ISSN 1301-2746

ADALYA

25 2022

AKMED
KOÇ UNIVERSITY
Suna & İnan Kıraç
Research Center for
Mediterranean Civilizations

25 2022 ISSN 1301-2746

ADALYA

The Annual of the Koç University Suna & İnan Kıraç Research Center
for Mediterranean Civilizations

(OFFPRINT)

KOÇ ÜNİVERSİTESİ

AKMED
KOÇ UNIVERSITY
Suna & İnan Kıraç
Research Center for
Mediterranean Civilizations

ADALYA

The Annual of the Koç University Suna & İnan Kıraç Research Center for Mediterranean Civilizations (AKMED)

Adalya, a peer reviewed publication, is indexed in the A&HCI (Arts & Humanities Citation Index – CC / A&H (Current Contents / Arts & Humanities), Social Sciences and Humanities Database of TÜBİTAK / ULAKBİM Tr index, ERIH PLUS (European Reference Index for the Humanities and Social Sciences), Scopus, SOBIAD, and Index Copernicus.

Mode of publication Worldwide periodical

Publisher certificate number 18318

ISSN 1301-2746

Publisher management Koç University

Rumelifeneri Yolu, 34450 Sarıyer / İstanbul

Publisher Umran Savaş İnan, President, on behalf of Koç University

Editor-in-chief Oğuz Tekin

Editors Tarkan Kahya and Arif Yacı

English copyediting Mark Wilson

Production Zero Production Ltd.
Abdullah Sok. No. 17 Taksim 34433 İstanbul
Tel: +90 (212) 244 75 21 • Fax: +90 (212) 244 32 09
info@zerobooksonline.com; www.zerobooksonline.com

Printing Fotokitap Fotoğraf Ürünleri Paz. ve Tic. Ltd. Şti.
Oruç Reis Mah. Tekstilkent B-5 Blok No. 10-AH111
Esenler - İstanbul / Türkiye
Certificate number: 47448

Mailing address Barbaros Mah. Kocatepe Sok. No. 22
Kaleiçi 07100 Antalya / Türkiye
Tel: +90 (242) 243 42 74 • Fax: +90 (242) 243 80 13
https://akmed.ku.edu.tr

E-mail address adalya@ku.edu.tr

KOÇ ÜNİVERSİTESİ

AKMED
KOÇ UNIVERSITY
Suna & İnan Kıraç
Research Center for
Mediterranean Civilizations

Contents

ADALYA 25, 2022

From the *Miltos* / *Sinopis* of Ancient Sinope to the *Yoşa* of Modern Cappadocia

DOMINIQUE KASSAB TEZGÖR*

Abstract

The word *miltos* in Greek, and its synonym *rubrica* in Latin, were generic terms for red ochre. Red ochre was not rare, but the type called the *miltos* of Sinope was well-known in classical antiquity because of its exceptional quality. It was originally extracted in Cappadocia and traded from the harbor of Sinope, hence its name. However, probably at the end of the second century BC, the main trade route changed, and it was exported through Ephesus following the extension of the city's catchment inland thanks to the improvement of the road network under Roman rule. Although its exportation presumably stopped at the end of the third century AD, its fame continued, and the name *sinopis* or *sinopia* was subsequently given to red ochre of high quality but of various origins. The aim of this study is to combine the data provided by the ancient texts and the archaeological evidences in light of *yoşa*, a red pigment still extracted in Cappadocia. It is undoubtedly the same as the *miltos* of Sinope, and continued in use in the post-Classical period for the wall decorations of the region's Byzantine churches and later for its dovecotes also. Today it is used by the potters of Avanos for decorating their wares.

Keywords: Cappadocia, fresco, red ochre, *miltos*, Sinope, transportation

Öz

Yunancadaki *miltos* kelimesi ve eş anlamlısı olan Latince'deki *rubrica*, kırmızı aşıboyası için genel terimlerdi. Kırmızı aşıboyası nadir değildi, fakat, Sinop *Miltos*'u olarak adlandırılan tip, olağanüstü kalitesi sebebiyle Klasik antik dönemde iyi biliniyordu. Aslen Kapadokya'da çıkarılmıştır ve Sinop limanından ticareti yapılmıştır, nitekim ismini buradan alır. Ancak, muhtemelen MÖ 2. yüzyılın sonunda, ana ticaret yolu değişti ve Roma yönetiminde yol ağının gelişmesi sayesinde şehrin su toplama havzasının iç kısımlara doğru genişlemesiyle Efes üzerinden ihraç edildi. MS 3. yüzyılın sonunda ihracatı muhtemelen durmuş olsa da ünü devam etmiş ve *sinopis* veya *sinopia* ismi sonradan yüksek kaliteli ancak çeşitli kökenlerden kırmızı aşı boyasına verilmiştir. Bu çalışmanın amacı, Kapadokya'da hala çıkarılan kırmızı bir pigment olan yoşa ışığında antik metinlerin sağladığı verilerle arkeolojik kanıtları birleştirmektir. Şüphesiz ki Sinop *Miltos*'unun aynısıdır ve Klasik sonrası dönemde bölgenin Bizans kiliselerinin duvar süslemelerinde ve daha sonra güvercinliklerinde de kullanılmaya devam etmiş ve bugün Avanos çömlekçileri tarafından kaplarını süslemek için kullanılmaktadır.

Anahtar Kelimeler: Kapadokya, fresk, kırmızı aşıboyası, *miltos*, Sinope, nakliye

* Prof. Dr. Dominique Kassab Tezgör, Bilkent Üniversitesi, Arkeoloji Bölümü, Ankara, Türkiye.
E-mail: tezgor@bilkent.edu.tr ; http://orcid.org/0000-0002-5736-1822

Introduction

Thanks to its exceptional topographical and geographical location, Sinope was undoubtedly a prosperous place in antiquity. Situated on a perpendicular peninsula on the south Black Sea coast with two sheltered harbors on either side guaranteeing safe anchorages, it was excellently located for an active commerce which played a major role in its prosperity. One valued product that certainly played its part in this affluence was the so-called *miltos* of Sinope. Alternatively known as *sinopis*, this was a form of what is generically known as red ochre, which actually came from Cappadocia but which gained its alternative name *sinopis* from being traded from Sinope.

Road network between Cappadocia and Pontus (© Fabrice Delrieux).

We know of its existence and fame principally as a pigment through the texts of Theophrastus, *De Lapidibus*, Dioscorides, *De Materia Medica*,[1] Pliny, *Historia Naturalis*, books 33, 35 and 36, and Vitruvius, *De Architectura*, although it also had some curative virtues (Plin., *HN* 35.32; Dioscorides 5.96, 2).[2] This coloring agent were first evaluated by Hugo Blümner in

[1] Ten articles of Dioscorides on minerals are copied in *PLeid.*, l. 582-678, as published in Halleux 2019, 30. See further below.

[2] We have an indirect clue that the pigment carrying the name of Sinope was still known as a curative resource in the first and second centuries AD, since Aretaeus of Cappadocia in his treatise *De curatione acutorum morborum* clearly differentiates it as such from the red earths of Lemnos or Samos (Book 1, ch. 7 and Book 2, ch. 2). However, Galen does not cite it.

his section on the color red in his seminal *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern* published in 1887.[3] Since Blümner's time, publications relative to the economic resources of Sinope often mention it, but have provided no new information and often display an ignorance of its exact nature and its precise origin. As such, its general description and identification as a red ochre is mostly accepted, although, as we shall see below, there have been other interpretations as to its nature. Yet, a red pigment is still exploited today in Cappadocia, where it is called *yoşa* (fig. 1).[4] There is little doubt that the *miltos* of Sinope and *yoşa* are one and the same. The presence of this coloring agent is visible everywhere in Cappadocia, most especially in the famous red rocks and red coloration of the silt of the ancient Halys, modern Kızılırmak River ("Red River"), so called to distinguish it from its northern neighbor, the classical Iris or Yeşilırmak ("Green River").[5] Today the most important supply of red ochre exploited in Cappadocia is at Özkonak, a village north of Avanos, well-known for its potteries and potters using the local clay for their wares. Another quarry is in Mucur, close to Kırşehir, where the pigment is considered of a deeper red color by the local craftsmen potters.

The aim of this article is to shine a new light on the *miltos* of Sinope by collecting and interpreting the information we have received from antiquity in the light of modern knowledge and studies. The *yoşa* of Cappadocia, which we consider as the original pigment, allows us to perceive better the specific qualities given to *miltos* in ancient texts, within the general framework of an interest in red ochre in general and Sinopean *miltos* in particular. After all, red ochre has long been a universally favored coloring agent, already used as such in Paleolithic times and found in prehistoric contexts worldwide.[6] As M. Pastoureau explained in his book dedicated to all the aspects of the color red: "Red is the archetypal color, the first color humans mastered, fabricated, reproduced, and broke down into different shades, first in painting, later in dyeing."[7] As we will see, the study of the *miltos* of Sinope illustrates well these aspects.

The *Miltos*

In ancient Greek texts the word μίλτος (*miltos*) is used to identify red ochre in its natural form or as a coloring agent as well as the red color obtained from it. However, it was not related to a specific provenance or quality.[8] By contrast, the English word "ochre" comes from the Greek word ὤχρα and referred to yellow ochre. The *miltos* we are concerned with here, however, was of a superior kind, as it was refined (διϋλίζεται) and brought (κατάγεται) to Sinope to be exported (Dioscorides 5.96.1).[9] For this reason, it was given the name of Σινωπική

3 Blümner 1887, 4:478-99.

4 I am grateful to Tolga Uyar for his guidance during my research on Cappadocian *yoşa*, and indebted to Levent and Mehmet Düzgün, potters in Avanos (generally known as the İkizler), and Mükrimen Tokmak, a local historian, for the valuable information that they provided.

5 Before the construction of the Bayramhacı Dam in 2010, the Kızılırmak still flowed with a red color as far as Avanos.

6 Eastaugh et al. 2008, 326.

7 Pastoureau 2017, 7.

8 In this article *miltos* in italics refers to its mention in Greek-language texts, and *sinopis* and *rubrica* to the Latin texts. The word "ruddle" has been used in English since the beginning of the 20th century to translate the Greek word *miltos*; see Eastaugh et al. 2008, 334. On the different uses of the term *miltos*, see Cherry et al. 1991, 299; Photos-Jones et al. 1997, 359.

9 For the trade through Sinope, see below.

(Theophr. 8.52) with Strabo providing the name ἡ Σινωπικὴ λεγομένη μίλτος (12.2.10) and Dioscorides μίλτος Σινωπική (5.96.1).

Pliny goes further in distinguishing between *rubrica*, *sinopis* and Pontic *sinopis* in his classification of red ochre. He explicitly states that the Greeks use the name *miltos* as the equivalent of *rubrica* in Latin (*HN* 33.115). In his vocabulary, the word *rubrica* refers to red ochre in general, and *sinopis* to one kind of it (*rubricae genus*: *HN* 35.33). For that reason, he distinguishes in his text between *sinopis* and *rubrica* (*HN* 35.30; 33.117). However, because the red ochre exported from Sinope was a guarantee of high quality, he used the name *sinopis* for all the best quality types of *rubrica* (*HN* 35.31). When he wanted to refer specifically to the *sinopis* of Sinope though, he named it the Pontic *sinopis* (*sinopis pontica*), noting that the name *sinopis* comes from Sinope, where it was "discovered" (*inventa*) for the first time (*HN* 35.31).

In general, *miltos* was considered as an earth (γῆς), as was ochre (Theophr. 8.40), while Strabo (3.2.6.) calls it Σινωπικῆς γῆς. Dioscorides gives us a quite precise description of the *miltos* of Sinope: it is thick (πυκνή) and heavy (βαρεῖα), with a liver color (ἡπατίζουσα), without stones (ἄλιθος), and of a homogeneous hue (ὁμόχρους), and can be easily dissolved in water (πολύχυτος ἐν τῇ ἀνέσει) (5.96.1). Pliny also records that the inside of a block (*glaeba*) of the material is homogeneously colored, but the exterior surface is spotted (*maculosus*) (*HN* 35.31) (fig. 2). According to Theophrastus, *miltos* and (yellow) ochre were present, sometimes together, in mines (μετάλλοι) of silver and gold, but also of copper (8.52). The yellow ochre was found in block form (ἀθρόα), while *miltos* was extracted from rock veins (ῥάβδοι) (8.51). Pliny considered that the best quality adheres to the rocks (*saxa*) (*HN* 35.31). Dioscorides completes our information by mentioning that the *miltos* of Sinope was found in caverns (σπήλαια) in Cappadocia (5.96.1). Pliny also refers to hollows (*speluncae*) for the extraction of *sinopis* in Lemnos and in Cappadocia (*HN* 35.31).[10] Theophrastus mentions that the yellow ochre and the *miltos* were found in the same mines in Cappadocia. He comments that the work was dangerous (χαλεπός) for the miners, because they were rapidly exposed to a risk of suffocation (8.52).[11] These caverns are in fact adits - tunnels following the rock veins that provided the material - as is shown by the ancient mines of Keos (modern Kea).[12]

The ancient writers agreed that a high quality of red ochre (the *sinopis* of Pliny) was found in Egypt, the Balearic Islands, and Lemnos (Plin., *HN* 35.31; Vitr. 8.7.2). To these provenances, Dioscorides added Carthage (5.96.3) and Pliny, Africa (*HN* 35.32). Theophrastus also names the island of Keos (8.52) as a source of *miltos*; indeed, according to him, it is the best kind of all.[13] Caley and Richards, who have studied the sites where this was obtained, note that other writers do not mention this source and so suggest it was not in use at the time they were writing.[14] It could also be that it was not widely available because of a monopoly exercised by Athens on the supply of Keon *miltos*.[15]

---

10 Pliny follows what Vitruvius says (7.7.2) on *rubricae*; see Croisille 1985, 152, n. 31.2.

11 This toxicity of the mining environment for *miltos* was the basis for the argument by Leaf (1916, 10-14) for identifying it as cinnabar. That hypothesis has since been refuted comprehensively and is best explained by the small space the men were working in and a common lack of safety precautions taken in mining in antiquity; see, e.g., Caley and Richards 1956, 176; Eichholz 1965, 123.

12 About the exploration of the mines, see Caley and Richards 1956, 176-77. See the photographs of the mining adits at https://sclawren.web.unc.edu/*miltos*/ (consulted 7/2021). On the *miltos* of Keos, see n. 13.

13 For recent fieldwork in Keos and analyses of the *miltos*, see Cherry et al. 1991, 300-3; Photos-Jones et al. 1997; Photos-Jones 2018, 427-29.

14 Caley and Richards 1956, 176.

15 See below regarding this monopoly.

In fact, as might be expected, the ancient writers were not in common agreement as to which *miltos* was the best of all. Theophrastus, for example, did not make a distinction between the *miltos* of Sinope and that of Lemnos, probably because he considered both of the same quality after that of Keos (8.52-53). For Strabo (12.2.10) and Dioscorides (5.111), the Sinopean was the best, but Strabo adds that it was challenged by that from the Balearics (12.2.10). For Pliny, the best *sinopis* was the Lemnian one (*HN* 35.31), although he does confuse the red ochre of Lemnos used for painting and the one used for medicinal purpose, since he describes it as packed in small, sealed quantities.[16] Vitruvius considered that all these *rubricae* are of the same high quality (7.7.2).

The Transportation from Cappadocia

Sinopean red ochre, like the others, was very much a "niche" product. That is to say it was in great demand by specialist artisans only, but one in which a small amount went very far in use in its actual application for whatever purpose. As such, it was perhaps not a viable product to trade in bulk by itself, but was more probably traded as a "piggy-back" cargo, an add-on to the trade of a more valued product, preferably a cargo with a guaranteed market. It is not possible to estimate the quantity of red ochre pigment exported from Sinope in antiquity, but probably it was not a negligible amount. It had a high reputation and was put to a large range of usages, albeit not forgetting, of course, that Cappadocia was not alone in producing a good quality of *miltos*.

As a niche product, Cappadocian red ochre would be included in a consignment of goods transported from there along with needed items from the same region and centers both close to home and further afield.[17] Metals mined in Cappadocia were most probably a part of the transport system as well as salt,[18] which was needed to salt fish presumably in Sinope or in its immediate surrounding for onward trade, but also for return to Cappadocia.[19] What is important here is that in a key sentence, Strabo (12.2.10) tells that *miltos* was transported from Cappadocia to Sinope until the Ephesian trade became accessible to these regions: "ὠνομάσθη δὲ Σινωπική, διότι κατάγειν ἐκεῖσε εἰώθεσαν οἱ ἔμποροι, πρὶν ἢ τὸ τῶν Ἐφεσίων ἐμπόριον μέχρι τῶν ἐνθάδε ἀνθρώπων διῖχθαι" ("It was named 'Sinopean' because the merchants were wont to bring it down thence to Sinopê before the traffic of the Ephesians had penetrated as far as the people of Cappadocia."[20] Thanks to recent research, we have a better knowledge of the road network in Anatolia which allows us to retrace in its main lines the potential road itineraries from the quarries of Cappadocia to Sinope and to Ephesus, before Strabo and in his own time as well as later. When we take into account new thoughts on Roman transport systems,[21] this allows us, to some extent, to partly reinterpret his text and establish why perhaps the focus of transport changed from Sinope to Ephesus.

---

16 Caley and Richards 1956, 177-78. About *miltos* sealed for medical use and for recent fieldwork there, see Photos-Jones and Hall 2014; Photos-Jones et al. 2017; Christidis et al. 2020.

17 The distribution of Sinopean amphora points towards their contents being part of some regulated trade system. Sinope may also have exported goods from Cilicia, as is suggested by coin hoards (Thonemann 2011, 107).

18 Salt is still a resource exploited nowadays in Cappadocia, where a village is called Tuzköy (Salt Village).

19 Braund 2005, 124.

20 Translation of Jones 1928.

21 E.g., Adams 2012.

To begin, we learn from Strabo that Sinope was the original exporting harbor for *miltos*. By examining the road network of Northern Anatolia, it is possible to reconstruct the route taken in transporting *miltos* to Sinope. According to Strabo (12.2.10), a chain of mountains (Küre Dağları) was the natural border between Cappadocia and the region of Pontus. In a pioneer article on the *Roads in Pontus*, Munro identified two trunk routes crossing the Pontic kingdom, later integrated with the province of Pontus. One was the Pontus Road running east to west between the head of the river Lycos (Çürüksu Çayı) and the head of the river Amnias (Gök or Gökırmak river),[22] as used by Mithridates VI and Lucullus on their respective campaigns in this region in the early first century BC.[23] However, according to Bekker-Nielsen, only a part of that route was formalized before Pompey took control of the kingdom of Mithridates VI in 66 BC and reorganized it,[24] then establishing seven cities along this route.

The other route identified by Munro ran between the modern cities of Ladik and Havza, meeting the other and connecting Mazaka in Cappadocia (modern Kayseri) to Zela, Amaseia, and Amisus.[25] It was in fact the northern part of a major north-south trans-Anatolian route from the Cilician Gates to the Black Sea and of a great importance for trade and troop movements.[26] Such a route between Cilicia and Sinope is mentioned by Herodotus (1.72, 2.34.2),[27] while Strabo describes a route connecting Issos to Sinope or Amisus (14.3.1).[28] Leaf, in an article of 1916, demonstrates that "the terminus of this Pontic trade-route is not at Sinope but at Amisus."[29]

The wording of Strabo lets us suppose that the pigment was sent directly from Cappadocia to Sinope by crossing the Pontic chain and not through Amisus. The only direct access to Sinope from Cappadocia was via the South-North highway, passing Zela and Amaseia to reach the Pontic Road, this then being followed to the west. At the location of today's Osmanköy village was a junction to the road going across the Pontic mountains through the Dranaz pass.[30] This ancient route was upgraded in the later Roman period when the whole network was improved, as testified by milestones from the period between Diocletian and Constantius II and Constans.[31] It was still used by travelers in the 19th century. Cuinet wrote in the 1890s, stating that the only road in the region of Sinope was to Boyabat and from Boyabat to Amaseia.[32] The modern road also follows this line, but passes through the Dranaz tunnel at the level of the pass, which rises to 1365 m. In spite of the height, this road should not have been difficult for the pack animals transporting goods, except in case of excessively bad weather.[33]

---

22 Munro 1901, 53-55; Leaf 1916, 7-8. Bryer and Winfield 1985, 69 and n. 8, 20-21.

23 Mitchell 1993, 127.

24 Bekker-Nielsen 2016, 43.

25 Munro 1901, 55; McGing 1986, 4.

26 Magie 1950, 1078-80, n. 25.

27 Debord 1999, 85 and 84, map 2; Thonemann 2011, 106-7. However, Herodotus's claim that distance involved could be covered in five days is an underestimate, as has been often noted; see, e.g., Thonemann 2011, 107 and n. 20; Godley 1926, 89, n. 1.

28 Braund 2005, 123. However, Magie 1950, 1076, n. 21, doubts the existence of this road.

29 Leaf 1916, 6-8.

30 Magie 1950, 1076-77, n. 21 and 1082, n. 30; Bekker-Nielsen 2016, 37 and 41.

31 For the road see Bryer and Winfield 1985, 39-40; Bekker-Nielsen 2016, 37 and 41; Olshausen 2014, 45. For the milestones see French 2013, 59-67, no. 21 (A-E). They were situated on the road C7: 20, map 5.1.1 and 173, map 5.2.1. See also Bekker-Nielsen 2016, 37 and n. 37; Mitchell 1993, 127, n. 69.

32 Cuinet 1894, 570-71.

33 Mitchell 1993, map 8, shows a route considered suitable for pack animals connecting the main road between

Some other itineraries were possible for transporting *miltos* from Cappadocia to the Pontic shore for onward trade, even if Strabo does not mention them. For example, an indirect route could have been via the south-north axis to join the Pontic road northeast to Amisus.[34] From there, the goods could have been transported to Sinope by sea, since the coastal road was more difficult that the waterway[35] and less expensive, since it was not necessary to feed a string of mules or other forms of land transport. Alternatively, the Halys (Kızılırmak), which flows through Cappadocia not far from the known quarry site used for extracting *miltos* today, could have offered a cheaper alternative to land transport, but only for some segments, since it was interrupted by cataracts and the level of the water fluctuated on a seasonal basis.[36] The part passing between Germanicopolis (Çankırı) and Tavium was navigable in antiquity while that between the modern cities of Çeltek and Bafra was still used in the 1960s.[37] A road along the riverbank probably existed, if only to haul the boats when the wind or water flow was not sufficient for navigation.[38] As a matter of fact, a mixed transport system combining river transport with animal haulage should have been the norm in Anatolia for the transportation of goods.[39]

Strabo tells us that *miltos* was transported from Cappadocia to Sinope for onward trade, and this explains how the material acquired its name. What then of his further statement that the transport of *miltos* for trade was directed to Ephesus? A major circulation axis in Anatolia in antiquity was the so-called Southern Highway, following the Maeander River eastward to Phrygia via Laodicea (near Denizli), continuing through Cappadocia, and then turning south to Cilicia.[40] Shortly after 129 BC, when the province of *Asia* was formed and Ephesus became the *de facto* capital,[41] milestones of the first governor of the territory, Manius Aquillius, show that the network of the roads in the region was improved immediately,[42] a fact presumably known to Strabo. However, was the enhancement of the road network in Asia province the only reason that the trade route for *miltos* changed, as this part of Strabo's text is often interpreted? On one hand, a route along the Maeander existed long before the Roman dominance of Anatolia began. In some parts the road was already in use in the Archaic period,[43] while in the Hellenistic period, a decree of Eumenes II or Attalus II stipulated that the road had to be maintained to be easily passable.[44] On the other hand, there is the importance also given to the roads in northern Anatolia since, as we have seen, the west-east road was already used in the Pontic kingdom and formalized under the authority of Pompey.[45] Therefore, at the time of Strabo, the roads in both directions were suitable for trade and transport.

Pompeiopolis and Neoclaudioplis to reach Sinope directly. On the common use of pack animals for transportation, see Adams 2012, 219, 230.

34 Olshausen 2014, 45.

35 Munro 1901, 54.

36 There were cataracts between Osmancık and Kargı; see Roelens-Flouneau 2018, 307. On the difficulties of river navigation in general, see Adams 2012, 227.

37 For navigation on the Halys, see Bryer and Winfield 1985, 18; McGing 1986, 6; Barat 2018, 225-26; Roelens-Flouneau 2018, 306-8, 317, fig. 12.

38 Roelens-Flouneau 2018, 306-7. See the map in Akkan 1962.

39 Adams 2012, 231.

40 Magie 1950, 40-41 and 789-93, n. 18. This road in some parts corresponded with the older Persian Royal Road; see also Magie 1950, 792; French 1998.

41 Külzer 2019, 149-152.

42 Külzer 2019, 152. See the maps of Asia west and east in French 2014, 25, 26.

43 Külzer 2019, 152; 2016, 5.

44 Magie 1950, 40-41.

45 Bekker-Nielsen 2016, 43.

A look at the distances is informative in this context. In a direct line, the distance from Ephesus to Cappadocia (Nevşehir) is 660 kilometers and by road today, which broadly follows the ancient route, it is 815 kilometers. Between Sinope and Cappadocia, and between Amisus (Samsun) and Cappadocia, the respective distance by direct line and by modern roads, which likewise broadly follow the ancient routes, are 375 and 550, and 320 and 455 kilometers respectively. The difference in distance is such that even if the road to Ephesus was easier since it was newly improved and there was no range of mountains to cross, it may not have been the main - or only - motivation for sending the Cappadocian pigment to Ephesus for onward trade. To which we should add that, whatever route was chosen, the problems of the differing factors of expense involved with land versus cheaper water transport, where this was possible, had to be taken into account.

One reason for a change in the direction of transport could be the commercial outreach of Ephesus. Aquillius's new road became a main trade route, and the quantity and the diversity of goods traveling there and back must have notably increased.

Other factors though could have played a role in shifting the transport of *miltos* to Ephesus, while taking obvious advantage of the better quality of the road. Given the extra expense of land transport with regard to the distance involved, it may have been compensated by the fact that *miltos* could be exported directly to the Aegean, Mediterranean and Western countries. It would have avoided to take the lengthier sea route from Sinope through the Bosporus, Marmara Sea, and Hellespont. The contract for the construction of the temple of Zeus Basileus at Lebadeia in Boeotia of before 172 BC, perhaps the 220s, states explicitly, for example, that Sinopean *miltos* (μιλτώ Σινωπίς) was to be used. This illustrates a clear use of the *miltos* of Sinope in mainland Greece.[46] Thus from Sinope, it had to traverse the southern Black Sea littoral and pass through the Bosporus, etc., to reach the Aegean. A point to be stressed here and also be kept in mind is that this water-borne route was not without its dangers and inconveniences. The Black Sea was especially known to be dangerous because of the currents and sudden changes of weather, making it possible that road transport, although more expensive by distance involved, was in some cases preferable.[47]

From what Strabo writes, however, it does not necessarily mean that the trade in *miltos* from Sinope was abandoned in favor of trade via Ephesus.[48] Sinope was the shorter way to reach the other Pontic cities that, without doubt, still needed to use red ochre. The Cappadocian one was more accessible compared to the other quality sources of the material. This trade route was active in the Roman period as with, for example, salted fish sent to the garrisons in Cappadocia, and it also supplied the inhabitants to help them during a food shortage.[49] Fragments of coarse ware pottery of a fabric similar to that of Sinope and Heraclea Pontica, and dated to the Late Roman or Early Byzantine period, have been found in the valley of Mecitözü. Here Euchaïta was located,[50] a city connected to Amisus on the north and Amaseia on the east.[51] Later in the first and second centuries AD, after the time of Strabo, the road network in all of Anatolia was fully organized, especially in the Flavian period; existing

46 See below, n. 93.

47 Adams 2012, 226, 230.

48 Leaf 1916, 13-14; Braund 2005, 124.

49 Curtis 1991, 126.

50 Vroom 2018, 138.

51 Euchaïta was at the crossway of major roads; see Craft 2018, 80-83 and 77, map 4.1.

roads were upgraded and new roads created.[52] The system hinged on four major routes across Anatolia, among which were the two major routes used to transport *miltos* north to Sinope and west to Ephesus. These were completed by less important roads.[53] Circulation could have been greatly facilitated by these improvements, and we can assume that the trade of *miltos* continued in the same way as before.

This leads us naturally to how the material was transported. Discoveries of small- or middle-sized blocks of red pigment are not rare. This pigment, abundantly used in the northern Black Sea, is often present in deposits of Berezan or Olbia.[54] The probability is high that the origin is from Cappadocia via Sinope. Some pigment remains are present in receptacles used as a "paint pot," such as the foot of an amphora, already broken, or was broken for that purpose. This habit is illustrated by the finds in the Athenian Agora:[55] one foot belongs to a vessel from the area of Clazomenae of the late sixth century (pigment was put inside the already broken bottom of the amphora), one is not identified, and a third one is from the north Aegean, both dated before 480 BC. Another bottom of a Corinthian B type amphora, a type dated to the end of the sixth century BC, has been recently discovered containing a red pigment together with a yellow one.[56]

These amphorae were reused ones, probably chosen by chance because they were available. Yet the broken foot could belong to vessel used as a container for the transportation of the pigment. Although it was certainly not the only mean of transportation, some finds show that amphorae were carrying pigments,[57] as was probably the case of the amphora found in Gorgippia.[58] Bearing in mind it is water soluble, then a fully waterproof container is more probable than sacks of whatever material to avoid it being affected by dampness. A few other objects containing red pigments have been found in the Athenian Agora,[59] often opened-shape vases. Another example is the fragment of kylix found in Olbia and dated to the early fifth century BC. It bore the graffito ΣΙΝΩΠ(…), which has been interpreted as a reference to the "Sinopean" red pigment inside.[60] This kylix may have been used to keep some *miltos*, and the inscription was written to serve as a label. However, except for the example of Olbia, if the interpretation is correct, the provenance of the pigment in other paint pots has not been identified.[61] The vessel itself does not give any clue about its origin and may well, because of its shape, have been chosen probably to be filled with the pigment, although it does provide a *terminus post quem* for when it was used.

---

52 Mitchell 1993, 124, 127 and 129. For the involvement of successive emperors in improving the system, see Magie 1950, 570-71, 676-77, now outdated somewhat, but still of use in its general remarks.

53 Mitchell 1993, 127 and 129.

54 Vinogradov 1981, 80. See Braund 2005, 124, about its frequent use in the Northern Black Sea region.

55 Lawall and Jawando 2002, 416-17.

56 Lawall and Jawando 2002, 419.

57 Panagou 2016, 318.

58 Personal communication from Ekaterina Alexeeva, former director of the excavation of that city. The date and the origin of the amphora are not known.

59 Lawall and Jawando 2002, 419 and n. 14 (mid and late fifth century BC). Some fragments of ceramics with red ochre inside, dating from the sixth-fifth centuries to the first century BC, have also been found in the Athenian Agora; see Caley 1945, 153-54, table II.2, 3, 7, 9 and 12.

60 Vinogradov 1981, 80. The fragment is identified as an ostrakon in the article, because it belongs to a kylix which has been broken in antiquity. I am indebted to Nino Inaishvili for forwarding this article with the translation.

61 According to Caley, the pigment in the small objects of the Agora (see above n. 59) may be of local provenance since there is a good quality red ochre in Attica; see Caley 1945, 155.

The Uses of *Miltos* as a Pigment in Antiquity

One major question that naturally requires further analysis is whether these examples of *miltos* found at such sites are indeed the Cappadocian variety and not some other kind. To this end and to help future researchers studying these and similar artefacts, a sample of Cappadocian *yoşa* was subjected to a preliminary analysis by the MTA (Maden Tetkik ve Arama Genel Müdürlüğü / Mineral Research and Exploration General Directorate) to provide a broad base from which to work.[62] It was identified by XRD analysis as hematite, an iron oxide component of red ochre.[63] However, only trace analysis will provide the distinctive chemical signature of *yoşa* that would give us the necessary data to differentiate it from other red ochres. For example, it could allow for the pigment identified as red ochre on frescoes at Sinope, for example, at the Roman bath at Sinope-Balat, as coming from Cappadocia.[64] In some cases, it has been mixed with cinnabar or other pigments to obtain a brown or violet color.[65]

Thus, we cannot go farther as yet on this question, except to note how hematite has unsurprisingly been proposed by some translators and commentators of the texts that we have studied here as the material identified in antiquity as *miltos*.[66] Dioscorides (5.126.5), though, is the only author to specify that hematite is present in the *miltos* of Sinope (εὑβρίσκεται δὲ ἐν τῇ Σινωπικῇ μίλτῳ). Other writers who mention *miltos* also knew of hematite as a mineral, but without indicating a link between them. For example, Theophrastus (8.37) describes hematite as "with a solid texture (πυκνή) (…); dull in color (αὐχμώδης), and in accordance with its name seems to be made of blood that has become firm and dry."[67] Pliny writes that hematite is found in mines and takes the color of *minium*[68] when it is roasted; it has red veins (*venae rubentes*) and is crumbly (*friabilis natura*) (*HN* 36.144-145). He divides hematite into five types, the fourth one "is known as the 'liver ore' (*hepatites*) in its natural state, and as 'ruddled ore' (*miltites*) when it is roasted" (*HN* 36.147-148).[69]

As for the manner in which red ochre-type materials were used in the past, archaeological evidence and ancient texts reveal that *miltos* / *sinopis* had a wide range of purposes from the artistic to the practical and even the esoteric. We shall limit discussion here to those uses documented by the texts and for some of them illustrated by archaeological evidence. We exclude some other well-known uses, not mentioned in the texts, such as the painting of sculptures, vases or terracottas, the infilling of inscriptions on stone, or the well-known *dipinti* on amphorae or other ceramics.

One use was in preparatory drawings for wall paintings. Red ochre, for example, was used in the later Bronze Age for drawing under sketches and outlines as seen by the frescoes of Akrotiri,[70] while from later times there is an interesting Hellenistic example from Herculaneum

---

62 I am thankful to Sema Kaya in MTA for organizing this analysis in 2016.

63 The results of the analysis eliminate some other identifications such as cinnabar (see n. 11) or bole (see below).

64 Bakiler et al. 2016, 269-70, table 3, samples RIV-1, RIV-2, RIV-7 to RIV-9, RIV-32, RIV 33.

65 Bakiler et al. 2016, 270-72.

66 For example, Caley and Richards 1956, 177 and 180; Croisille 1985, 152, § 31.1.

67 Translation, Caley and Richards 1956, 53.

68 The *minium* is a pigment of bright orange-red color obtained by roasting white lead.

69 Translation, Eichholz 1962. See the comments of Caley and Richards 1956, 138-39.

70 Immerwahr 1990, 17; Angelidis et al. 2018, 365.

of such use on marble slabs.[71] Preparatory sketches in red ochre have been observed in Pompeii on paintings of the Pompeian second and third Style, in fashion from the second quarter of the first century AD.[72] Pliny may refer to such underlying sketches when he says that the *rubrica* from Aegyptus and Africa were the best for the workers because it is easily absorbed by the coating of the walls (*tectorium*) (35.35).[73] As we shall see below, this practice continued into the Middle Ages when it took the name of *sinopia*.

With only a few exceptions, we cannot know if the red ochre coming from Cappadocia had some specific uses. Pliny himself, who is our main source on the material and its usage in the classical period, does not unfortunately indicate how it was to be used in artwork.[74] Instead, he gives more importance to its color and price than to the region from where the pigment comes. Nevertheless, thanks to his description, we can understand what distinguished *sinopis* from the other *rubricae* and why it was highly appreciated. As is well known, he divides the colors into two categories: the dark ones (*austeri*) and the bright ones (*floridi*) (*HN* 35.30). The *sinopis* and the *rubrica* are among the *colores austeri*. Moreover, he classifies the *sinopis* and the *rubrica* among the colors which are natural (*nascuntur*) because they may be used directly, as opposed to the ones which are fabricated (*fiunt*) (Plin., *HN* 35.30) or manufactured from other sources. For example, the red pigment obtained by the firing of yellow ochre was fabricated, and for that reason was considered to be of lower quality compared with the red ochre found naturally (Theoph. 8.53).[75]

According to Pliny (*HN* 35.31), the red of *miltos* added a glow (*splendor*) to a painting but at the same time, it was less bright (*acris*) than the cinnabar and *minium* which were *colores floridi*. This is the main reason why it was preferred to these for monochrome painting (*HN* 33.39). Indeed, we can visualize it perfectly when comparing Cappadocian *yoşa* to samples of cinnabar (from which vermilion is obtained) and of *minium*. Another reason for its preference in monochrome artwork is that the other pigments required too much care in their application (*curatio magni operi erat*) (*HN* 33.117).[76] By that, Pliny probably refers to the repainting necessary if the color in an artwork was fading away.[77] Pliny also comments about the pigment's hue in detailing three types of *sinopis* - red (*rubra*), light red (*minus rubens*), and intermediary (*media*) (*HN* 35.31). As such he concurs with Theophrastus (8.53), possibly his source,[78] who states that in its natural state, *miltos* could be an intense red (ἐρυθρὰ σφόδρα), pale (ἔκλευκος) or medium (μέση), in which case it is "self-sufficient" (αὐτάρκης) because it "does not need to be mixed with anything," thus used without the addition of other pigments.[79]

---

71 Although these were first interpreted as monochrome paintings, it is now understood they were in fact preparatory sketches since some overlying colors are still visible; see Barbet and Allag 1972, 1036 and fig. 52.

72 Barbet and Allag 1972, 1033-44.

73 However, in the text, *tectoriis* is sometimes read as *picturis*; see Croisille 1985, 154 (§ 35.1).

74 This may be the reason why some associate the *miltos* of Sinope with the use of *miltos* in general: see, e.g., Robinson 1906, 141-43.

75 Cherry et al. 1991, 302.

76 On the interpretation of the expression, see Zehnacker 1983, 204-5, § 117.3.

77 Repainting has been well observed on terracotta figurines; see Bourgeois and Jeammet 2014.

78 Caley and Richards 1956, 180.

79 Translation by Eichholz 1965, 77. According to the reading of the text, this description may concern any type of *miltos* or the one of Sinop. Eichholz 1965, 123, § 53 reads αὐτῆς as referring to *miltos* in general; Caley and Richards 1956 relate it to the *miltos* of Sinope. The intensity of the red depends on the quantity of iron oxide. We know from analysis that *miltos* was often mixed with other pigments when used in painting; see, for example above, the analysis of the frescoes of Balat, n. 65.

According to Theophrastus, *miltos* was used in paintings for depicting naked flesh because "it is found in every variety of shade" (παντοδαπής) (8.51).[80] This is certainly a reference to the different hues which he describes. Horace in one of his satires makes allusion to it when describing the legs of gladiators drawn in red (*rubrica picta*) or charcoal (*carbo*) (*Sat.* 2.7.95-100).[81] Famous painters, such as Apelles, Aetion, Melanthius and Nicomachus, all working in the fourth century BC, used Pontic *sinopis* for the red color in tetrachromy, a painting technique using only red, white, ochre and black as colors (*HN* 35.50).[82] Pliny tells us that the more expensive *sinopis*, used to paint with a brush or to paint wood, costs two *denarii* per *libra* (*HN* 35.31). The *sinopis* and *rubrica* were also used for the fashionable monochrome paintings (*monochromata*) mentioned above.[83] Pliny could see examples of these, since he specifies that they were still done in his time (*etiam nunc*) (*HN* 33.117).

Sinopis was also used for frescoes and the like, mural art being a common feature of Roman buildings as at Pompeii and Herculaneum. Pliny, *praefectus* of the fleet in nearby Misenum, describes its use in his own living environment. According to the hue, which was related to the origin of the pigment, it was used for different part of the walls. The *sinopis* of Africa (*cicerculum*), which was redder (*magis rubet*), was preferred for the panels (*abacus*). The dark one (*maximus fuscus*), called *pressior*, was reserved for the base of these panels (*basis abacorum*) (*HN* 35.32). Pliny tells us that *sinopis* entered into the composition of fabricated pigments, such as *leucophorum* made from a mixture of Pontic *sinopis*, bright ochre (*sil lucidum*),[84] and earth of Melos (*melinum*), which was used to apply gold to woodwork (*HN* 35.36). He notes also how *sandyx* was made of ceruse (*cerussa*)[85] and *rubrica* (*HN* 35.40).

Among the more practical uses, we can refer to Homer's statement that ship hulls were of the color *miltos* (μιλτοπάρῃοι) (*Iliad* 2.637; *Odysseus* 9.125).[86] Pliny refers to this comment of Homer's (*HN* 33.115), as probably does Herodotus also, when he says that in the past ships were covered with *miltos* (τὸ δὲ παλαιὸν ἅπασαι αἱ νέες ἦσαν μιλτηλιφέες) (3.58). Some wall paintings show us the ships with "vermilion cheeks," as we see for example on the famous miniature fresco of the ship procession in the west house of Akrotiri in Thera.[87] This red color on boat hulls has been discussed and interpreted in different ways.[88] Through a close examination of the texts and of the archaeological evidence, E. Lytle has convincingly demonstrated that *miltos*, which was efficient in agriculture to protect trees and vines against rot and woodboring beetle larvae, was also used to preserve the wood of ships.[89] When used together with pitch or mixed with it, as well as with wax, it resulted in μιλτόπισσα.[90] Thus the supply of

---

80 Translation Eichholz 1965, 77.

81 Liou and Zuinghedau 1995, 155, 7.2.1. interpret the text as describing a drawing.

82 For ochre, Pliny uses the word *sil* (see below n. 84).

83 On such monochrome paintings see Zehnacker 1983, 204, § 117.1.

84 Pliny dedicated a chapter to *sil* (*HN* 33.56), translated as yellow ochre by N. Rackham in the Loeb edition. See Liou and Zuinghedau 1995, 154, 4 for a study of the *sil* used for the yellow / ochre color of the tetrachromy (see above).

85 For the reading of the text, see Croisille 1985, 158, § 40.2.

86 Usually it is translated as "vermilion cheeks" in a poetic, but inaccurate way as the vermillion is coming from the cinnabar.

87 Strasser 2010, 17, fig. 5.

88 For a summary of the discussions, see Lytle 2013, 520-23.

89 Lytle 2013, 524-50.

90 Lytle 2013, 537.

miltos was vital for Athens to maintain its fleet. This explains the reason for the monopoly that the city had imposed in the middle of the fourth century BC on the *miltos* of the island of Keos, where it was abundant and of a good quality.[91]

Miltos was commonly required to check the leveling of the stonework in masonry construction, [92] which implies - at the scale of monumental architecture in the classical world - a supply required in large quantities. Probably any form of *miltos* could have been used, preferably one exploited geographically nearby and cheaper. However, in the contract for the construction of the temple of Zeus Basileus at Lebadeia in Boeotia (referred to above), it is stated explicitly that Sinopean *miltos* was to be used (μίλτῳ Σινωπίς) mixed with pure olive oil. If it was not used, a fine would be levied.[93] Dioscorides treats separately the use of *miltos* proper for building, masonry and carpentry (τεκτονικὴ <μίλτος>) and says that it was of a lower quality than the one of Sinope (Dioscorides 5.96.3). According to him, the best ones for these purposes were from Egypt and Carthage, because they have a homogeneous texture without stones (ἄλιθος) and were easy to grind (εὐθρυβής). Hence it seems to be the same as the one used for decorating walls, as already mentioned.

Lastly, two papyri dated to the period of Constantine I at the beginning of the fourth century AD - one now at Leyden and one at Stockholm - provide information on the use of what must be *miltos*, which is recorded nowhere else.[94] The Leyden papyrus records some recipes for the use of "earth from Sinope" to create gold, in an early example of alchemy.[95] But the term might be used here synonymously for red ochre. The papyrus of Stockholm on the other hand tells us that it is used for dyeing wool "in a fine deep red purple,"[96] and could also dye a stone to make it like a sardonyx.[97]

Sinopis / *Sinopia* in the Post-Classical World

The surviving texts from late antiquity suggest that *miltos* pigment from Cappadocia was no longer known in the Western world, and so it was not traded abroad anymore. This does not mean that it was not exploited and used in a more restricted geographical area. The period in which it ceased to be exported cannot be determined precisely from these texts, but may have occurred in the second half of the third century AD. The decline of Ephesus in connection with the so-called Third-century crisis had begun, in part owing to the successive attacks

---

91 For the monopoly see Cherry et al. 1991, 299-300; Photos-Jones et al. 1997, 359 and Photos-Jones 2018, 427; Lytle 2013, 549, n. 90. See above for the *miltos* of Keos. The text of Herodotus - mentioning that the red on the hull belongs to the past - implies that the use of *miltos* has been replaced for a time by another process. It should have been resumed at the time of the monopoly.

92 Concerning this technique, see Ginouvès and Martin 1985, 77, 41.1 (s.v. Sanguine, Ocre rouge). It is well explained in the commentary to the Lebadeia contract by Choisy 1884, 205-6. According to him, this technique was still used in the 19th century in France and was called "*dressage au rouge*."

93 *SIG*^{3}, 3:972-155-59; Pitt 2016, 196 and 199. This temple was never finished. Robinson 1906, 143 and n. 1, mentions some red marks on architectural blocks in other sites.

94 The exact purpose of these papyri and their date is discussed by Halleux 2019, 24-30.

95 *PLeid.*, l. 96 and 477, Halleux 2019, 88 and 104.

96 *PStock.*, l. 872 and 884; Halleux 2019, 142, 201, commentary of p. 142, n. 5 and 202, commentary of p. 142, n. 11. This should be differentiated from the purple manuscripts such as the famous *Codex Sinopensis* made in Syria and dating to the second half of the sixth century, preserved in the Bibliothèque Nationale, Paris (Supplément grec 1286): https://manuscripta.hypotheses.org/530? Its color was obtained from orchil, a dye extracted from lichens; see Aceto et al. 2020, 1275.

97 *PStock.*, l. 122; Halleux 2019, 114.

of the Goths and Sasanids.[98] Other facts could also have played a role, such as the successive territorial reorganizations of the Roman province of Cappadocia and the foundation in the early fourth century AD of the new capital of Constantinople, which changed the direction of trade in Anatolia. A deterioration of the road networks may also have contributed to a decline in trade westwards from Cappadocia as the road network declined progressively into the Late Byzantine period.[99]

Yet, even if the real appearance of the original *sinopis* has probably been forgotten soon after its export ceased, its reputation as a high-quality pigment and its origin from Cappadocia were not entirely lost, thanks to some Greek and Latin texts from late antiquity. The name remained in use to refer to a red ochre distinguishable by its quality. For example, it is noted by Isidore of Seville, who mentions *sinopis* in book 19, chapter 17 of his Etymologiae (*Etymologiæ*) dated to AD c. 590-636. He differentiates this red ochre (*sinopis*) from red earth (*rubrica*), and indicates that the first originated from Sinope while the second from *Pontus*. This confusion probably represents his reliance on written tradition without any reference to a tangible reality.

The work of Isidore of Seville was very popular in the Middle Ages and during the Renaissance, so may have contributed to keeping the name *sinopis* in currency, although the material per se was not used anymore. According to Thompson, Sinope in the Middle Ages was associated with red ochre pigment originating from places other than Cappadocia, and the Latin name *sinopis* or the Italian *sinopia* (pl. *sinopie*) became simply synonymous with high-quality red ochre.[100] That may be so, but as a language curiosity, if nothing else, it is worth mentioning how in the Middle Ages, the contemporary French word *sinople* developed from the Latin *sinopis* and was used originally for a red tincture in heraldry. After an unexplained shift of meaning, however, starting in the mid 14th century, it came to designate the *vert* (green) tincture.[101] The Florentine painter Cennino Cennini (c. 1357 / 1364-before 1427),[102] active in the Late Gothic period and considered a precursor of the Renaissance, wrote a treatise on painting called *Il libro dell'arte*. In chapter 38 he refers to a red pigment called *sinopia*, which he notes was used for frescoes (*a fresco* or *a secco*).[103] He adds that, together with his father Andrea Cennini, he found a cave in the region of Sienna in Tuscany where they were living, with veins of dark and light *sinopia* next to other colors (ochre, azure, white and black).[104]

More to the point, his account shows clearly how the name *sinopia* designated a pigment according to its color and quality, and no longer its origin. We can find this fact clearly stated

98 Merrifield 1846, XXXII, observes that the 16th-century painter Giovanni Paolo Lomazzo does not mention *Sinopia* in his treatise *Trattato dell'arte della pittura, scoltura et architettura* (1584). He supposes that it could be because the Ottoman Turks would not allow enough trade of that pigment to meet the need of European artists, as had been the case for Armenian blue according to Georgius Agricola. This cannot be true since the exportation of the pigment had already stopped in the late antiquity.

99 Külzer 2019, 151; Craft 2018, 77-78.

100 Thompson 1956, 98. The author confuses the *miltos* of Sinope and that of Lemnos which was the one sealed by a small quantity (see n. 16). See Loumyer 1998, 190-92 for the reference to the *sinopis* in medieval texts referring to different natures of red. We shall now use the name *sinopia*, which is commonly used today.

101 Pastoureau 2017, 200, n. 29.

102 Broecke 2015, 2 and 3.

103 Broecke 2015, 61. In that chapter, Cennini combines *cinabrese*, *sinopia* and *porphyre*: 61 and nn. 2 and 3.

104 Broecke 2015, 70-71, ch. 45. The "cave" location reminds us of that by Dioscorides of the source of *miltos* (see above).

for the first time in the *Discorsi* of the *De Materia Medica* of Dioscorides by Pietro Andrea Mattioli dated to 1544. In his commentary, he says that nobody could "show him" the real *Rubrica Sinopica*,[105] indicating that access to authentic *sinopia* was now lost. According to him the closest mineral to the ancient material then used in medicine was the Armenian *bole*,[106] and notes that it is called *Rubrica* or *Arcanne Sinopique*.[107] Later texts also mention that the pigment *sinopia*, per se, is no longer known. In the article dedicated to the *terre de Sinope* ("earth of Sinope") in Diderot's *Encyclopedia* of 1765, Jaucourt writes that the location of the red earth of Sinope is not known anymore, and also identifies it as *bole*, used as the base for gilding.[108] Victor Mottez, who was himself an oil and a fresco painter, published a French translation of Cennino Cennini's work in 1858.[109] There he commented on *sinopia* - that this color is not used anymore under this name nor the *cinabrese*, and cites Matteoli in confirmation of this observation.[110] Mary Merrifield, who published in 1846 *The Art of Fresco Painting*, studied in detail the nature of *sinopia* and other "natural red pigments" and made the following statement: "Rubrica, Sinopia, Cinabrese, Majorica, Terra Rossa d'Inghilterra, Bruno d'Inghilterra, Rouge Violet, Ferretta di Spagna, Almagra, Pabonazo (…) are merely different names for the same pigment, different merely in quality, intensity of color, or mode of preparation. That this pigment is in fact the Haematite (*sic*) or red ochre of the mineralogists."[111]

As we can see from the writings of Matteoli and Jaucourt, the origin and exact nature of the *miltos* of Sinope had long been lost by their time. Nevertheless, the name was sometimes understood as the equivalent of *bole* which was used for gilding but also had some medicinal virtues. However, Marry Merrifield in her study specifies that *sinopia* has been wrongly interpreted as Armenian *bole*.[112] In particular, what the works cited above show is that although the red earth of Sinope no longer came to Europe from its origin in Cappadocia, the use of *sinopia* in the Middle Ages and during the Renaissance demonstrates a practical continuity in art techniques linked to a red ochre of high quality. This was most obviously so in the technique of making the outlines of the figures and the underlying sketches on frescoes with the red ochre already mentioned that existed in antiquity. The pigment conventionally called *sinopia* gave its name to these drawings, and Cennino Cennini recommended its use for the underlying sketch of the face and whole figures, whether completed *a fresco* or *a secco*.[113] This freehand drawing in the *sinopia* method, however, was superseded in the middle of the 15th century by the use of a cartoon on which the drawing is done and then transferred to the wall by the pricking and pouncing method.[114]

---

105 Du Pinet 1642, ch. 71.30.

106 Du Pinet 1642, ch. 71.20-60.

107 *Arcanne* is a red chalk used for setting out the framework in masonry construction.

108 *Encyclopédie* 15 s.v. "Sinope". The Armenian *bole* was used for its medicinal properties but also in art. The term "bole" alone refers to art.

109 He has added in his edition the foreword and comments of Chevalier G. Tambroni (1773-1824), an Italian diplomat.

110 Mottez 1858, 52-53, n. 2. See below for *cinabrese*.

111 Merrifield 1846, xxix. See also Eastaugh et al. 2008, 327.

112 Merrifield 1846, xxxiii-xxxiv. Some modern commentators also interpret *miltos* as *bole*, using that appellation as an equivalence of red ochre; see Lasserre 1981, 155, n. 1; Liou and Zuinghedau 1995, 155. Robinson 1906, 141 calls the *miltos* of Sinope "Red Earth or Bole"; see Eastaugh et al. 2008, 327.

113 Broecke 2015, 101, ch. 67; 113, ch. 72.

114 Mayer 1991, 375.

Cennini also reports that light red *sinopia* was used to dye paper a reddish or peach-color.[115] It was also used to manufacture a pigment *cinabrese*, which would be in the category of those described as *fiunt* by Pliny (*HN* 35.30). Cennini's recipe describes the mixing of the best and lighter category of *sinopia* with the so-called "Saint-John white," made of slaked lime.[116]

He indicates also how in painting, the uses of *sinopia* and *cinabrese* are mostly similar. The dark variety of *sinopia*, usually mixed with other colors, was good for the flesh tones to enhance the outline of the facial features and to detail the hair.[117] It could also represent the color of the wood.[118] However, for drapery or to represent silk, it needed to be mixed with black as a first layer, and then covered with other colors.[119] *Cinabrese*, on the other hand, was often mixed with additional "Saint-John white" and diluted, then used for the color and modeling of the lips and the cheeks.[120] For the folds in a cloth, it was also used in a pure state to create a *chiaroscuro* effect.[121]

From *Miltos* to *Yoşa*

Although the export of Sinopean red earth from Sinope and from Ephesus to the wider Roman Empire seems to have ended in the third century AD, within Cappadocia itself its use continued into the Byzantine period and beyond. The predominance of red in painting the Cappadocian churches, for one thing, is striking, without distinction of date, and the color used in figurative frescoes and in decorative patterns alike. In Göreme alone we might mention as good examples of its use the Saint Barbara Church (ca. 1100) (fig. 3), the façade of Karanlık Kilise (Dark Church) (mid-11th century) (fig. 4), and the Çarıklı Kilise (Sandal Church) (11th century) (figs. 5 and 6). It is also found in secular contexts, as with the simple geometric outline schemes on the facades of dovecotes. This is an integrant part of the canon of Byzantine residential architecture, but also associated with some churches.[122] The earliest dated examples belong to the 16th century,[123] with a resurgence of this practice in the 18th century, continuing into the 19th and a part of the 20th century.[124] Today, in the potter's town of Avanos, craftsmen are also using the locally obtained iron oxide which they call *yoşa* (fig. 7). They dilute it in water and dip their products inside, and when it is dry, burnish the surface before firing. Their aim is to give a more vivid color to the surface of their products, in a manner reminiscent of the technique used on Attic vases of antiquity,[125] although just as often they use the *yoşa* slip for decorative patterns on the otherwise non-slipped surface (fig. 8). In both cases, some clay is added to the water as a binder.

115 Broecke 2015, 42, ch. 20.

116 Broecke 2015, 62-63 and n. 2, ch. 39 and 84, ch. 58.

117 Broecke 2015, 102, ch. 67; 190-91, ch. 160; 192, ch. 161.

118 Broecke 2015, 119, ch. 82.

119 Broecke 2015, 119, ch. 83; 185, ch. 155.

120 Broecke 2015, 102, ch. 67.

121 Broecke 2015, 111, ch. 71.

122 Ousterhout 2005, 153-55, figs. 121 and 123. On the dovecotes in Cappadocia, see Gülyaz 1998. Dovecotes have been carved in the Karanlık Kilise (fig. 4).

123 Gülyaz 1998, 549.

124 Amirkhani et al. 2010, 48-50, 55-56, figs. 11-12. Many were constructed in the windows or doors of the churches.

125 Cohen 2006, 44-53.

Conclusion

Since antiquity, the red ochre from Cappadocia has been held in high esteem for use in a variety of ways. As seen in a series of texts from antiquity, through the Middle Ages and the Renaissance into early modern times, it is possible to follow the changes of its name reflecting its changing fortunes. What was known in antiquity as the *miltos* of Sinope or as the Pontic *sinopis* referenced precisely the pigment extracted from the mines of Cappadocia. In late antiquity, in the Middle Ages and later, *sinopis* or *sinopia* became synonymous with *miltos* or *rubrica*, that is red ochre. But the name was preserved from antiquity as one of distinction given only to high-quality versions of red ochre. The fact that it was called after the name of the city of Sinope was never forgotten nor its real origin, Cappadocia. Some online sites, for example, sell a pigment for painting called "sinopia" and correctly mention the origin of the name, even if the hue of the pigments called by that name varies.[126] Some companies have even chosen "Sinopia" as a brand name. By contrast, it is a chest of the less-rare *miltos* of Keos that features in the video game "Assassins Creed Odyssey,"[127] which if nothing else brings an awareness of the substance to a large, non-academic audience.

Today, on the web colors, the sinopia is equivalent to vivid reddish orange,[128] but it has been given the name "sinoper" in English, which corresponds to a different color.[129] However, the real pigment extracted in Cappadocia, which provides this name, has not circulated outside the immediate area since at least late antiquity. However, its mining has probably never ceased, so it is still traded in Türkiye. The exploitation of the quarries, the use of the material, and its trade and the name(s) given to the pigment during this long timespan would require detailed research, including the study of Byzantine and Ottoman texts. It is beyond the scope of this article's aim, although we might end by noting how the name *yoşa*, for what was once known generically as *miltos*, is of probably relatively recent origin.

Acknowledgment

I am much grateful to my colleague and friend Julian Bennett for his valuable suggestions and for editing the English text of this article. I am also very thankful to Fabrice Delrieux for preparing the map of Northern Anatolia with the road network.

126 The name is given, as far as Japan, to a pigment sold as "red bolo (Sinopia)": https://pigment.tokyo/product/?q=Sinop&set_language=en (consulted 26/7/2021).

127 https://www.powerpyx.com/assassins-creed-odyssey-red-in-the-wreckage-side-quest-walkthrough/ (consulted on the 26/7/2021).

128 Its hexadecimal format is #cb410b (https://www.crispedge.com/color/cb410b) (consulted on the 26/7/2021).

129 Thompson 1956, 98. The hexadecimal format is #bb1111 (https://www.crispedge.com/color/bb1111) (consulted on the 26/7/2021).

Bibliography

Ancient Sources

Dioscorides. *Pedanii Dioscuridis Anazarbei. De Materia Medica*, *Libri Quinque*. Vol. 3, *Quo Continentur Liber V. Crateuae, Sextii Nigri Fragmenta, Dioscuridis liber De simplicibus*, edited and commented by M. Wellman in Latin. Berlin: Weidmannos, 1914.

Herodotus. *The Persian Wars*. Vol. 1, *Books I-II*, with an English translation by A.D. Godley. Revised and reprinted. Loeb Classical Library 117. Cambridge, MA: Harvard University Press, 1926.

Herodotus. *The Persian Wars*. Vol. 2, *Books III-IV*, with an English translation by A.D. Godley. Revised and reprinted. Loeb Classical Library 118. Cambridge, MA: Harvard University Press, 1938.

Horace. *Satires, Epistles, and Ars Poetica,* with an English translation by H.R. Fairclough. Revised and reprinted. Loeb Classical Library 194. Cambridge, MA: Harvard University Press, 1929.

Plin. *Pliny, Natural History*. Vol. 9, *Books 33-35*, with an English translation by H. Rackham. The Loeb Classical Library 394. Cambridge, MA: Harvard University Press, 1952.

Plin. *Pliny, Natural History,* Vol. 10, *Books 36-37*, with an English Translation by D.E. Eichholz. The Loeb Classical Library 419. Cambridge, MA: Harvard University Press, 1962.

Strabo. *Strabo, Geography*. Vol. 5, *Books 10-12*, with an English translation by H.L. Jones. The Loeb Classical Library 211. Cambridge, MA: Harvard University Press, 1928.

Strabo. *Strabo, Geography*. Vol. 6, *Books 13-14*, with an English translation by H.L. Jones. The Loeb Classical Library 223. Cambridge, MA: Harvard University Press, 1929.

Theophr. *Theophrastus, De lapidibus*, with an English translation and commentary by D.E. Eichholz. Oxford: The Clarendon Press, 1965.

Vitr. *Vitruve, De l'Architecture*, *Livre VII,* with a French translation by B. Liou, and M. Zuinghedau. Collection des Universités de France. Série latine - Collection Budé 327. Paris: Les Belles Lettres, 1995.

Modern Works

Aceto, M., E. Calà, A. Agostino, G. Fenoglio, M. Labate, C. Förstel, C. Denoël, and A. Quandt. 2020. "Non-Invasive Study on the Sinope Gospels." *Heritage* 3.4:1269-278.

Adams, C. 2012. "Transport." In *The Cambridge Companion to the Roman Economy*, edited by W. Scheidel, 218-40. Cambridge Companions to the Ancient World. Cambridge: Cambridge University Press.

Akkan, E. 1962. "Kızılırmak'ın Asağı Kesiminde Kayıkla Nakliyat." *Ankara Üniversitesi Dil ve Tarih Coğrafya Fakültesi Dergisi* 20.3-4:263-70.

Amirkhani, A., H. Okhovat, and E. Zamani. 2010. "Ancient Pigeon Houses: Remarkable Example of the Asian Culture Crystallized in the Architecture of Iran and Central Anatolia." *Asian Culture and History* 2.2:45-57.

Angelidis, P., E. Kalambouki, S. Sotiropoulou, and M. Hamaoui. 2018. "The Preliminary Designs in the Akrotiri Wall-Paintings." In *Χρωστήρες / Paintbrushes. Wall-Painting and Vase-Painting of the Second Millennium BC in Dialogue: Proceedings of the International Conference on Aegean Iconography, Akrotiri, Thera, 24-26 May 2013*, edited by A.G. Vlachopoulos, 359-69. Athens: University of Ioannina / Hellenic Ministry of Culture and Sports.

Bakiler, M., B. Kırmızı, Ö. Ormancı Öztürk, Ö. Boso Hanyalı, E. Dağ, E. Çağlar, and G. Köroğlu. 2016. "Material Characterization of the Late Roman Wall Painting Samples from Sinop Balatlar Church Complex in the Black Sea Region of Turkey." *Microchemical Journal* 126:263-73.

Barbet, A., and C. Allag. 1972. "Techniques de préparation des parois dans la peinture murale romaine." *MÉFRA* 84.2:935-1069.

Barat, C. 2018. "L'Halys, un fleuve structurant en Asie Mineure." In *Études des Fleuves d'Asie Mineure dans l'Antiquité*. Vol. 2, edited by A. Dan and S. Lebreton, 203-33. Arras: Artois Presses Université.

Bekker-Nielsen, T. 2016. "Trade, Strategy and Communication on the Roman North-East Frontier." *Cedrus* 4.1:31-46.

Blümner, H. 1887. *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern*. 4 vols. Leipzig: Teubner.

Bourgeois, B., and V. Jeammet. 2014. "Peindre et Repeindre sur terre cuite en Grèce hellénistique." *Technè* 40:84-95.

Braund, D. 2005. "Across the Black Sea: Patterns of Maritime Exchange on the Northern Periphery of Roman Asia Minor." In *Patterns in the Economy of Roman Asia Minor*, edited by S. Mitchell and C. Katsari, 115-38. Swansea: The Classical Press of Wales.

Broecke, L., ed. and trans. 2015. *Cennino Cennini's Il Libro dell'Arte. A New English Translation and Commentary with Italian Transcription*. London: Archetype Publications Ltd.

Bryer, A., and D. Winfield. 1985. *The Byzantine Monuments and Topography of the Pontos*. 2 vols. Dumbarton Oaks Studies 20. Washington D.C.: Dumbarton Oaks Research Library and Collection.

Caley, E.R. 1945. "Ancient Greek Pigments from the Agora." *Hesperia* 14.2:152-56.

Caley, E.R., and J.F.C. Richards. 1956. *Theophrastus on Stones: Introduction, Greek Text, English Translation, and Commentary*. Graduate School Monographs. Contributions in Physical Science 1. Columbus, OH: The Ohio State University Press.

Cherry, J.F., J.L. Davis, E. Mantzourani, W. Rostoker, and J. Dvorak. 1991. "Miltos and Metallurgical Extraction." In *Landscape Archaeology as Long-Term History. Northern Keos in the Cycladic Islands, from Earliest Settlement until Modern Times,* edited by J.F. Cherry, J.L. Davis and E. Mantzourani, 299-303. Monumenta Archaeologica 16. Los Angeles, CA: Institute of Archaeology, University of California.

Choisy, A. 1884. *Études sur l'architecture grecque. 4e Étude: Un devis de travaux publics à Livadie*. Paris: Librairie de la société anonyme de publications périodiques.

Christidis, G.E., C.W. Knapp, D. Venieri, I. Gounaki, C. Elgy, E. Valsami-Jones, and E. Photos-Jones. 2020. "The Interweaving Roles of Mineral and Microbiome in Shaping the Antibacterial Activity of Archaeological Medicinal Clays." *Journal of Ethnopharmacology* 260. https://doi.org/10.1016/j.jep.2020.112894

Cohen, B. 2006. "Coral-Red Gloss." In *The Colors of Clay. Special Techniques in Athenian Vases*, edited by B. Cohen, 43-70. Los Angeles, CA: The J. Paul Getty Museum.

Craft, S. 2018. "Travel and Communication." In *Archaeology and Urban Settlement in Late Roman and Byzantine Anatolia. Euchaïta-Avkat-Beyözü and Its Environment*, edited by J. Haldon, H. Elton and J. Newhard, 70-96. Cambridge: Cambridge University Press.

Croisille, J.-M., trans. 1985. *Pline l'Ancien. Histoire naturelle, Livre XXXV (La Peinture)*. Collection des universités de France. Série latine - Collection Budé 272. Paris: Les Belles Lettres.

Cuinet, V. 1894. *La Turquie d'Asie; géographie administrative, statistique, descriptive et raisonnée de chaque province de l'Asie-Mineure*. Vol. 4. Paris: Ernest Leroux.

Curtis, R.I. 1991. *Garum and Salsamenta: Production and Commerce in Materia Medica*. Studies in Ancient Medicine 3. Leiden: Brill.

Debord, P. 1999. *L'Asie Mineure au IVe siècle (412-323 a.C.). Pouvoirs et jeux politiques*. Études - Ausonius 3. Bordeaux: Université / Paris: De Boccard.

Du Pinet, M.A. 1642. *Les Commentaires de M.P. André Matthiolus, Médecin Senois, sur les six livres de Pedacius Dioscoride Anazarbéen, de la matiere medecinale: Traduit de Latin en François, par M. Antoine du Pinet*. Lyon: Claude Prost. http://catalogue.bnf.fr/ark:/12148/cb309084

Eastaugh, N., V. Walsh, T. Chaplin, and R. Siddall. 2008. *Pigment Compendium: A Dictionary and Optical Microscopy of Historical Pigments*. Oxford: Butterworth-Heinemann.

Eichholz, D.E., trans. 1962. *Pliny, Natural History*. Vol. 10, *Books 36-37*. Loeb Classical Library 419. Cambridge, MA: Harvard University Press.

Eichholz, D.E., trans. 1965. *Theophrastus. De Lapidibus*. Oxford: The Clarendon Press.

Encyclopédie 15 Sinope. L. de Jaucourt, s.v. Sinope, *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* 1765. Vol. 15, *Sen-Tch,* edited by D. Diderot and J.R. d'Alembert, 213. Paris: Samuel Faulche.

French, D. 1998. "Pre- and Early-Roman Roads of Asia Minor. The Persian Royal Road." *Iran* 36:15-43.

French, D.H. 2013. *Roman Roads and Milestones of Asia Minor*. Vol. 3, *Milestones*. Fasc. 3.4, *Pontus et Bithynia (with Northern Galatia)*. British Institute at Ankara Electronic Monograph 4. London: British Institute at Ankara. https://doi.org/10.18866/BIAA/e-04

French, D.H. 2014. *Roman Roads and Milestones of Asia Minor*. Vol. 3, *Milestones*. Fasc. 3.5, *Asia*. British Institute at Ankara Electronic Monograph 5. London: British Institute at Ankara. https://doi.org/10.18866/BIAA/e-05

Ginouvès, R., and R. Martin. 1985. *Dictionnaire méthodique de l'architecture grecque et romaine*. Vol. 1, *Matériaux, techniques de construction, techniques et formes du décor. CÉFR* 84.1. Athens / Rome: École Française de Rome.

Godley, A.D., trans. 1926. *Herodotus, The Persian Wars*. Vol. 1, *Books I-II*. Loeb Classical Library 117. Cambridge, MA: Harvard University Press.

Gülyaz, M. 1998. "Dovecotes of Cappadocia." In *Cappadocia*, edited by M. Sözen, 548-59. Istanbul: Ayhan Şahenk Foundation.

Halleux, R., trans. 2019. *Les Alchimistes Grecs*. Vol. 1, *Papyrus de Leyde, Papyrus de Stckholm, Recettes*. Collection des Universités de France. Série grecque - Collection Budé 281. Paris: Les Belles Lettres.

Immerwahr, S.A. 1990. *Aegean Painting in the Bronze Age*. University Park, PA / London: The Pennsylvania State University Press.

Külzer, A. 2016. "The Network of Communication Routes in Anatolia in Late Antiquity and Medieval Times, in International Symposium Culture and Communication in Anatolia: Past, Present and Future." Presented *Culture and Communication in Anatolia: Past, Present and Future Atılım University, Ankara, June 15-17, 2016*. International Symposium. https://www.academia.edu/27832584/The_Network_of_Communication_Routes_in_Anatolia_in_Late_Antiquity_and_Medieval_Times

Külzer, A. 2019. "Roads and Routes. Communication Networks in the Hinterland of Ephesos." In *Ephesos from Late Antiquity until the Late Middle Ages. Proceedings of the International Conference at the Research Center for Anatolian Civilizations, Koç University, Istanbul, 30th November-2nd December 2012*, edited by S. Ladstätter and P. Magdalino, 149-60. Österreichisches Archäologisches Institut Sonderschriften 58. Vienna: Holzhauser.

Lasserre, F., trans. 1981. *Strabon, Géographie*. Vol. 9, *Livre XII*. Collection des universités de France. Série grecque - Collection Budé 280. Paris: Les Belles Lettres.

Lawall, M., and A. Jawando. 2002. "Notes from the Tins 2: Research in the Stoa of Attalos." *Hesperia* 71.4:415-33.

Leaf, W. 1916. "The Commerce of Sinope." *JHS* 36:1-15.

Liou, B., and M. Zuinghedau, trans. 1995. *Vitruve, De l'Architecture. Livre VII*. Collection des Universités de France. Série latine - Collection Budé 327. Paris: Les Belles Lettres.

Loumyer, G. 1998. Reprint. *Les Traditions techniques de la peinture médiévale*. Genoa: Slatkine. Original edition, Bruxelles: G. van Oest, 1914.

Lytle, E. 2013. "Farmers into Sailors: Ship Maintenance, Greek Agriculture, and the Athenian Monopoly on Kean Ruddle (IG II^2 1128)." *GRBS* 53:520-50.

Magie, D. 1950. *Roman Rule in Asia Minor to the End of the Third Century after Christ.* 2 vols. Princeton, NJ: Princeton University Press.

Mayer, R. 1991. *The Artist's Handbook of Materials and Techniques.* Revised and updated by S. Sheehan. 5th ed. New York: Viking Penguin.

McGing, B.C. 1986. *The Foreign Policy of Mithridates VI Eupator, King of Pontus.* Mnemosyne, Suppl. 89. Leiden: Brill.

Merrifield, M. 1846. *The Art of Fresco Painting, as Practised by The Old Italian and Spanish Masters, with a Preliminary Inquiry into The Nature of the Colours Used in Fresco Painting, with Observation and Notes.* London: C. Gilpin / Brighton: Arthur Wallis.

Mitchell, S. 1993. *Anatolia. Land, Men, and Gods, in Asia Minor.* Vol. 1, *The Celts and the Impact of the Roman Rule.* Oxford: Clarendon Press.

Mottez, V., trans. 1858. *Traité de la peinture de Cennino Cennini: mis en lumière pour la première fois avec des notes.* Paris: Jules Renouard / Lille: L. Lefort.

Munro, A.R. 1901. "Roads in Pontus, Royal and Roman." *JHS* 21:52-66.

Olshausen, E. 2014. "Pontos: Profile of a Landscape." In *Space, Place and Identity in Northern Anatolia*, edited by T. Bekker-Nielsen, 39-48. Geographica Historica 29. Stuttgart: Franz Steiner.

Ousterhout, R. 2005. *A Byzantine Settlement in Cappadocia.* Dumbarton Oaks Studies 42. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Panagou, T. 2016. "Transport Amphoras and Their Contents." In *Ηχάδιν. Τιμητικός Τόμος Για τη Στέλλα Δρούγου,* edited by M. Giannopoulou and Ch.O. Kallini, 2:312-34. Athens: Ταμείο Αρχαιολογικών Πόρων και Απαλλοτριώσεων.

Pastoureau, M. 2017. *Red: The History of a Color.* Translated by J. Gladding. Princeton / Oxford: Princeton University Press.

Photos-Jones, E., A. Cottier, A.J. Hall, and L.G. Mendoni. 1997. "Kean Miltos: The Well-Known Iron Oxides of Antiquity." *BSA* 92:359-71.

Photos-Jones, E., and A.J. Hall. 2014. "Lemnian Earth, Alum and Astringency: A Field-Based Aproach." In *Medicine and Healing in the Ancient Mediterranean World*, edited by D. Michaelides, 183-89. Oxford / Philadelphia: Oxbow Books.

Photos-Jones, E., C. Edwards, F. Häner, L. Lawton, C. Keane, A. Leanord, and V. Perdikatsis. 2017. "Archaeological Medicinal Earths as Bacterial Agents: The Case of Basel Lemnian Sphragides." In *Geology and Medicine: Historical Connections*, edited by C.J. Duffin, C. Gardner-Thorpe, and R.T.J. Moody, 141-53. Geological Society Special Publication 452. London: Geological Society. https://doi.org/10.1144/SP452.6

Photos-Jones, E. 2018. "From Mine to Apothecary: An Archaeo-Biomedical Approach to the Study of the Greco-Roman Lithotherapeutics Industry." *WorldArch* 50.3:418-33. https://doi.org/10.1080/00438243.2018.1515034, consulted on the 26/7/2021

Pitt, R.K. 2016. "Inscribing Construction: The Financing and Administration of Public Building in Greek Sanctuaries." In *A Companion to Greek Architecture*, edited by M.M. Miles, 194-205. Blackwell Companions to the Ancient World. Chichester: Wiley-Blackwell.

Robinson, D.M. 1906. "Ancient Sinope." *AJP* 27.2:125-53.

Roelens-Flouneau, H. 2018. "Remarques sur la navigabilité des fleuves d'Asie Mineure dans l'Antiquité." In *Études des Fleuves d'Asie Mineure dans l'Antiquité.* Vol. 1, edited by A. Dan and S. Lebreton, 251-317. Arras: Artois Presses Université.

Strasser, T.F. 2010. "Location and Perspective in the Theran Flotilla Fresco." *JMA* 23.1:3-26.

Thompson, D.V. 1956. *The Materials and Techniques of Medieval Painting.* New York: Dover Publications.

Thonemann, P. 2011. *The Maeander Valley. A Historical Geography from Antiquity to Byzantium*. Greek Culture in the Roman World. Cambridge / New York: Cambridge University Press.

Vinogradov, Ju. G. 1981. "Sinopa i Ol'vija v V v. do n.è. Problema političeskogo ustrojstva. = Sinope und Olbia im 5. Jh. v.u.Z. Das Problem der Staatsordnung." *VDI* 156.2:65-90.

Vroom, J. 2018. "The Ceramics, Agricultural Resources and Food." In *Archaeology and Urban Settlement in Late Roman and Byzantine Anatolia. Euchaïta-Avkat-Beyözü and Its Environment*, edited by J. Haldon, H. Elton, and J. Newhard, 134-84. Cambridge: Cambridge University Press.

Zehnacker, H., trans. 1983. *Pline l'Ancien. Histoire naturelle. Livre XXXIII*. Collection des universités de France. Série latine - Collection Budé 266. Paris: Les Belles Lettres.

Standard Reference Works

PLeid. Papyrus of Leyden. Les Alchimistes Grecs. Vol. 1, *Papyrus de Leyde*, *Papyrus de Stockholm*, *Recettes*, with a French translation by R. Halleux. Collection des Universités de France. Série grecque - Collection Budé 281. Paris: Les Belles Lettres, 2019.

PStockh. Papyrus of Stockholm. See *PLeid.*

SIG^{3}. W. Dittenberger, *Sylloge inscriptionum graecarum*, re-edited by Friedrich Hiller von Gaertringen. 4 vols. 3rd ed. Leipzig: Apud Z. Hirzelium, 1915-1924.

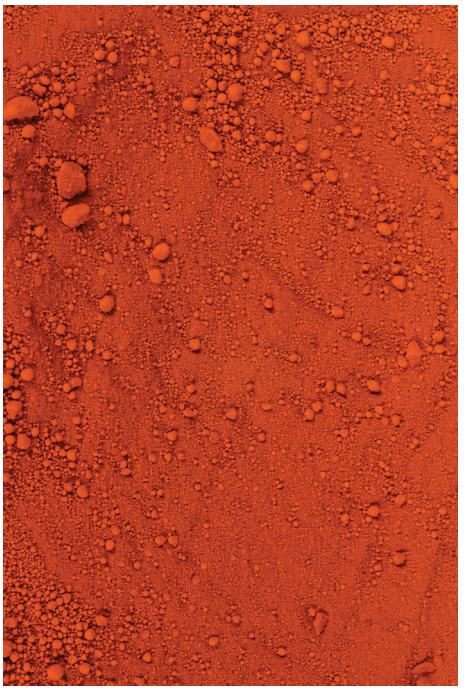

FIG. 1 Ground *yoşa* from Cappadocia (© A. Ramazanoğlu).

FIG. 2 Raw *yoşa* from the quarry (© A. Ramazanoğlu).

FIG. 3 Santa Barbara Church (© D. Kassab Tezgör).

FIG. 4 Karanlık Kilise (© D. Kassab Tezgör).

FIG. 5 Çarıklı Kilise (detail) (© D. Kassab Tezgör).

FIG. 6 Çarıklı Kilise (detail) (© D. Kassab Tezgör).

FIG. 7 Iron oxide (*yoşa*) used by potters (© D. Kassab Tezgör).

FIG. 8 Vase with a decorative pattern made with the *yoşa* slip (© D. Kassab Tezgör).