION

Byzantine science was, until recently, quite a neglected subject.[1] Among the various disciplines practiced in the Byzantine world and deemed more or less "scientific" by historians of science, alchemy always occupied a border region: on the one hand, it was seen by many as the historical precursor of our modern chemistry, giving importance to experimental questions and sense-related matters, while on the other, it was also seen as characterised by irrational or mystical issues, unlike the kind of ancient scientific literature exemplified by Euclid's *Elements*.[2] Recently, a more balanced and accurate description of alchemy has been provided by, among others, William R. Newman and Lawrence Principe, who rightly pointed out the double root of this discipline, both in artisanal techniques and in philosophical theories

[1] Maria Mavroudi. "Occult Science and Society in Byzantium: Considerations for Future Research," in *The Occult Sciences in Byzantium*. Ed. by Paul Magdalino and Maria Mavroudi. (Geneva: La pomme d'or, 2006), 39–95 and Anne Tihon. "Science in the Byzantine Empire," in *The Cambridge History of Science. Medieval Science*. Ed. by David C. Lindberg and Michael H. Shank. (Cambridge: Cambridge University Press, 2013), vol.2.
[2] Maria K. Papathanassiou. "The Occult Sciences in Byzantium," in *A Companion to Byzantine Science*. Ed. by Stavros Lazaris. (Leiden-Boston: Brill, 2020), 464.

related to nature. Indeed, we have evidence in antiquity of both a technical recipe literature and also a developed philosophical reflection on a fundamental question: "What is matter? How does one thing change into another?"[3] This is not the appropriate place to delve too deeply into such issues, but I believe that Principe's definition captures the essential point about Graeco-Egyptian and, later, Byzantine alchemy.

In order to highlight this experimental and practical side of Graeco-Egyptian and Byzantine alchemy, I wish to present here a quite striking description of a technical process involving lac (i.e. the resinous secretion produced by the scale insect *Kerria lacca*), as reported by a Byzantine alchemist, the so-called Christian Philosopher (or Christianos), whose work is preserved in the *Corpus alchemicum graecum*.[4] I will begin by discussing some of the chronological problems concerning Christianos, which involve also an issue regarding lac dye circulation in the Mediterranean world during Graeco-Roman and Byzantine times. I will then proceed with the analysis of Christianos' text, which in my opinion describes both the water extraction of lac dye from sticklac and some kind of shellac manufacturing process.

CHRONOLOGICAL ISSUES REGARDING CHRISTIANOS

In the few scientific articles dedicated to the chronological issues concerning Greek alchemists, Christianos is tentatively assigned to a quite large chronological period, namely sixth to eighth century CE.[5] Jean Letrouit was particularly clear-cut in his refusal of a *terminus post quem* (i.e. the earliest possible date for a certain event, hereafter *TPQ*) preceding the Islamic conquest of Egypt (mid seventh

[3] Lawrence M. Principe. *The Secrets of Alchemy*. (Chicago-London: The University of Chicago Press, 2013), 13. Cf. Gerasimos Merianos. "Alchemy," in *The Cambridge Intellectual History of Byzantium*. Ed. by Anthony Kaldellis and Niketas Siniossoglou. (Cambridge: Cambridge University Press, 2017), 243.

[4] The main manuscripts preserving Christianos' work are: Biblioteca Nazionale Marciana, MS *Mar. gr. Z.* 299 (**M**); Bibliothèque nationale de France, MSS *Par. gr.* 2325 (**B**) and *Par. gr. 2327* (**A**).

[5] Edmund O. von Lippmann. *Entstehung und Ausbreitung der Alchemie.* (Berlin: Julius Springer, 1919), vol. 1, 102; André-J. Festugière. *La Révélation d'Hermés Trismégiste. L'astrologie et les sciences occultes*. (Paris: Les Belles Lettres, 1944), 240; Robert Halleux. *Les textes alchimiques*. (Turnhout: Brepols, 1979), 62; Michèle Mertens. "Graeco-Egyptian Alchemy in Byzantium," in *The Occult Sciences in Byzantium*. Ed. by Paul Magdalino and Maria Mavroudi. (Geneva: La pomme d'or, 2006), 205–30 (on 209); Cristina Viano. "Anonymous Alchemist "Christianus" (500–800 CE?)," in *The Encyclopedia of Ancient Natural Scientists. The Greek Tradition and Its Many Heirs*. Ed. by Paul T. Keyser and Georgia Irby-Massie. (London-New York: Routledge, 2008), 87–8; Cristina Viano. "Byzantine Alchemy or the Era of Systematization," in *The Oxford Handbook of Science and Medicine in the Classical World*. Ed. by Paul T. Keyser and John Scarborough. (Oxford: Oxford University Press, 2018), 943–64 (on 945); Matteo Martelli. *L'alchimista antico*. (Milano: Editrice Bibliografica, 2019), 111–12; Gerasimos Merianos. "The Christianity of the Philosopher Christianos," in *ARYS* 20 (2022), 271–322 (on 303).

century CE) and, in his view, the establishment of stable commercial routes with the Indian subcontinent.[6] According to Letrouit, before this period it would have been impossible to know about the existence or at least the technical uses of Indian goods such as lac dye in the Mediterranean world.[7] Since Christianos explicitly mentions lac along with a reference to its production and use in India, Letrouit argues that Christianos must have lived after the establishment, in the early Islamic period, of these trade routes to and from India. I will now proceed to argue for an early seventh century CE date for Christianos, while also presenting evidence about the knowledge and use of Indian lac dye in the Graeco-Roman world.

Marcellin Berthelot, the co-editor with Charles-Émile Ruelle of the *Collection des anciens alchimistes grecs*,[8] dated Christianos to the fifth/sixth centuries CE, on the basis of two elements: 1) the identification of a dedicatee called Sergius, who is mentioned at a certain point by Christianos, with Sergius of Reshaina, who died in 536 CE, and 2) for a general theological reason, which he did not detail in his argument.[9] While the identification with the famous scholar of Reshaina is highly speculative, Berthelot's idea of using Christian dogma to better date our alchemist is right and it might be further developed. According to Gerasimos Merianos, we can see in Christianos's work some elements of Calcedonian Christianity (the fourth Ecumenical Council of 451 CE in Calcedony) and we can also date a precise formula, used by Christianos, regarding the Son "who without change became man,"[10] since the emperor Justinian I (527–565 CE) introduced this formula in a hymn for the Divine Liturgy of Constantinople in 535/536 CE, according to Theophanes.[11] A further element can be added to these considerations. I have identified in Christianos' text some references to Romanos the Melodist (late fifth–second half of sixth century CE).[12] If this identification is correct, one would have here a confirmation of the *TPQ* given by the

[6] Jean Letrouit. "Chronologie des alchimistes grecs," in *Alchimie : art, histoire et mythe. Actes du 1er Colloque international de la Société d'Étude de l'Histoire de l'Alchimie*. Ed. by Didier Kahn and Sylvain Matton. (Paris-Milano: S.É.H.A./Arché, 1995), 11–93 (on 62).
[7] For the use of lac in Islamicate ink recipes literature, cf. Sara Fani. *Prendi, aggiungi, mescola e scrivi. Ricettari arabi sulla preparazione di inchiostri*. (Milano: Editrice Bibliografica, 2023), 101–3.
[8] For Christianos' text, cf. Marcelin Berthelot and Charles-Émile Ruelle, eds. *Collection des anciens alchimistes grecs. Texte grec : avec variantes, notes et index*. (Paris: G. Steinheil, 1888 [henceforth cited as CAAG2]), vol. 2, 27, 35, 272–85, 395–421.
[9] In his words: "par les opinions relatives à la nécessité de la grâce divine," Marcelin Berthelot and Charles-Émile Ruelle, eds. *Collection des anciens alchimistes grecs. Traduction : avec notes, commentaire, tables et index*. (Paris: G. Steinheil, 1888 [henceforth cited
as CAAG3]), vol. 3, 379.

[10] "ἀτρέπτως ἐνανθρωπήσας," which appear only in MS **M**; cf. CAAG2, 27.

[11] Cf. Theoph I.II, 216, ll. 23–24.; Flavius Iustinianus. *Scritti teologici ed ecclesiastici di Giustiniano*. Ed. by Mario Amelotti and Livia Migliardi Zingale. (Milano: Giuffrè, 1977), *Troparium*, 44, l. 6; Merianos, "The Christianity of the Philosopher Christianos," 289–90.
[12] I will cite Christianos' text using both the lines in my PhD dissertation and Berthelot-Ruelle's edition. Christianos (cap. 1, ll. 14–15 = CAAG2, 396, ll. 8–9): "καὶ οἵά τε πηγὴν ἀέναον ἐν μέσῳ παραδείσου βλύζουσαν πότιμον νάμα καὶ γόνιμον τῷ παντὶ χαριζομένην";

Justinian hymn and by Romanos' quotations, i.e. roughly the second half of the sixth century. This would make the attribution of the dedication to Sergius of Reshaina very unlikely.

Moreover, we know that Christianos never quotes a very important seventh-century alchemist, Stephanus of Alexandria. Christianos never cites authors later than Stephanus, whereas at least one alchemist later than Stephanus, the so-called Anepigraphos (eighth to ninth century CE), cites Christianos.[13] In my opinion, an important point is that the identification of the aforementioned Sergius with Sergius I (610–638 CE), patriarch of Constantinople under the emperor Heraclius, is quite possible.[14] The plausibility of this identification rests on the assumption that the war against the Persians waged by the emperor Heraclius (610–641 CE), which caused a massive and almost fatal financial crisis in the empire, greatly stimulated the interest for gold-making techniques and alchemical knowledge.[15] In fact, Heraclius financed his campaign by taking away – as a very last resort – the precious metal vestments from the churches in Constantinople, melting these vestments to mint coins in order to pay army wages and mercenaries.[16] It is not surprising then to find Heraclius himself mentioned as an alchemical author in MS

Mar. gr. Z. 299 (fol. 2r) but also to find him as the dedicatee of Stephanus of Alexandria's *On the Great and Sacred Art of Making Gold*.[17] These historical events involving alchemy and war should also be seen in the light of the famous passage preserved in the *Suda* about the emperor Diocletian (284–305 CE): "After seeking out the books written by the ancient [Egyptians] concerning the alchemy of gold and silver,

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to be compared to Romanos: "Πηγῆς ἀενάου τῆς ἐν τῷ παραδείσῳ τὰ νάματα ὄντως εἰς ποταμοὺς διαιροῦνται," Romanus Melodus. *Sancti Romani Melodi cantica. Cantica genuina*. Ed. by Paul Maas and Constantine A. Trypanis. (Oxford: Oxford University Press, 1963 [henceforth cited as Rom 1]), vol. 1, 53, 6, ll. 1–2. Christianos (cap. 1, l. 18 = CAAG2, 396, ll. 12–14): "καὶ τὸ ἀμειδὲς τῆς νυκτὸς ἀφανίζουσαν, πλησιφαῶν τῶν δίσκων ἅπαντα τοῦ ἡλιακοῦ στησαμένην φωτός"; to be compared to Romanos: "Νὺξ ἀμειδὴς ἡ φύσις ἡ ἐμή, καὶ πῶς ἐξ αὐτῆς λάμψει ὁ ἥλιος;," Rom 1, 37, 11, l. 1. See also Romanos: "Νύκτα ἠφάνισε τὴν ἀμειδῆ καὶ ἔδειξε μεσημβρίαν τὸ πᾶν κατηύγασε τὴν οἰκουμένην τὸ ἀνέσπερον φῶς, Ἰησοῦς ὁ σωτὴρ ἡμῶν," Rom 1, 6, 16, ll. 1–2.

[13] Letrouit, "Chronologie des alchimistes grecs," 63. This alchemist refers to an original numerical result obtained by Christianos, the total number of possible typologies of alchemical operations. Cf. CAAG2, VI.xv, 433, ll. 13–14.

[14] Cf. Henri D. Saffrey. "Historique et description du manuscrit alchimique de Venise Marcianus Graecus 299," in *Alchimie : art, histoire et mythe. Actes du 1er Colloque international de la Société d'Étude de l'Histoire de l'Alchimie*. Ed. by Didier Kahn and Sylvain Matton. (Paris-Milano: S.É.H.A./Arché, 1995), 1–10 (on 6).

[15] Cf. Merianos, "Alchemy," 237, 247–50. There is a possible historical comparison to be made between this crisis and the one under the emperor Constantine IX Monomachos (1042–1055 CE). Indeed, it is not unlikely that a somewhat comparable financial relief was needed when Michael I Cerularios (1018–ca.1078 CE), patriarch of Constantinople under Constantine IX, asked the famous scholar Michael Psellos "how to make gold," which became the title of Psellos' work dedicated to solve Cerularios' request; cf. Marco Bellini. "Psellos' Petrified Root: Transmutations and Natural Wonders from Classical Antiquity to Byzantine Times," in *Physis* LV.1–2 (2020), 223–41 (on 223–5); Joseph Bidez. *Catalogue des manuscrits alchimiques grecs. Michel Psellus : Épître sur la chrysopée, Opuscules et extraits sur l'alchimie, la météorologie et la démonologie*. Ed. by Joseph Bidez et al. Vol. 6. (Bruxelles: Union Académique Internationale, 1928 [henceforth cited as CMAG VI]), vol. 6, 32, ll. 5–9.

[16] Cf. Warren Treadgold. *A History of the Byzantine State and Society*. (Stanford: Stanford University Press, 1997), 293; ChronPasch, 706; Theoph I.II, 303.

[17] Cf. Saffrey, "Historique et description du manuscrit alchimique de Venise Marcianus Graecus 299," 5; Letrouit, "Chronologie des alchimistes grecs," 58; Maria K. Papathanassiou. *Stephanos von Alexandreia und sein alchemistischen Werk. Die kritische Edition des Griechischen Textes eingeschlossen*. (Athen: Cosmoware, 2017 [henceforth cited as SvAAW]), 35–9.

he burned them so that the Egyptians would no longer have wealth from such a technique, nor would their surfeit of money in the future embolden them against the Romans."[18]

To conclude, all these elements make me consider conjectural yet plausible a *terminus ante quem* (*TAQ*, i.e. the latest possible date for a certain event) between the end of the patriarchate of Sergius I (610–638 CE) and the end of the Byzantine–Sasanian War of 602–628 CE, a war which immediately precedes the sudden rise and the vast military conquests of the Rāshidūn Califate.

A PECULIAR DATING ELEMENT: LAC DYE

It is possible to add something more to our chronological analysis. We have seen that Letrouit proposed a much later *TPQ*, related to the Islamic conquest of Egypt (early 640s CE) and based on Christianos's mention of lac. His argument rests, first, on the identification of the material substances mentioned by Christianos with the resinous secretion from the insect *Kerria lacca*.[19] Second, it is based on the assumption that the technical knowledge of a dye derived from *Kerria lacca*, which thrives only in India and South-Eastern Asia, could not predate the Rāshidūn or the Umayyad Caliphate's relations with the Indian subcontinent. While the first point is highly probable, the second is factually incorrect.

In fact, recent Mediterranean archaeological evidence shows how lac dye was used in dyeing ceramics as early as the third century BCE, and how its availability has been a plausible consequence of Alexander the Great's conquests and subsequent expansion of trade routes.[20] The authors of this discovery examined an oinochoe from Canosa di Puglia, now at the British Museum, and found traces of laccaic acid A and B as well as erythrolaccin among the various pigments used on the object: their presence is a precise indication for lac dye usage. Given this early archaeological evidence for lac dye in Italy, it should not be surprising to hear about other exotic Indian products present in the markets of classical Rome. For instance, Pliny the Elder (23/24–79 CE) tells us that the pigment indigo (*Indicum*) was a new commercial

[18] "ὅτε δὴ καὶ τὰ περὶ χημείας ἀργύρου καὶ χρυσοῦ τοῖς παλαιοῖς αὐτῶν γεγραμμένα βιβλία διερευνησάμενος ἔκαυσε πρὸς τὸ μηκέτι πλοῦτον Αἰγυπτίοις ἐκ τῆς τοιαύτης περιγίνεσθαι τέχνης μηδὲ χρημάτων αὐτοὺς θαρροῦντας περιουσίᾳ τοῦ λοιποῦ Ῥωμαίοις ἀνταίρειν," Suda. s.v. Διοκλητιανός (δ 1156 Adler). Trans. by Ross Scaife. url: http://www.stoa.org/sol- entries/delta/1156. Cf. JoAntR, 10, 248.

[19] "Chrétien désigne les sécrétions résineuses de *Kerria lacca* à l'aide de mots λάχα et λάχιον, cf. l'arabe *lakk*. Tous ces termes dérivent du sanscrit *lākshā*," Letrouit, "Chronologie des alchimistes grecs," 62, n. 215.

[20] Cf. Joanne Dyer, Diego Tamburini and Sophia Sotiropoulou. "The identification of lac as a pigment in ancient Greek polychromy – The case of a Hellenistic oinochoe from Canosa di Puglia," in *Dyes and Pigments* 149 (2018), 122–32; Merianos, "The Christianity of the Philosopher Christianos," 276.

import from India as well: “Indigo, the composition of which is at present unknown to me, is also imported from India.”[21] We might also add further but less precise archaeological evidence, since lac dye from *Kerria lacca* was also found on some Graeco-Egyptian and Coptic textiles, which are collectively dated to first to the ninth century CE and are preserved in various Spanish museums; for example, the red ground in a fragment depicting the classical motif of Hercules in one of his labours (Barcelona: Museu Tèxtil i d’Indumentària, MTIB-27866) is obtained from lac dye.[22] In general, it is today well-known that trade between the Mediterranean and the Indian subcontinent was highly developed at least since the beginning of the Augustan period, thanks to a whole series of factors, such as new or better land routes between the Nile and the Red Sea,[23] the availability of better shipbuilding techniques, the discovery of faster shipping routes through the monsoon winds to and from India, and political stability thanks to *Pax Romana*.[24]

Concerning the word used by Greek alchemists to denote lac or one of its products, we might find an instance of it in the alchemical books written by Ps.-Democritus (first century CE), which attest the word λακχά,[25] although Matteo Martelli expresses doubts as to whether or not this term can be identified with another dyeing substance, the plant ἄγχουσα (*Alkanna tinctoria*).[26] Regarding further literary non-alchemical evidence, in the *Periplus Maris Erythraei* (ca. first century CE),[27] among the various lists of

[21] “Adportatur et Indicum ex India inexploratae adhuc inventionis mihi,” Plin. *Nat*. XXXV, 43.
[22] Cf. Laura Rodríguez Peinado et al. “Discovering Late Antique Textiles in the Public Collections in Spain: an interdisciplinary research project,” in *Greek and Roman Textiles and Dress*. Ed. by Mary Harlow and Marie-Louise Nosch. (Oxford-Philadelphia: Oxbow
Books, 2014), 354–6, 365. Lac dye is attested also on similar textiles preserved in Italy, cf. Monica Gulmini et al. “The “Coptic” textiles of the “Museo Egizio” in Torino (Italy): a focus on dyes through a multi-technique approach,” in *Archaeological and Anthropological Sciences* 9.4 (2017), 485–97.
[23] Strabo gives credit to the Ptolemies for coming up with the idea, cf. Str., XVII, 1, 45.

[24] Cf. Andrew Wilson. “Red Sea Trade and the State,” in *Across the Ocean: Nine Essays on Indo-Mediterranean Trade*. Ed. by Federico De Romanis and Marco Maiuro. (Leiden-Boston: Brill, 2015), 13–32 (on 13). On this general topic, cf. also Federico De Romanis. *Cassia, cinnamomo, ossidiana. Uomini e merci tra Oceano Indiano e Mediterraneo*. (Roma: L’Erma di Bretschneider, 2006); Matt Gibbs. “Manufacture, trade, and the Economy,” in *The Oxford Handbook of Roman Egypt*. Ed. by Christina Riggs. (Oxford: Oxford University Press, 2012); Raoul McLaughlin. *The Roman Empire and the Indian Ocean. The Ancient World Economy and the Kingdoms of Africa, Arabia, India*. (Barnsley: Pen & Sword Military, 2014).
[25] Pseudo-Democrito. *Scritti alchemici. Con il commentario di Sinesio*. Ed. by Matteo Martelli. (Paris-Milano: S.É.H.A.-ARCHÈ, 2011 [henceforth cited as PsDSA]), 180–82, ll. 16, 18, 19, 29; moreover, cf. PsDSA, 276–7, n. 23. For another instance of this term in a twelfth-century Byzantine alchemical recipe, cf. Lisa Benedetti. “Ricette bizantine del XII secolo per tinture e inchiostri,” in *Aevum* 88.2 (2014), 443–54 (on 449).
[26] Cf. PsDSA, 262–4, n. 7; Matteo Martelli. “Alchemical Textiles: colourful garments, recipes and dyeing techniques in Graeco-Roman Egypt,” in *Greek and Roman Textiles and Dress*. Ed. by Mary Harlow and Marie–Louise Nosch. (Oxford-Philadelphia: Oxbow Books, 2014), 111–29 (on 112–4). For the alchemical papyri, Robert Halleux, ed. *Papyrus de Leyde, papyrus de Stockholm, fragments de recettes*. Vol. 1. Les Alchimistes grecs. (Paris: Les Belles Lettres, 1981), P. Leid. X, 89, l. 498, 90, ll. 501–502, 91, ll. 505–507, etc.
[27] A periplus is a sort of travel log, describing landmarks, distances, routes, commercial opportunities, and so on. The *Periplus Maris Erythraei* is a Greek document of this kind, focused on ports along the Red Sea and the Horn of Africa, the Arabian Sea, and the Indian Ocean, including Sindh and the southwestern regions of India.

trade products from India, one can find a certain λάκκος χρωμάτινος,[28] namely "lac dye."[29] In the light of the previously discussed archaeological evidence, it is worth noting that the first mention of lac dye in Greek literature might be the one attested to in a fragment attributed to Ctesias of Cnidus (fifth century BCE), which I will quote *in extenso*:

> [Ctesias says] that animals are born here which are as big as a dung beetle and they are red as cinnabar; [the animal] has also very long legs and it is soft as an earthworm. These [animals] are born on the trees that produce amber and they devour the fruits of these and they destroy [these trees], as among the Greeks lice [destroy] the vines. In fact, crushing these animals, the Indians dye red clothes, tunics and anything else they want; they are better than the dyes of the Persians.[30]

The mentions of amber reminds us what Pliny says about amber from India.[31] He might be referring here to sticklac, which is the lac incrustation on twigs as will be discussed in the next section, since this substance resembles amber in colour and translucence.

There is further literary evidence on this issue and we can find it in a second-century papyrus, an inventory of furniture (σκευογραφία) for the purpose of sale compiled by a widow, a certain Tertia Ancharenia, for a buyer, a certain Iulius Agrippianus. The editor dates the papyrus to the reign of Trajan and more precisely to the years 103–117 CE. In this list one can find some exotic items, for example a *flagellum* made from "Indian reed" (i.e. bamboo; φλαγέλλιον καλάμου ἰνδικοῦ). Our interest though should be reserved for another item, a number of supposedly lac-dyed or lacquered wood plates (σκούτλια ξύλινα λελακκωμένα).[32] While the participle λελακκωμένα might derive in principle from a verb λακκόω

[28] Peripl.M.Rubr. 6, l. 61.

[29] Lionel Casson, ed. *The Periplus Maris Erythraei*. (Princeton: Princeton University Press, 1989), 55. In the comment on the text, it is explicitly said that the insect of origin is *Coccus lacca*, another name for *Kerria lacca*, Casson, op. cit., 114.

[30] "ὅτι αὐτόθι ἐστὶ γινόμενα θηρία τὸ μέγεθος ὅσον κάνθαρος, ἐρυθρὰ δὲ ὥσπερ κιννάβαρι· πόδας δὲ ἔχει μακροὺς σφόδρα· μαλακὸν δέ ἐστιν ὥσπερ σκώληξ. καὶ γίνεται ταῦτα ἐπὶ τῶν δένδρων τῶν τὸ ἤλεκτρον φερόντων καὶ τὸν καρπὸν κατεσθίει αὐτῶν, καὶ διαφθείρει, ὥσπερ ἐν τοῖς Ἕλλησιν οἱ φθεῖρες τὰς ἀμπέλους. ταῦτα οὖν τὰ θηρία τρίβοντες οἱ Ἰνδοὶ βάπτουσι τὰς φοινικίδας καὶ τοὺς χιτῶνας καὶ ἄλλο ὅ τι ἂν βούλωνται· καὶ εἰσὶ βελτίω τῶν παρὰ Πέρσαις βαμμάτων," Felix Jacoby. *Die Fragmente der griechischen Historiker*. (Berlin-Leiden: Weidmann-Brill, 1923–1958 [henceforth cited as FGrH]), 3c, 688, F45, ll. 360–372 = Phot. *Bibl.* 72, 47b–48a. Translation is mine. The same story is also in FGrH, 3c, 688, F45pγ = Ael. *NA*, IV, 47.

[31] Cf. Plin., *Nat*. XXXVII, 46.

[32] P. Lond. II, 191, l. 10 (TM 19963).

and simply suggest that the plates were hollowed out, the socio-historical context and the example of the coeval *Periplus Maris Erythraei* (λάκκος χρωμάτινος) point to a derivation from λάκκος as one of the Greek words for lac dye, and not as the homophonous word for pond, cistern, or pit.[33]

Closer to the date of the text by the alchemist Christianos, the famous *Book of the Eparch* (or *of the Prefect*), which is a ninth to tenth century Byzantine manual concerning market regulations and addressed to the governor of Constantinople, is relevant for our discussion. While for the late antique and early Byzantine periods there are comparable sources regarding marketplace organisation and related urban regulations in the main cities of the empire,[34] none of them explicitly mentions lac. Since lac dye is attested as a commercial good in the *Periplus*, and assuming that its import was not too discontinuous, we can place it among the other red dyes which were sometimes directly sold in the shops (ἐργαστήρια) of dyers, as in late antique Sardis.[35] For Constantinople at least, a certain degree of uniformity in the marketplace organisation is attested from the late antique to the medieval period.[36] In the *Book of the Eparch* not only do we explicitly find lac but it is also mentioned using one of the words we find in Christianos (λαχάς), which is not used in this form by any other previous source.

In this book, we thus find a list of certain goods, the sole responsibility for which was assigned to the perfumers' guild (μυρεψοί).[37] In this socio-economic context, "perfumers" were defined as a single guild by their own expertise in luxury substances that smelled good and not bad, including in this peculiar category not only aromatics but also dyeing substances.[38] The *Book of the Eparch* lists "pepper (πέπερι), nard (στάχος), cinnamon (κιννάμωμον), aloe (ξυλαλόη), ambergris (ἄμβαρ), musk (μόσχος), frankincense (λίβανος), myrrh (σμύρνα), balsam? (βαρζίν), indigo (λουλάκιν, i.e. lilac), shellac/lac dye (λαχάς), lapislazuli (λαζούριον), *Cotinus coggygria*/dyer's sumac (χρυσόξυλος), styrax? (ζυγαία)."[39] The word

[33] Cf. Robert Beekes and Lucien van Beek. *Etymological Dictionary of Greek*. 2 vols. (Leiden-Boston: Brill, 2010), s.v. λάκκος 2.
[34] For dyers, cf. Catherine Saliou. *Le traité d'urbanisme de Julien d'Ascalon. Droit et architecture en Palestine au VIe siècle*. (Paris: De Boccard, 1996), 39 (10.1).
[35] Paint shop E6–8, cf. J. Stephens Crawford. *The Byzantine Shops at Sardis*. Archaeological Exploration of Sardis Monograph 9. (Cambridge-London: Harvard University Press), 1990, 15–7.
[36] Cf. Marlia Mundell Mango. "The Commercial Map of Constantinople." in *Dumbarton Oaks Papers* 54 (2000), 189–207 (on 197–98).
[37] Johannes Koder, ed. *Das Eparchenbuch Leons des Weisen*. (Wien: Verlag der Österreichischen Akademie der Wissenschaften, 1991 [henceforth cited as EpBib]), 10, ll. 456–493.
[38] EpBib, 10.1, l. 464.

[39] EpBib, 10.1, ll. 462–464. Translation is mine.

λαχάς was translated by Koder in the current standard edition as Gummilack (i.e. shellac in German) while, in a previous English translation, it was confused with the word for “garden-herbs” (λάχανα), which has its root in the verb “to dig” (λαχαίνω), and it was translated, in an apparently reasonable way, as “sweet-smelling herbs.”[40]

All this evidence shows how technical knowledge about lac was circulating in the Mediterranean long before the Islamic conquest of Egypt. Therefore, considering all these elements and in particular the lines quoted from Romanos the Melodist (late fifth–second half of sixth century CE), it seems quite reasonable to have at least the second half of the sixth century CE as a *TPQ* for our alchemist Christianos, *pace* Letrouit.

Christianos’s text on lac dye extraction and shellac manufacturing

After this necessary chronological fine-tuning, I now present the translated passage on lac dye ascribed to Christianos, followed by a short commentary. The Greek text derives from my unpublished PhD dissertation (Università di Bologna, July 2023) and may differ slightly from the one in Berthelot–Ruelle’s edition.[41] The present English translation, intentionally quite literal, is also mine.

> Οὕτω γὰρ δεκτικὰ γίνεται τῶν χρωμάτων· ὥσπερ δὲ χοοποιηθεὶς ὅ ἐστιν λάχιον ὃ καλοῦσιν λαχὰν οἱ λαχωταί, τουτέστιν οἱ ἰνδικοβάφοι. Λοιπὸν εὐμόρφως διὰ νίτρου θερμοῦ ὅλον ἀφίησιν ἑαυτοῦ τὸ εἶδος τὸ αἱμωπόν, καὶ ἐν ἀσκαλωνίτιδι γάστρᾳ λίαν ἀνατριβόμενος ταῖς χερσίν, ὡς ἐπὶ τῶν πλυνομένων ὀσπρίων. Γενόμενος δὲ λευκός, μᾶλλον δὲ ἄχρους [εὔχρους **BAL**], οὕτως ἐλαύνεται σφύραις παιόμενος ἐπὶ μυλικῶν λίθων ἐν τῇ γῇ πεπηγότων, πυκνὰ δὲ μεταστρεφόμενος ἅμα τῷ ξυλαρίῳ ἐν ᾧ ἐνεπάγη, προθερμανθείς. Εἶτα καὶ χρωΐζεται παρ’ αὐτὰ ζωγραφικῷ εἴδει λαμβάνων [λαμβάνον **M**] αὐτόθι σφυροκοπούμενος, ἵνα μὴ ψυγείς, ἀμάλακτος

[40] Edwin H. Freshfield, ed. *Roman law in the later Roman Empire: Byzantine guilds, professional and commercial. Ordinances of Leo VI, c. 895, from the* Book of the Eparch. (Cambridge: Cambridge University Press, 1938), 30.
[41] Cf. CAAG2, 418, l. 20–419, l. 10.

γένηται ψυγεὶς ἐκ τοῦ ἀέρος, καὶ ἀνέλπιδος [ἄνελπις **BAL** : ἀνέλπιστος coni. **BeRu**] γένηται τῶν βαμμάτων. Αἱ γὰρ πυκναὶ τῶν νεανιῶν καὶ συνεχεῖς αὐτῶν πληγαὶ προσφερόμεναι μαλακίζονται πρὸς τὴν εἴσκρισιν τῶν χρωμάτων καὶ τῆς κολοφωνίας [κωλοφονίας **M**] τῆς ἀντικατόχου καὶ κόλλης αὐτῶν [f. l. ἐξ αὐτῶν coni. **BeRu**] παραλαμβανομένης.

Thus, indeed, [the substances] become apt to receive colours; as, indeed, that which[42] is worked at the crucible, which is *lachion*,[43] which the lacquerers,[44] – namely, the Indian dyers[45] – call *lachas*.[46] Then, beautifully, through natron and heat, [the *lachas*] emits entirely from itself the substance, the blood-red one, when it (scil. the *lachas*) is also rubbed by hands in a jar of Ascalon,[47] as in the case of the legumes that are washed. Becoming therefore white, or rather colourless, so it (scil. the *lachas*) is worked, struck by hammers on grindstones fixed in the ground, but changing direction frequently together with a twig into which it (scil. the *lachas*) has been driven, being heated beforehand. Then it (scil. the *lachas*) is dyed immediately with a pigment, receiving [the pigment] while it (scil. the *lachas*) is hammered on the spot, until it becomes dry; it becomes non-malleable dried by the air, and also impossible[48] to be dyed. (this next sentence is unclear) Indeed, the frequent and continuously-delivered strikes of young men are softened for the penetration of the colours and of the resin of Colophon, "that which holds fast in return," and of glue from the same.[49]

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[42] Here the implied subject is the masculine noun *lachas* (λαχάς).

[43] In the MS **B**, all this passage is annotated in the margin by a different hand, which writes "λάχιον" and then "ἰνδικοβάφοι λαχωταί."

[44] The term λαχωτής is an *hapax* of Christianos.

[45] I translated as such the term ἰνδικοβάφος, which is another *hapax* of Christianos, using the term ἰνδικοπλεύστης as a model. On the other end, Berthelot and Ruelle translated it – mistakenly thinking about indigo – as "teinturiers en bleu," CAAG3, 401.

[46] The term ὁ λαχάς is the masculine noun referred to by many participles in the text.

[47] There are other examples of this kind of vessel in the *corpus alchemicum graecum*, cf. CAAG2, III.xxxix, 210, l. 15, IV.xx, 291, ll. 16–17. Literary and papyrological evidence point out to a specific vessel-type, probably used to transport wine or other liquids and so
smeared inside with pitch, cf. Philip Mayerson. "The Gaza 'Wine' Jar (Gazition) and the 'Lost' Ashkelon Jar (Askalônion)," in *Israel Exploration Journal* 42.1/2 (1992), 76–80.

[48] The term ἀνέλπιδος, -ον is attested in the *Lexikon zur byzantinischen Gräzität* (LBG).

[49] This last sentence is not yet clear enough to me, and so the translation is difficult. The word ἀντικάτοχος is an *hapax* of Christianos. It is not clear to me how this term should be interpreted in this context. The word κάτοχος means something retentive or something which holds down or holds fast. In any case, it seems to be here the propriety of being adhesive for colours. We could also translate as "…and of the resin of Colophon as the substitute adhesive and of glue from the same," if we interpret ἀντικάτοχος as something substitutive of κάτοχος; for a possible similar term, i.e. the medical term ἀντίσποδον as a substitute for a σποδός, cf. Dsc., V, 75, ll.13–16.

Immediately thereafter, Christianos proceeds with the second term of this comparison, saying that copper, after being worked in a similar way as lac, becomes then apt to receive various colouring processes.

Commentary on Christianos's text

Before commenting further on Christianos's text, I consider it essential to provide the general reader with a very short lexicon about lac and its processes, in order to minimise potential misunderstandings in the interpretation of the various texts, Christianos's and others, which I will present later.

Lac terminology and Kerr's account concerning traditional lac manufacturing in late eighteenth-century India

In a very general way, lac is the resinous protective covering created by the sap-feeding insect *Kerria Lacca* during certain stages of its life. This insect owes the name to its first comprehensive description in 1781 by James Kerr,[50] since previous seventeenth-century Western accounts were more focused on lac as a commercial product.[51] Today, lac products have a wide spectrum of applications, from varnishes to food, medicine, and cosmetic industries.[52] The ICAR–NISA (Formerly Indian Institute of Natural Resins

[50] A previous entomological description was offered by Guy Tachard, cf. Guy Tachard. "Sur la lacque," in *Histoire de l'academie royale des sciences* (1710), 44–6. One of the alternative names of the Indian lac insect is *Tachardia lacca*. In his account, Kerr calls the insect *Coccus lacca* and divides lac into "Stick Lac" ("the natural state from which all others are formed"), "Seed Lac" ("the cells separated from the sticks"), "Lump Lac" ("seed lac liquified by fire, and formed into cakes"), and "Shell Lac" ("the cells liquified, strained, and formed into thin transparent laminae"), James Kerr. "XXIV. Natural history of the insect which produces the Gum Lacca," in *Philosophical Transactions of the Royal Society* 71 (1781), 374–82 (on 377–8). A few years later, another description of the insects – called here *Chermes lacca* – and their cells was provided by William Roxburgh, who gives us an effective image: "The substance of which the cells were formed cannot be better described, with respect to appearance, than by saying it is like the transparent amber that beads are made of," William Roxburgh. "XV. Chermes Lacca," in *Philosophical Transactions of the Royal Society* 81 (1791), 228–35 (on 228). For additional historical annotations, cf. Leonard Trengove. "Chemistry at the Royal Society of London in the Eighteenth Century–IV.Dyes," in *Annals of Science* 26.4 (1970), 331–53; A. J. Gibson. "The story of lac," in *Journal of the Royal Society of Arts* 90.4611 (1942), 319–35; Anantanarayanan Raman. "Discovery of *Kerria lacca* (Insecta: Hemiptera: Coccoidea), the lac insect, in India in the late 18th century," in *Current Science* 106.6 (2014), 886–90. For more entomological informations, cf. Ayashaa Ahmad et al. "Distinction of Indian Commercial Lac Insect Lines of *Kerria* spp. (Homoptera: Coccoidea) Based on Their Morphometrics," in *Journal of Insect Science* (2014); R. K. Varshney and K. K. Sharma. *Lac Insects of the World – An updated Catalogue and Bibliography*. (Ranchi: ICAR–IINRG, 2020). Misconceptions about lac and *Kerria lacca* were common until recently, for instance as reported by A. J. Gibson in the first half of twentieth century: "Not so long ago, a Midland weekly actually described lac as 'that useful excretion of a versatile Indian beetle'; such a description would be a most excellent one, were it not for the fact that the insect in question is not a beetle, that the resin it manufacture is not an excretion, and that versatility is not an outstanding feature of its brief and rather miserable life-cycle," Gibson, "The story of lac," 319.

[51] Such as Garcia de Orta's account, cf. Garcia de Orta. *Colóquios dos simples e drogas da India*. (Lisboa: Imprensa nacional, 1892), vol. 2, 29–45. There is also the one by John Huyghen van Linschoten, cf. Gibson, "The story of lac," 320.

[52] Cf. Uday Chand Dutt and George King. *The Materia Medica of the Hindus*. (Calcutta: Adi-Ayurveda Machine Press, 1922), 277–8; Rashmi Dikshit and Padmavathi Tallapragada. "Comparative Study of Natural and Artificial Flavoring Agents and Dyes," in *Natural and Artificial Flavoring Agents and Food Dyes*. Ed. by Alexandru M. Grumezescu and Alina M. Holban. (London: Academic Press,

and Gums & Indian Lac Research Institute), established in 1924, is still an active Indian R&D centre focused on all the various technical and social aspects of lac.[53] Modern technical terminology on lac is not too dissimilar from the one already attested in Kerr's report.

Glossary

Here it is a short list of the most common terms regarding lac and its products.[54]

1. ***Lac***: it is a general term for the natural resin secreted by lac insects, not only the Indian *Kerria lacca* but also the other species from Thailand and China. Indian *Kerria lacca* insect thrives only on specific host trees, such as palash (Butea monosperma), ber (Ziziphus mauritiana) or kusum (Schleichera oleosa).[55] Lac from *Keria lacca* is a composite of three main parts: resin, wax, and pigment.[56]

1. ***Sticklac***: also referred to as raw lac, it is the resinous incrustation present on the twigs of *Kerria lacca* host trees, roughly scraped off and grossly collected. It contains not only lac and its three sub-components (resin, wax, and pgment), but also many impurities (insect parts, bark, sticks, etc.). Collecting sticklac is the first step in lac dye and shellac processing. The mechanically ground and washed sticklac is called ***seedlac***.

2. ***Shellac***: it is the pure resin component of lac, obtained by a heat filtration process.[57] In the traditional way of processing, sticklac is first collected into a very long canvas tube, which then has one of its ends placed in front of a heat source. This tube is then wrung out and the resin progressively flows out of the heated end. An operator continuously scrapes this resin from the

2018), 83–111 (on 91–3); T. Nandkishore et al. "Shellac as a multifunctional biopolymer: A review on properties, applications and future potential," in *International Journal of Biological Macromolecules* 215 (2022), 203–23 (on 210–8).

[53] The current (March 2024) website is https://nisa.icar.gov.in.

[54] Cf. Nandkishore et al., "Shellac as a multifunctional biopolymer: A review on properties, applications and future potential," 205–7.

[55] Cf. C. L. Green. *Natural colourants and dyestuffs. A review of production, markets and development potential*. Non-Wood Forest Products 4. (Rome: Food and Agriculture Organization of the United Nations, 1995), 66.

[56] "The lac resin is a polyester complex of long-chain hydroxy fatty acids and sesquiterpenic acids. Indian lac dye is a mixture of at least five anthraquinone derivatives called laccaic acids. Lac wax is a complex mixture of long-chain acids, alcohols, esters and hydrocarbons," K. K. Sharma, A. Roy Chowdhurry and S. Srivastava. "Chemistry and Applications of Lac and Its By-Product," in *Natural Materials and Products from Insects. Chemistry and Applications*. Ed. by Dhiraj Kumar and Mohammad Shahid. (Cham: Springer, 2020), 21–37 (on 24).

[57] "In its natural form, Shellac is a long chain polyester type of resin consisting of inter and intra esters of polyhydroxy carboxylic acids where some acids are aliphatic long-chain hydroxy acids, and some are sesquiterpene acids," Nandkishore et al., "Shellac as a multifunctional biopolymer: A review on properties, applications and future potential," 207.

heated end of the canvas tube, creating on a flat surface small button-like cakes of resin, called ***button lac***. Another way of collecting this resin is by forming not many small cakes but a single flat sheet on a heated surface (e.g. the surface of a metal canister full of hot water). This sheet is then manually stretched further by an operator, using their feet, mouth, and hands. When this stretched shellac cools and dries, forming a flat sheet, it is then broken into tiny flakes. Shellac is usually sold in this second form, as flakes, because it is easily transported and can be simply mixed by end-users with ethanol to make a coating varnish, usually employed for wooden surfaces (***liquid shellac*** or [shellac-based] ***lacquer***).

3. ***Lac dye***: it is the red coloured substance extracted by washing sticklac, essentially a by-product of shellac extraction.[58] From a chemical point of view, the main colouring components of this dye are the laccaic acids A and B, together with laccaic acids C, D, E, and F as minor components.[59] Shellac is more or less deprived of laccaic acid, while other yellowish colouring molecules, such as erythrolaccin, are preserved.[60] In order to remove these last colouring molecules, shellac can be bleached.[61]

This glossary is also useful for reading Kerr's account. In this regard, Kerr gives us a description of the traditional manufacturing process both for shellac and lac dye, which is identical to our previous

[58] For its economical evaluation at the end of twentieth century CE, Green, Natural colourants and dyestuffs, 64–5.
[59] For laccaic acids A and B, cf. R. Burnwood et al. "The Pigments of Stick Lac. Part I. Isolation and Preliminary Results," in *Journal of the Chemical Society* (1965), 6067–73; R. Burnwood et al. "The Pigments of Stick Lac. Part II. The Structure of Laccaic Acid A," in *Journal of the Chemical Society* (C) (1967), 842–51; E. D. Pandhare et al. "Lac pigments," in *Tetrahedron* 22.8 (1966), 229–39; E. D. Pandhare et al. "The constitution of laccaic acid B," in *Tetrahedron Letters* 26 (1967), 2437–40; E. D. Pandhare, A. V. Rama Rao and I. N. Shaikh. "Lac pigments: part III isolation of laccaic acids A and B and the constitution of laccaic acid A," in *Indian Journal of Chemistry* 7 (1969), 977–86; N. S. Bidhe et al. "Lac pigments: part IV constitution of laccaic acid B," in *Indian Journal of Chemistry* 7 (1969), 987–95; H. Oka et al. "Separation of lac dye components by high-speed counter-current chromatography," in *Journal of Chromatography A* 813 (1998), 71–7; H. Oka et al. "Identification of lac dye components by electrospray high performance liquid chromatography-tandem mass spectrometry," in *Journal of the Mass Spectrometry Society of Japan* 46 (1998), 63–68. For laccaic acids C, D, E, and F, cf. A. V. Rama Rao, I. N. Shaikh and K. Venkataraman. "Laccaic acid C, the first natural anthraquinone with an ammino acid side chain," in *Indian Journal of Chemistry* 7 (1968), 188–89; A. R. Mehandale et al. "Desoxyerythrolaccin and laccaic acid D," in *Tetrahedron Letters* 18 (1968), 2231–334; D. Hu, A. Hasegawa and S. Nakatsuka. "Isolation and structure determination of laccaic acid F from lac-dye produced from Thai sticklac," in *Heterocyclic Communications* 4 (2011), 327–30. For a general overview, cf. Erwin Rosenberg. "Characterisation of historical organic dyestuff by liquid chromatography-mass spectrometry," in *Analytical and Bioanalytical Chemistry* 391 (2008), 33–57; Sanne V. J. Berbers et al. "Historical formulations of lake pigments and dyes derived from lac: A study of compositional variability," in *Dyes and Pigments* 170 (2019). For a description of lac dye in the context of other red dyes extracted from insects, cf. C. J. Cooksey. "The red insect dyes: carminic, kermesic and laccaic acids and their derivatives," in *Biotechnic & Histochemistry* 94.2 (2019), 100–07.
[60] Cf. Gulsaz Shamim et al. "Biochemistry and biosynthesis of insect pigments," in *European Journal of Entomology* 111.2 (2014), 149–64 (on 153).

[61] Cf. Nandkishore et al., "Shellac as a multifunctional biopolymer: A review on properties, applications and future potential," 207.

descriptions based on the non-industrial or traditional practices still common in India, and he also includes a few recipes for certain products derived from lac processing.[62]

Interpreting Christianos's text: terms and procedures

We can now attempt a more precise interpretation of what kind of technical operations Christianos is describing and what are the terms employed by this alchemist and by other related texts.

Terms

The text starts as a sort of comparison between the dyeing involving some other alchemical substances (copper, as it will be clear later in Christianos' text) and the dyeing involving a particular one, the so-called *lachion*. In this comparison, Christianos states that copper becomes capable of receiving colours in a manner similar to the *lachion*. What is also quite striking is the specific mention of Indian dyers (οἱ ἰνδικοβάφοι), that reminds us of the text by Ctesias cited above, although he (or better, the synthesis written by Photios) speaks not of Indian dyers but, in a more general way, of Indians that dye, and he never assigns a name to the red dyeing substance.

Assuming all these texts are referring to the same substance, we can then find in Christianos two names for lac, λάχιον and λαχάς, this second also attested in the Middle Byzantine *Book of the Eparch* or, in a slightly different form, in Aëtius of Amida (mid fifth–mid sixth century CE) as λαχχάς. The other attested names are λάκκος from the *Periplum* and the *P. Lond.* II 191, and λακχά from Ps.-Democritus. It seems that there was no stable form for this technical term, probably due its relative rarity and foreign etymology. Usually, scholars state that "lac" is derived from the Sanskrit word "laksha" (i.e. one hundred thousand),

[62] "Separate the cells from the branches, break them into small pieces, throw them into a tub of water for one day, wash off the red water and dry the cells, and with them fill a cylindrical tube of cotton cloth, two feet long, and one or two inches in diameter ; tie both ends, turn the bag above a charcoal fire ; as the Lac liquifies twist the bag, and when a sufficient quantity has transuded the pores of the cloth, lay it upon a smooth junk of the Plantain tree (Musa Paradisiaca, linnæi), and with a strip of the Plantain leaf draw it into a thin lamella ; take it off while flexible, for in a minute it will be hard and brittle. They value Shell Lac according to its transparency," Kerr, "XXIV. Natural history of the insect which produces the Gum Lacca," 378. Roxburgh, mentioned previously in a note regarding the insect name, displayed instead a strange ignorance of the economic uses and of the technical aspects of lac dye, despite writing around ten years later than Kerr: "The eggs, and dark-coloured glutinous liquor they are found in, communicate to water a most beautiful red colour, while fresh. After they have been dried, the colour they give to water is less bright ; it would therefore be well worth while for those, who are situated near places where lac is plentifully found, to try to extract and preserve the colouring principles by such means as would prevent them from being injured by keeping. I doubt not but in time a method may be discovered to render this colouring matter as valuable as cochineal," Roxburgh, "XV. Chermes Lacca," 233.

referring to the great number of lac insects on host trees during their brooding season,[63] and state that the term was already used in ancient Indian literature.[64] Regarding the Greek term, apparently the word changes from the Attic form λάκκος to the Byzantine λαχάς (λάχιον is a diminutive), passing through a λακχά and λαχχάς phase in the Imperial era and late antiquity, respectively.

Furthermore, regarding the famous physician Aëtius of Amida, we find some useful elements for our discussion in a recipe by him for a cosmetic red. I have translated here this recipe, following the Greek text of Olivieri's critical edition (CMG VIII 1–2).

> Preparation of *Roidarion*. The *Roidarion* is prepared with many colours and this is the best preparation. Having taken some lac, soak it in water and, having triturated the so-called talc stone, pour some of the infusion on the talc stone and let it dry. Having taken some alkanet (*Anchusa tinctoria*) root, boil it with oil until the oil turns red and pour on a little of the oil and triturate and let it dry for fifteen days and again project from the infusion of lac and let it dry. Then roast [it], having thrown and closed [it] in an earthenware vessel. So it will be the beautiful *Roidarion*. The talc is imported from Caesarea Palaestinae. Those without talc, use unslaked lime in the preparation.[65]

Aëtius, here, not only explicitly says that lac and *Anchusa tinctoria* are different substances,[66] but once again confirms the use of water for lac dye extraction. There is no mention of India in Aëtius, while he is more specific about the provenance of talc. It is not clear to what extent lac was considered a common

[63] For a different opinion on this etymology, cf. S. Mahdihassan. "Lac and Its Decolourization by Orpiment as Traced to Babylon," in *Indian Journal of History of Science* 21.2 (1986), 187–92.

[64] For a sixteenth-century attestation of the word "lac," cf. Padmanabh S. Jaini. "Pāṇḍava-Purāṇa of Vādicandra: Text and Translation (Continued)," in *Journal of Indian Philosophy* 27.3 (1999), 215–78 (on 240). For lac as a medical substance, cf. Kenneth G. Zysk.
"Religious Healing in the Veda. With translations and annotations of the medical hymns from the *Ṛgveda* and the *Atharvaveda* and the renderings from the corresponding ritual texts," in *Transactions of the American Philosophical Society* 75.7 (1985), 1–311 (on 74–75, 98, 113, 198–99, 202).

[65] "Ροιδαρίου σκευασία. Σκευάζεται μὲν ποικίλως τὸ ῥοιδάριον· ἐστὶ δὲ καὶ αὕτη ἀρίστη σκευασία. λαβὼν λαχχὰ ἀπόβρεχε ὕδατι καὶ λεάνας λίθον τὸν κουφόλιθον λεγόμενον ἐπίχεε ἐκ τοῦ ἀποβρέγματος τῷ κουφολίθῳ καὶ ἔα ξηραίνεσθαι καὶ λαβὼν ῥίζαν ἀγχούσης ἕψε σὺν ἐλαίῳ ἕως τὸ ἔλαιον πυρρὸν γένηται καὶ ἐπίβαλλε ἐκ τοῦ ἐλαίου ὀλίγον καὶ λείου καὶ ἔα ξηραίνεσθαι ἐπὶ ἡμέρας καὶ πάλιν ἐπίβαλλε ἐκ τοῦ ἀποβρέγματος τοῦ λαχχᾶ καὶ ἔα ξηρανθῆναι, ἔπειτα βαλὼν εἰς ὀστράκινον ἄγγος καὶ φιμώσας ὅπτα· καὶ ἔσται ῥοιδάριον καλόν. κομίζεται δὲ τὸ κουφόλιθον ἀπὸ Καισαρείας τῆς Παλαιστίνης. οἱ δὲ ἀποροῦντες κουφολίθου, ἀσβέστῳ χρῶνται εἰς τὴν σκευασίαν," Aët., II, 68.

[66] As already mentioned by Martelli, PsDSA, 263, n. 7.

ingredient in the eastern Mediterranean milieu around a century before Christianos, whose geographical provenance is still unknown.[67]

Procedures

Christianos mentions that the lac dye extraction is obtained by water, natron, and heat. He says: “through natron and heat, [the *lachas*] emits entirely from itself the substance, the blood-red one, when it (i.e. the *lachas*) is also rubbed by hands in a jar of Ascalon, as in the case of the legumes that are washed.” William Roxburgh, mentioned previously within footnotes, wrote down a lac dye extraction process involving, precisely, water and alum.[68] This process is similar to the descriptions in Kerr’s account, respectively for a paint and for a dye.[69] The main points to make regarding these late eighteenth-century accounts is that all the recipes involving lac dye extraction say to put sticklac in water and add alum [to precipitate the red colouring agent]. Christianos, in the early seventh century, says exactly the same.[70]

Christianos then proceeds to describe the result of this washing, by saying “becoming therefore white, or rather colourless.” He is describing the separation of lac dye from the sticklac, or maybe referring to some kind of bleaching process.[71]

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[67] For an overview of other ancient and modern lac dye recipes, cf. Berbers et al., “Historical formulations of lake pigments and dyes derived from lac: A study of compositional variability.” The authors assume the recipe in *Mappae Clavicula* (ninth century CE) as the oldest, and they identify four main variables in the various recipes discussed: “pH (from neutral to alkaline), temperature (from room temperature to boiling), time of extraction (from minutes to days) and additives (for example urine or ley – potassium carbonate – to adjust the pH),” Berbers et al., op. cit., 2.

[68] Roxburgh, “XV. Chermes Lacca,” 234–35.

[69] Kerr gives a recipe for producing a red colour from lac, used for painting purposes. One of the main differences between the two is the use of milk in this recipe: “Take one gallon of the red liquid from the first washing for Shell Lac, strain it through a cloth, and let it boil for a short time, then add half an ounce of soap earth (fossil alkali) ; boil an hour more, and add three ounces of powdered load (bark of a tree) ; boil a short time, let it stand all night, and strain next day. vaporate three quarts of milk, without cream, to two quarts, upon a flown fire, curdle it with sour milk, and let it stand for a day or two ; then mix it with the red liquid above mentioned ; strain them through a cloth, add to the mixture one ounce and an half of allum, and the juice of eight or ten lemons : mix the whole, and throw it into a cloth-bag strainer. The blood of the insect forms a coagulum with the caseous part of the milk, and remains in the bag, while a limpid acid water drains from it. The coagulum is dried in the shade, and is used as a red colour in painting and colouring,” Kerr, “XXIV. Natural history of the insect which produces the Gum Lacca,” 380–81.

[70] For the textile archaeological evidence mentioned previously, it might be of interest to read Kerr’s words on the production of lac red for dyeing silk or cotton clothes: “Take one gallon of the red liquid prepared as before without milk, to which add three ounces of allum. Boil three or four ounces of tamarinds in a gallon of water, and strain the liquor. Mix equal parts of the red liquid and tamarind water over a brisk fire. In this mixture dip and wring the silk alternately until it has received a proper quantity of the dye. To increase the colour, increase the proportion of the red liquid, and let the silk boil a few minutes in the mixture. To make the silk hold the colour, they boil a handful of the bark called Load in water, strain the decoction, and add cold water to it ; dip the dried silk into this liquor several times, and then dry it. Cotton cloths are dyed in this manner ; but the dye is not so lasting as in silk,” Kerr, op. cit., 381.

[71] Regarding “white lac” (i.e. bleached shellac): “In the early nineteenth century, several methods for decolourizing shellac resin were introduced, including chemical bleaching processes using chlorine, which were developed in London by the colour manufacturer George Field and in Philadelphia by the chemist Robert Hare,” Ken Sutherland. “Bleached shellac picture varnishes: characterization and case studies,” in *Journal of the Institute of Conservation* 33.2 (2010), 129–45 (on 129). Cf. Leslie Carlyle. *The*

This next passage is, as far as I know, not attested elsewhere. Christianos effectively says that the washed sticklac, which we would call seedlac, is now colourless. Then he says that it can be fixed on a heated stick and hammered, before being dyed again with other substances, implying that seedlac is now shellac, since it is heated and malleable: "so it is worked, struck with hammers on grindstones fixed in the ground, but changing direction frequently together with a twig into which it (namely, the *lachas*), being heated beforehand, has been driven." Christianos is probably reporting here the recolouring of shellac by a natural pigment, also described by Kerr in his red-seal wax recipe; it begins by heating a mass of shellac cakes or leaves on a twig, which functions as a support:

> Take a stick, and heat one end of it upon a charcoal fire ; put upon it a few leaves of the Shell Lac softened above the fire ; keep alternately heating and adding more Shell Lac, until you have got a mass of three or four pounds of liquified Shell Lac upon the end of your stick (in this manner Lump Lac is formed from Seed Lac). Knead this upon a wetted board with three ounces of levigated cinnabar, form it into cylindrical pieces ; and, to give them polish, rub them while hot with cotton cloth.[72]

Not only is Christianos apparently describing the production of coloured shellac, but he is also correctly reporting that dried shellac is brittle and cannot be mechanically mixed with other colouring substances, by saying "it becomes non-malleable dried by the air, and also impossible to be dyed."

Christianos's last sentence is more puzzling, not only because it can be translated in different ways, but also because it mentions a peculiar ingredient, the resin of Colophon (Κολοφωνία). Also called rosin, this is a valuable conifer resin with a sweet odour and many uses. During the classical era, it was a typical product of the Ionian city of Colophon. Galen assigns it to the category of first class emollient remedies[73] and it is attested as an ingredient for medical poultices, since it does not dry out easily and maintains a sufficiently wet consistency to facilitate the absorption of the drug.[74] It is not clear how this particular

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Artist's Assistant. Oil Painting Instruction Manuals and Handbooks in Britain, 1800–1900, with Reference to Selected Eighteenth-century Sources. (London: Archetype, 2001), 87–93.

[72] Kerr, "XXIV. Natural history of the insect which produces the Gum Lacca," 379.

[73] "Μαλακτικὰ φάρμακα πρώτης τάξεως," Gal. *Comp. per gen.* VII, 4 (= XIII, 959, l. 11 Kuhn).

[74] For a comprehensive pharmacological overview of this substance, cf. Isabella Andorlini. "P.Grenf. I 52: Note Farmacologiche," in *The Bulletin of the American Society of Papyrologists* 18.1–2 (1981), 1–25 (on 20–22); Marguerite Hirt and David Leith, eds. *The*

ingredient can be used to manufacture coloured shellac or even if it can be useful in preventing shellac from drying out easily.

Conclusions

In this paper we have examined an alchemical text written by a seventh-century Byzantine alchemist, Christianos. This alchemist described two technical processes, namely lac dye extraction and coloured shellac manufacturing. In the eighteenth century these procedures were described in similar terms by the first English authors reporting on Indian lac industry. In order to facilitate the intelligibility of Christianos' text, I have provided ample textual parallels, both ancient and modern. I have also used lac at the beginning as a clue to provide a plausible answer to the chronology of our alchemist Christianos.

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Oxyrhynchus Papyri. Vol. LXXX. (London: Egypt Exploration Society, 2014), 151. It was also used as a name for scammony (*Convolvulus scammonia*), which is a potent purgative and antihelminthic root: "οἱ δὲ σκαμμωνίας ῥίζα, οἱ δὲ Κολοφωνία," Ps.-Dsc., IV, 170.

Note on contributor

Marco Bellini is a research fellow in History of Science at the University of Bologna. E-mail: marco.bellini11@unibo.it.

ORCID

https://orcid.org/0000-0003-0424-4945

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