

# Lapis lazuli, lazurite, ultramarine 'blue', and the colour term 'azure' up to the 13<sup>th</sup> century

Guido Frison and Giulia Brun<sup>1</sup>

*Department of Anthropology, University College London, UK*

*<sup>1</sup>Independent researcher*

*Emails: frison.guido@gmail.com; giulia.brun@gmail.com*

The social man creates or borrows practical procedures, and with them specific phrases. Unfortunately present literature often separates these phrases from the techniques in which the same phrases are used. This is the case of the colour term 'azure' and 'lapis lazuli' that denotes today an aggregate of minerals from which the pigment *ultramarine 'blue'* was extracted in the course of the Middle Ages. The present work collects well-established pieces of information from a multidisciplinary standpoint with the aim of highlighting the various social utilisations of ground lapis lazuli, or better, its 'blue' mineral called *lazurite*. New data is extracted from the *Thesaurus Linguae Graecae*, and Medieval Latin manuscripts (MSS) devoted to colour making. The oldest Western use of the pigment *ultramarine 'blue'* preceded of about seven centuries the first three 13<sup>th</sup>-14<sup>th</sup> century recipes, which describe the production of the pigment from lapis lazuli. This enormous time gap requires a new interpretation of the social mechanisms that transmit practical arts. Available chemical data refutes the hypothesis of a single mining supply source for archaeological findings of lapis lazuli, and new evidence demonstrates also that the phrase *ultramarine 'blue'* is strongly misleading. The term 'blue' became a basic colour term most likely in the early 15<sup>th</sup> century England. Instead, the Medieval Latin word '*lazurum*' and the corresponding Vernacular terms drew from *lazurin*, a 9<sup>th</sup> century A.D. transliteration of the Greek *λαζούρ* (*lazour*), attested since the 4<sup>th</sup> century A.D. The latter stemmed from the Persian colour term *lājvard*, which denoted lapis lazuli and other 'blue' substances. This study paves the way for the study of the intricate social utilisations of an 'azure' pigment that was successively called *ultramarine 'blue'*, and on the first linguistic evidence of the term 'azure'.

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## Introduction

The present paper aims to explore the main aspects of the social history of ground *lapis lazuli* and the pigment *ultramarine 'blue'* up to the end of the 13<sup>th</sup> century. Although it draws on a large part upon previous research, we have been able to add a few bits of new information, which have not yet been published. As we are touching on a large number of topics, we will address them schematically, for which we apologise. However, our main aim is to present a new approach to the issue.

Since the first scientific work on *ultramarine* in 1792 by Johann Beckmann [1], the phrase *lapis lazuli* and the term *ultramarine* seemed strange. *Lapis lazuli* is in fact an odd mixture of the Medieval Latin word for stone (*lapis*) and *lazuli*, which is the genitive of Medieval Latin *lazulum*, a loanword from the Persian *lājvard* (*lāzhvard*; *lāzvard*) via a Greek intermediate. According to its modern meaning, *lapis lazuli* indicates a metamorphic rock that is an aggregate of many minerals (calcite pyrite, diopside and other phases), whose most socially appreciated component is the 'blue' mineral *lazurite*. *Ultramarine* 'blue' refers to the pigment obtained by crushing and grinding the *lapis*, successively enriched by the 'blue' mineral *lazurite* via a floatation process. The phrases *lapis lazuli* and *azurum ultramarinum* have medieval origins, but the term *lazurite* entered the scientific jargon with its present meaning only with the sixth edition of Dana's *System of Mineralogy* (1892). The phrase *azurum ultramarinum* is usually translated into English as *ultramarine* 'blue', although it is misleading in many ways. Firstly, neither *lapis lazuli* nor *ultramarine* 'blue' originate from "the opposite shore of the sea", as the medieval name, *ultramarine*, suggests, but have more distant origins. Ground *lapis lazuli* was at least used since the 4<sup>th</sup> century A.D. as a wall pigment in Central Asian caves devoted to Buddhist rituals (Kizil grottoes). The mineral deposits of the Pamir Mountains in Tajikistan, the Chagai Hills in Pakistan and in the Afghan province of Badakhshan in the Kocha valley are the likely sources of the stone *lapis lazuli* [2]. Secondly, the medieval term 'azure', as a *denotatum* of a visual percept (colour term) was used for denoting the *lapis lazuli* and the pigment *ultramarine*. The word *azure* was successively substituted in German, French and English languages by the term 'blue', which became a basic colour term (BCT), while other European languages have two BCTs in the BLUE area [3-4]. After the publication of a reference paper by Plesters [5], new analytical, non-invasive and *in situ* techniques were introduced for detecting the presence of *lazurite* on various supports. In this way, increasing data was available to scholars. However, the history of *ultramarine* 'blue' continues to be discussed within a framework that considers the art of painting but ignores other utilisations of ground *lapis* for medical preparations, preparing inks, colouring glass enamels, and pottery glazing. Similarly, the complex history of the medieval family of terms deriving from the Persian word *lājvard* has barely been touched upon.

The present paper has a twofold approach. On the one hand, we examine the social utilisations of ground *lapis*, whose main chemical-mineralogical witness is the presence of the mineral *lazurite*. On the other hand, we will discuss the literary records concerning the classical and medieval words for 'blue' pigments and colour terms of the BLUE area, up to the first medieval 13<sup>th</sup>-14<sup>th</sup> century recipes for fabricating *ultramarine*. This paper first overviews the social utilisations of ground *lapis* at a word scale, both outside and within the art of painting. We distinguish the notable cases of the use of *lazurite* for types of supports and geographical or cultural areas. It then discusses the idea that the social man creates or borrows practical procedures, and with them, specific words or phrases. The discussion summarises the first Medieval Western recipes for the making of *ultramarine* 'blue' and the set of 'blue' colour terms and substance names from Theophrastus to Isidore of Seville. The following subsections treat the word root *λαζουρ-* (*lazour-*) in the *Thesaurus Linguae Graecae*, the early Medieval Latin records of the lemma *lazur-* and the semantic field of 'blue' colour terms or coloured substances in the *Compositiones lucenses* tradition.

## The social utilisation of ground lapis lazuli

### ***Some of the social uses of ground lapis lazuli outside the art of painting***

Specific geological and geochemical conditions are required for the petrological genesis of the *lapis*, and for that reason there are only a small number of deposits around the world. There is evidence that

not only the quarries of Badakhshan in north-eastern Afghanistan, but also those of the Pamir Mountains in Tajikistan and the Chagai Hills in Pakistan, were being exploited since ancient times, thus refuting the hypothesis of a single supply source [2].

*Lapis lazuli*'s presence has been detected in almost all major archaeological sites from Western Pakistan (around 7000 years B.C. [6]) to Egypt, where it had been used since the early pre-dynastic period for beads and inlays (Naqada I period, 4000-3500 B.C.) and subsequently for amulets, jewellery and seals [7]. Archaeological evidence shows that *lapis lazuli* was generally extracted with most of the calcareous matrix removed. The process of extracting the 'blue' mineral from the calcareous gangue for producing beads or carved objects involves simple utensils and repeated smoothing, incising, and chipping [8]. Both in Mesopotamia and Egypt, *lapis lazuli* was highly valued by the ruling classes, who referred to the stone in their respective mythologies and religious stories [6, 9].

Many pieces of evidence show that ground *lapis* was used long before the Western Medieval uses of *ultramarine* on walls and MSS. However, being that the present work is an overview, we will only summarise the topic. The most important use of ground *lapis* was medical. The two main examples referred to Egyptian and Mesopotamian medical pharmacopeias are the eye ointments in Ebers' papyrus (around 1550 B.C.) [10] and some written records in the 7<sup>th</sup> century B.C. Ashurbanipal library [11]. In a later Byzantine source (Alexander of Tralles, 525-605 A.D.), a component of a recipe for eyewash is likely to be ground lapis (*χρυσόσάπφειρος* or gold sapphire, *Therapeutica*, II 45.12 [12]).

Ground *lapis* is present in the vast Islamic medical literature and in the *aqrābādhīn* or recipe-books for the composition, preparation and application of various drugs. From Ḥunain ibn Ishāq (809-877) ([13]: 146) to the late 13<sup>th</sup> century pharmacist al-Kūhīn al-‘Attār, and his formulary *Minhāj al-dukkān* ([14]: 210-212), a long series of authors used ground *lapis* as a regular component of their medical preparations.

At least two factors were determinants of the systematic use of ground *lapis* in the Islamic pharmacopeia: i) the separation of the profession of the physician from that of the pharmacist, and ii) the systematic taxonomy of stones in Arabic alchemical and gemmological works, which was much more accurate than equivalent Western discourses on lapidaries, the authors of which were apparently not aware of Theophrastus' *On Stones*. Instead, both Jabir ibn Hayyan and Muhammad ibn Zakariya Al-Razi articulated a phenomenological classification for the stones, in which *lapis* was given a precise place [15].

Yet, the Medieval Latin medical tradition was aware of the use of *lapis*. Simon Januaensis' *Clavis Sanationis* – a late 13<sup>th</sup> century medical dictionary with alphabetical entries – mentions two kinds of *lapis*. The first “*est laudabilis mundus a marmore albo et a marcasita*” (is prized if cleaned from its white marble and pyrite). The second - likely Armenian stone or azurite- is unsuitable for medical uses, “*est fragilis minus pulchri coloris veluti terra azurina qui citra mare nascitur*” (is brittle, less pleasant and is of azure earth-like colour; it is borne overseas [16]). The distinction between the two types of *lapis* by means of the Latin prefixes *citra* or *ultra* and the presence of two accessory minerals of *lazurite* (likely calcite and pyrite) was acknowledged in the 13<sup>th</sup> century.

Ground *lapis lazuli* was recorded at least since the 11<sup>th</sup> century in recipes for producing 'blue' coloured inks employed in Muslim manuscripts (MSS) (see for example the Ibn Badis Umdatt-al-kuttāb's MS [17]). Nevertheless, this material was used much time before and much time later than the 11<sup>th</sup> century in the arts of fire as a likely consequence of cross-craft exchanges within the art of glass, ceramics, mosaics, and imitation of precious stones. It was exploited as a pigment and opacifier in two chronologically distant periods (see Table 1). A reasonable rationalisation is that *lapis lazuli*, being a potential colouring agent and a well-known semi-precious stone, mediated and continued to mediate the interactions between different arts.

The present literature does not always distinguish between the phrases *ultramarine 'blue'* (a pigment obtained from ground *lapis lazuli* by means of a medieval procedure employing the *pastellum*), *lapis lazuli* (an aggregate of minerals), and *lazurite* (the most valuable 'blue' mineral component of the *lapis lazuli*). Actually, specific chemical reactions occur between ground lapis and *pastellum* in the preparation of ultramarine 'blue'; consequently, the mineralogical composition of ultramarine 'blue' is different with respect to simple ground *lapis* [18-19]. As a result, a quantitative mineralogical analysis is needed for distinguishing micro samples of ultramarine 'blue' from simple ground *lapis*.

No.	Item descriptions	<i>Lapis lazuli</i> / <i>Ultramarine 'blue'</i> / <i>Lazurite</i>	Century	Reference
1	Faience, recovered in Pompeii: 13 turquoise glaze items, most of which are typologically similar to the so-called Egyptian Faience	<i>Lazurite</i> , cobalt, and copper were revealed in the glaze sample	1 <sup>st</sup> B.C – 1 <sup>st</sup> c. A.D.	[20]
2	Glass: Begram treasure ( <i>Musée des Arts Asiatiques Guimet</i> , Paris)	<i>Lazurite</i> was found as a pigment of the enamel	1 <sup>st</sup> c. A.D.	[21]
3	A Roman glass (Szczecin Museum, Poland): its short duration firing process is similar to those used on Islamic and Venetian enamelled glasses	Powdered <i>lazurite</i> was used for the opaque 'blue' enamel. <i>Lazurite</i> , calcite, and diopside were detected in the 'blue' coloured enamel layers	2 <sup>nd</sup> c. A.D. (first half)	[22]
4	Enamelling on Syrian glass and Persian ceramics: their similar special firing of short duration suggests an interaction between glass workers and potters		12 <sup>th</sup> c. A.D.	[23]
5	'Blue' glazed Persian ewer ceramics (private owner): the glaze is a dispersion of cobalt ions in an alumina-silicate glass	<i>Lazurite</i> and diopside were deposited at the body/glaze interface	13 <sup>th</sup> c. A.D.	[24]
6	Melfi (Apulia, Italy), glass shards	<i>Lazurite</i> and cobalt ions were used as 'blue' colouring agents of the glass matrix	13 <sup>th</sup> c. A.D.	[21]
7	Islamic glasses of the British Museum. The vessel's enamelling agent was probably prepared by mixing 'blue' grains of lapis with glass powder	<i>Lazurite</i> was used as a colouring and opacifier agent. The enamel of one shard is the combined result of <i>lazurite</i> and tin oxide	13 <sup>th</sup> –14 <sup>th</sup> c. A.D.	[25]
8	The pottery of Castel Fiorentino (Foggia, Italy) is similar to Rakka's wares produced in Egypt and the Near East	First identification of <i>lazurite</i> in a 'blue' pigment pottery glaze	13 <sup>th</sup> –14 <sup>th</sup> c. A.D.	[26]
9	The use of lazurite as a ceramic pigment was quite common in proto-majolica items from the sites of Siponto (Manfredonia, Foggia) Castel Fiorentino and Lucera (Apulia, Southern Italy)	Areas painted in 'blue' contain <i>lazurite</i> crystals	13 <sup>th</sup> –14 <sup>th</sup> c. A.D.	[27]

Table 1: The use of ground lapis lazuli and cross-craft exchanges between the art of ceramics, glass, and mosaics.

### ***The first uses of lazurite as a pigment on various supports***

The new sophisticated chemical-physical procedures [28] cannot be able to determine if the painters/illuminators themselves produced the ultramarine powder or if they bought it. Besides, the early medieval tracts on *mercatura* (bookkeeping MSS and trade manuals) did not distinguish between the trade of lapis lazuli or its powder. In any case, the reliable new data available since the late 80s makes it possible to change the traditional approach to the social history of ultramarine, which was led by the 1849 seminal work by Mary P. Merrifield's *Original Treatises on the Arts of Painting*, which was mainly based on 14<sup>th</sup> and 15<sup>th</sup> century literary records.

### ***The first Western use of lazurite on walls and other supports***

The utilisation of *lazurite* in all cases of the Table 2 occurred by mixing it with other pigments, with the exception of the record no. 2.

The presence of *lazurite* in records nos. 1 and 8 could have resulted from a previous restoration [29, [36]. In short, there is some unwillingness to accept the idea that *lazurite* could have been used before the medieval times. According to Heywood (record no. 2), at the time of the late 17<sup>th</sup> Dynasty the *ultramarine* was obtained by grinding high-quality *lapis lazuli* [30].

Between the 8<sup>th</sup> and the 12<sup>th</sup> centuries A.D. the use of *lazurite* became generalised and has been recognised in France, Germany, and Northern Italy [39].

<b>No.</b>	<b>Item descriptions</b>	<b><i>Lapis lazuli / Ultramarine</i> <i>'blue' / Lazurite</i></b>	<b>Reference</b>
1	1600 ca B.C., 17th Dynasty. National Museum of Scotland, Edinburgh (UK)	Lid of Rishi coffin for adult female excavated at Qurneh  (maybe affected by sample contamination)	[29]
2	1580 to 1550 B.C., late 17th Dynasty. Metropolitan Museum of Arts, New York (USA)	Fragmented statue of an Egyptian queen, excavated in the Asasif valley at Thebes	[30]
3	13 <sup>th</sup> c. B.C., Gla in Beotia (Mycenaean Greece)	Wall painting	[31]
4	Last quarter of the 5 <sup>th</sup> c. B.C., National Archaeological Museum of Athens (Greece)	Marble pyxide	[32]
5	200 ca B.C., Manchester Museum (UK)	Fragments of two decorated Ptolemaic coffin lids	[33]
6	From the first century B.C. to the 1 <sup>st</sup> c. A.D. Roman villa in Banõs de Valdearados (Spain)	Wall painting	[34]
7	1st c. A.D. Roman Colchester (UK)	Wall painting	[35]
8	3 <sup>rd</sup> or 4 <sup>th</sup> c. A.D. Egypt, Naples Museum (Italy)	Few particles of lazurite were found on a canvas (maybe affected by sample contamination)	[36]
9	First half of the 8 <sup>th</sup> c. A.D. San Saba Church, Rome (Italy)	Wall painting	[37]
10	Last quarter of 8th century A.D. – First decades of the 9th century A.D., Tower of Torba (Italy)	Wall painting	[38]

Table 2: Western European notable occurrences of lazurite on walls and other supports.

### **Notable Western European occurrences of lazurite on MSS**

In this section we cite only the first cases of the use of *lazurite* and the transition from an organic (woad/indigo) or inorganic (*azurite*) 'blue' colorant to the much more costly *lazurite*.

The oldest Western notable cases are the following three 9<sup>th</sup> century MSS: the first two belong to the Archivio and Biblioteca Capitolare of Vercelli (Italy) MS 104 [40] and MS 202 (personal communication by Maurizio Aceto, data not yet published), and the third is the Biblioteca Apostolica Vaticana (BAV) MS Vat. Reg. lat. 124, written in Fulda or Mayence [41]. Six other cases have been recorded in the 10<sup>th</sup> century. The transition from an organic 'blue' dye to *lazurite* was documented in the 11<sup>th</sup> century in France (Fécamp Abbey) [42] and England [43], and one century later in Italian Tuscan MSS, in which *azurite* was substituted for *lazurite* [44]. From the 12<sup>th</sup> century onwards, the use of *ultramarine* was no longer restricted to any specific geographic areas and became common all over Western Europe.

### **The oldest use of lazurite in Byzantine artworks**

Written data on the pigment palette used in the Byzantine MSS is scarce and attestations of the use of *lazurite* between the 6<sup>th</sup> and the 10<sup>th</sup> centuries A.D. are still limited. The four oldest MSS in which *lazurite* has been detected, are the following:

i) Wien, *Österreichische Nationalbibliothek, Medicus Graecus 1*, often called the *Dioscorides Vindobonensis* (beginning of the 6<sup>th</sup> century, ca 512); it is a precious and elaborate volume given as a gift to the Western Roman imperial princess Juliana Anicia [45].

ii) Rossano Calabro, Museo Diocesano, *Codex Purpureus Rossanensis* (Cosenza, Italy), mid 6<sup>th</sup> century [46].

iii) Paris, BNF Supplément grec 1286, often called *Codex Sinopensis*, 6<sup>th</sup> century (personal communication by Maurizio Aceto, data not yet published).

iv) Florence, Biblioteca Mediceo Laurenziana, cod. Plut. I, 56, or Rabbula MS (late 6<sup>th</sup> century [47]): this MS, the Christological cycle of San Saba's wall paintings [37], and the Rossanensis MS, share likely a Syriac origin and a common use of *lazurite*.

A *badly washed ultramarine*, to use Laurie's visual-based interpretation, was used by the illuminators of a 6<sup>th</sup> century Byzantine MS Add. 5111, at the British Library, as was the 'blue' colour of the *Lindisfarne Gospels* (a Hiberno-Saxon MS copied at the beginning of the 8<sup>th</sup> century) [48]. More recently, Brown and Clark have demonstrated the absence of ultramarine, or better, *lazurite*, in the latter manuscript with a more sophisticated and reliable technique of analysis [43].

### **The oldest use of lazurite in Arabic artworks**

Only a limited number of publications are devoted to the pigments used in early Islamic artworks. The earliest findings of the use of *lazurite* are from the Umayyad period. A few pages of a Qur'an dated at the end of the 7<sup>th</sup> century or the beginning of the 8<sup>th</sup> century (Paris, BNF, MS Arabe 330c, ff 11-19). Another few pages of a second Qur'an dated to the 8<sup>th</sup> century (Paris, BNF, MS Arabe 324c, ff. 8v, 14v, 18v, 32r, 36v, 39r) [49]. The fresco paintings of the Umayyad rest place at Qusayr Amra, Jordan of the first mid 9<sup>th</sup> century (but for some author they are dated *ante* 811-812) show the influence of Byzantine and Sasanian art on the iconology and painting procedures [50].

### **The oldest use of lazurite on wall paintings in Asia and central Asia**

In Asia and central Asia *ultramarine 'blue'* was mainly used in connection with the spread of the Buddhist cult from India through central Asia. In most of the cases the Buddhist temples were excavated from cliffs. The early use of *lazurite* was identified in the 4<sup>th</sup> century murals of the Kizil Grotto caves 38 and 114, on the northern route of the Silk road around the northern edge of the Taklimakan desert

(Central Asia) [51] [52]. From the 4<sup>th</sup> until the 8<sup>th</sup> centuries, some of the wall paintings of its 236 rock-cut caves were performed using *azurite*, which was identified by X-ray diffraction [52]. Subsequently, *lazurite* was used in the wall paintings of caves 251 and 259 of the Dunhuang caves (Gansu, North-western China), about 1,500 km east from Kizil, in the early Wei period (439-534 A.D.) [53]. Zuixiong dates some caves to the period 304-581 A.D. [52].

Westward to Kizil, *lazurite* was utilised for wall paintings in Afghanistan, Uzbekistan and Tajikistan (5<sup>th</sup>-8<sup>th</sup> Centuries). The analysis of the pigments of the wall paintings of Central Asia (now in the State Hermitage Museum) shows that the use of *lazurite* was common in pre-Islamic times in the murals of the Bāmiyān and Kakrak Buddhist caves (Afghanistan), in the Buddhist Monastery of Ajina-Tepa (Uzbekistan), in Afrasiab's aristocratic block of houses – now the ruins of ancient Samarkand – and in the centres of Shahristan and Panjikent (Tajikistan) [54].

## From *λαζουρ* to *azzurro* – some notes on the history of the colour term *azzurro*

### **Medieval Western recipes for the making of ultramarine 'blue'**

In the mid-30s of the 20<sup>th</sup> century Daniel V. Thompson drew attention on the three earliest medieval MSS on the procedures for achieving *ultramarine*: i) Cambridge, Gonville and Caius College, 214 (James 181); ii) London, British Library, Sloane, 342; and iii) Bologna, University Library, 153 [55].

The first MS – a 13<sup>th</sup> century record – transmits Michael Scot's *Tractatus alkimie* with a final section containing the recipe *Azurum transmarinum hoc modo per pastillum afinatur* (f. 32, r. 21; on the chemical reaction between the *pastillum* and the minerals of ground *lapis lazuli* see [18, 19]). The difference between the *lombardicum* and *transmarinum azurum*, the composition, and the procedure *per pastillum* for achieving the pigment are clearly stated, while the basic pH value of the procedure is not yet present. Both the procedure and the composition of the *pastillum* are recorded in the two following MSS, in which no distinction between two types of *azure* is made. Sloane's recipe *Si vis facere azurium* (f. 132v, r. 11) is part of a 13<sup>th</sup> century small collection of colour making recipes entitled *Massa de coloribus*, which is located among medical texts grouped to form a *compositus* codex. This recipe states the grounding of a *lapidem lazuli* and the addition of binding media (oil and rosin) to obtain a patty. The alchemical Bologna MS may be most likely dated to the turn of the 14<sup>th</sup> century: it includes tracts on falconry and alchemy, besides the *Liber claritatis* and its recipe *De azulo faciendo* for producing the *azurum* (f. 11v, r. 17). In the last two examples, however, there are no direct mentions of the *pastillum* in the description of its production and *azurum* does not come with the adjective *ultramarine*.

The modern terminology (*lapis lazuli* and *azurum ultramarinum*) had not yet been fully developed in the 13<sup>th</sup> century. The recipe *Nobile azolum ultramarinum conficitur sic* (f. 61v; BAV, MS Vat. Lat. 598, 13<sup>th</sup> century) contains one of the first attestations of the term *ultramarine*, although not concerning the production of *ultramarine* [56]. Yet the term *ultra-mer* was already present in the *Chanson de Roland* (67, 3156, 3507; 2<sup>nd</sup> half of the 11<sup>th</sup> century).

From Thompson onwards, the art historians struggled with two main questions: when *ultramarine 'blue'* became a common pigment in wall paintings and MSS in Western Europe and how big was the time gap between the Western use of *lazurite* and the 13<sup>th</sup>-14<sup>th</sup> centuries recipes. The literature shares Thompson's view that the 'blue' extracted from *lapis lazuli* "was used in Europe long before any of the recipes for extracting it [...] were written" [57]. For Thompson, *ultramarine* was not common before the 14<sup>th</sup> century, but recent literature refutes this view. The delay between the first actual use of

*ultramarine* and the 13<sup>th</sup>-14<sup>th</sup> centuries recipes for producing it cannot be rationalised by Thompson's approach to medieval recipe books on pigments and colours.

The ability to produce *ultramarine* and the literary descriptions of the procedures for producing this pigment are social facts that belong to different types of *chaînes opératoires* [58]: the context of the first fact was the practical art of painting and the second context was the noblest art and science of medicine and the lesser noble alchemy. However, since Thompson's study, little research has been undertaken on cultural and socio-economic contexts, and linguistic and procedural aspects of the social uses of ground *lapis lazuli*.

The Islamic literature provides this information: for instance, two authors specify data for the craft process for obtaining *ultramarine* in a distinctive social context of atelier expertise devoted exclusively to its making. However, there is uncertainty surrounding the procedure described for getting the pigment (see the 12<sup>th</sup> century *Azhar al Afkar fi Djawahir al Ahdjar* by al- Tīfāšī [59] and the 12<sup>th</sup> -13<sup>th</sup> centuries *Bayān al-ṣenā'āt* by Ḥobayš Teflisi [60]).

### ***A summary of 'blue' colour terms and substance names from Theophrastus to Isidore of Seville***

There are at least three determinants that are helpful in distinguishing the linguistic transition from the Greek and Latin colour terms to the medieval terms:

i) The Greeks and Romans did not have a specific colour term or substance name for what we call today *lapis lazuli*, unlike the Mesopotamians and Egyptians (Sumerian *za.gin<sub>3</sub>*; Akkadian *uqnū*; Egyptian *ḥsbḏ*).

ii) Theophrastus' *Περὶ λίθων* (371 –287 B.C., *On Stones*) was unknown in the Middle Ages and its influence on the origin of medieval colour term 'azure' appears to be negligible. Moreover, the Greek or Medieval Latin lapidaries cannot be considered a discourse on minerals or rocks in the modern sense because they mainly addressed the stone's curative, magical, or mystical and theological properties.

iii) The Latin system of colour terms for 'blue' as a BCT completely fell away in the Romance languages, unlike the case of 'red' as a BCT [61].

The categories of knowledge and the boundaries between disciplines change over time: in fact the lapidary's identifying features for stones (the colour, lustre, hardness, occasionally taste, uses and, above all, virtues of stones) are incommensurable with the defining criteria used by modern mineralogy. Therefore we will refrain from addressing the still unresolved questions of the meanings of 'blue' colour terms and substances in Classical Greek and Latin up to Isidore of Seville.

Concerning 'blue' as a BCT, there is a set of Greek and Latin words, some of which worked both as colour terms and substance names, a second stock of classical place-names and a third set of modern names. The relationships between these three sets of words are yet to be determined:

i) Colour terms or substance names: *κύανος* (*kyanos*), *cyanos*, *σάπφειρος* (*sappheiros*), *sappirus*, *caeruleum*, *lomentum*, *vestorianum*, *ḥsbḏ iryṯ* (Egyptian = *lapis lazuli from the kiln*), *χρυσόκόλλα* (*chrysokólla*), *indicum*, *χυτὸς κύανος* (*chytos kyanos* = 'blue' smalt).

ii) Place names: cyan from Egypt, Scythia and Cyprus (Theophrastus, *De Lap.*, 55; Pliny, *N. H.* 37, 39, 119), Armenian stone (Pliny, *N.H.*, 35, 47; Vitruvius, *De Arch.*, VII.5.8, VII.9.6).

iii) Modern substance names: *azurite*, *malachite*, *chrysocolla*, *sapphire*, *lapis lazuli*, *lazurite*, *Egyptian 'blue'* (a frit containing cuprorivaite), smalt, indigo, and woad.

From Beckmann's work until today, more than two hundred years have passed, but there is still no agreement in the literature about the relationships between the ancient names and mineral substances according to modern mineralogy [62].



Passages in ancient texts that refer to a ‘blue’ stone with many gold points or golden spots are commonly interpreted by scholars just as *lapis lazuli* (see for example Pliny the Elder, *N.H.* 37, 38,119 or Isidore of Seville’s *Etymologiae*, 16, 9). In this way, sapphire was equated with *lapis lazuli*, whilst recognising that the ancient sapphire should not be identified with the modern oxide of aluminium ( $\alpha\text{-Al}_2\text{O}_3$ ), whose colour is caused by trace elements.

### **The *λαζουρ-* (*lazour-*) word root in the *Thesaurus Linguae Graecae* (TLG)**

The very large corpus of the TLG includes eleven attestations for the root word *λαζουρ-* (*lazour-*). Two of them are not well dated and three others are placed outside our chronological limits. Moreover, the *Commentarii in Apocalypsin* by Arethas of Caesarea, already known in the literature [63], are not included in the TLG. As a result, there are seven useful attestations, summarised in Table 3. Five cases precede the first 9<sup>th</sup> century Western attestations of the Latin lemma *lazur*.

No.	Text’s title	Meaning	Context	TLG’s reference	Date (A.D.)
1	<i>Cyranides</i>	<i>Λαζοῦριν</i> ( <i>lazourin</i> ) indicates the name of a pigment	Hermetic lapidary with medico-magical aims	Book I, sec. 18, line 10	4 <sup>th</sup> c.
2	<i>Astrologica Hygromantia Salomonis</i>	<i>Λαζουριου</i> is the name of a coloured substance	Prescription of a spell	Vol. 8.2, pg. 158, line 25	5 <sup>th</sup> – 6 <sup>th</sup> c.
3	<i>Palchus, Dodecaeteris chaldaica</i>	<i>Λαζουρόν</i> : Selene’s colour is like the less known colour <i>lazuron</i>	Description of the colour of the moon (astrological genre)	Vol. 5.1, pg. 182, line 32	7 <sup>th</sup> c.
4	Andrew of Caesarea, <i>Commentarii</i>	<i>Λαζούριον</i> is a substance or the name of a colour like the body of the sky and of sapphire	<i>Book of Revelation</i> : description of the city wall of the Saints, which is adorned with precious stones	Logos 23, Ch. 67, sec. 21.19, line 2	7 <sup>th</sup> c.
5	Leontius Mechanicus, <i>De praeparatione sphaerae Arateae</i>	<i>Λαζουρίωι</i> is the name of an opaque (azure) pigment or dye	Description of the astronomical globe: one of the circles is painted in <i>azure</i>	Sec. 5, line 20	7 <sup>th</sup> c.
6	Arethas of Caesarea, <i>Commentarii in Apocalypsin</i>	<i>Λαζούριον</i> is the name of a colour that is comparable to sapphire	<i>Book of Revelation</i> : description of the city wall of the Saints, which is adorned with precious stones	Migne J.P. (ed.), 1866, <i>Patr. Grae.</i> , 106, 773-4	9 <sup>th</sup> – 10 <sup>th</sup> c.
7	<i>Eparchicon Biblion</i>	<i>Λαζούρηνη</i> is sold by perfumers	List of traded goods in an administrative-economic context	Ch. 10, sec. 1, line 7	10 <sup>th</sup> c.

Table 3: The attestation of the root word *λαζουρ-* (*lazour-*) in the *Thesaurus Linguae Graecae*.

A thorough discussion of all these occurrences is beyond the scope of the present paper. Nevertheless, we emphasise that Beckmann addressed this lexicological aspect and already noted the attestation of records nos. 4 and 5 [1]. Unfortunately, the present literature does not show further progress with respect to Beckmann’s [1] and Ploss’ works [63].

The word *lazourin* (λαζοῦριν) in Book I of the *Cyranides* (record no. 1; 4<sup>th</sup> century [64]) indicates a kind of sapphire, or a dark 'blue' stone (Σάπφειρος λίθος, ἢ κύνεος) with golden veins (φλεβία χρυσᾶ), which was used by painters (ζωγράφοι) in order to obtain natural *lazurite* (λαζοῦριν φυσικόν). *Cyranides* is a magical lapidary; a similar magical context is also shared by record no. 2 [65].

Record no. 3 is of an astrological character and mentions the colour *lazuron* (Λαζουρόν) in the description of the moon [66]. Records nos. 4 and 6 belong to the genre of Christian lapidary. Among these, we quote the mid 12<sup>th</sup> century *Prüller Steinbuch*, in which the less known *sapphire* is compared to the better-known *lasur* [67].

The four editions of the *Eparchicon Biblion* (record no. 7) – the first three by Nicole (1893), Boak (1929), Freshfield (1938) – translated the term λαζούρη differently and no reference to *lapis lazuli* is made, except in Koder's critical edition [68]. The section quoted from the *Eparchicon Biblion* concerns perfumers or dyers: the Latin merchant of colour (*pigmentarius*) was also a seller of perfumes, of the various components of medical recipes and dyes for fabric [69]. Likely the word *perfumer* means druggist, analogous to the Islamic specialisation of the profession of the pharmacist, as suggested by the fact that the preparer of the drugs was named *attār*, i.e. perfumer [70].

This section demonstrates that the root word λαζουρ- may refer both to a colour term and a colouring agent. The first attestation in the 4<sup>th</sup> century seems to be the intermediate between the notable case of 1<sup>st</sup> century A.D. of Colchester (see Table 2) and the four 6<sup>th</sup> century A.D. Byzantine MSS in which *lazurite* was used, while the dating of Egyptian canvas no. 8 fits with the oldest literary record of the TLG.

If one considers *ultramarine* as a case of ground *lapis*, then it is possible to rationalise why *lazurite* was likely sporadically used as a pigment a long time before its use in Central Asia and Europe. The spreading of the use of *lazurite* from Central Asia may justify only a part of this scarce set of notable occurrences. A more general hypothesis could be a multiple and unrelated set of inventions of ground *lapis lazuli* as a pigment.

### ***The first attestations of the Latin lemma lazur- and the Compositiones lucenses tradition up to the 13<sup>th</sup> century***

The first Medieval Latin attestations of the word *lazur* come from two 9<sup>th</sup> century literary records. The first one – a reference to wall pigments – is a letter by Frothar, bishop of Toul (813 – 847<sup>+</sup>), already quoted in Du Cange's *Glossarium ad Scriptores Mediae et Infimae Latinitatis*. The other record is the well-known recipe book *Compositiones lucenses* (MS 490) held by of the *Biblioteca Capitolare* of Lucca, copied between 787 (or 796) and 816 A.D. Recent acquisitions on the organization of the contents of Lucca's MS stress that the latter is severely disordered and fragmentary. Consequently the study of *Compositiones lucenses* (CL) cannot rely exclusively on this manuscript and may be better understood by integrating its text with the entire tradition (hereafter CLT), which consists of 26 MSS [71].

CLT recounts on twelve MSS up to the 13<sup>th</sup> century; eight show the use of the term *lazur* in 17 text-units, 7 of which were already registered by Lucca MS. There are a further 14 MSS from the 14<sup>th</sup> to the 17<sup>th</sup> centuries, but only two of them provide new passages including the term *lazur*. These two MSS at the National Central Library in Florence, although useless for our purposes, should be mentioned for the sake of completeness: the MS Palatino 951 (late 14<sup>th</sup> century, see f. 11r) and the alchemical MS Palatino 981 (late 15<sup>th</sup> century, see f. 8r), which include recipes for colour making both inside the CLT and other unknown sources.

Table 4 contains concordances of the term *lazur*, sufficiently detailed in this respect just to underline how the Latin lemma *lazur* could have different meanings. *Lazur* is a compound (1) and *azur* is milled (17). *Lazur* is an ingredient of a mixture of reddish/purplish colour (4, 5, 6, 7, 9, 11, 12, 14, 15). *Lazur* is specified using a set of additive terms: *lazuri zonta* (3), similar to woad/indigo;

*porfyrizonta* or *lazurin diforon qui dicitur bifaces* (9), purplish hue; *lazurin melini zonta* (10), a greenish azure; *lazurin erinon* or *aereum* (11) sky-azure; *Lazurin carnei coloris* (12), an azure of a flesh-colour; *lazuri onichini zonta* (13), onyx-coloured azure.

<b>MSS list:</b> <b>Lu</b> _Lucca, Biblioteca Capitolare, 490 (9 <sup>th</sup> c.)    <b>K</b> _Klosterneuburg, Stiftsbibliothek, frag. s.n. (9 <sup>th</sup> c.)    <b>S</b> _Sélestat, Bibliothèque Humaniste, 17 (10 <sup>th</sup> c.)    <b>C</b> _Corning, Museum of Glass, Phillipps 3175 (12 <sup>th</sup> c.)    <b>L</b> _London, British Library, Add. 41486 (12 <sup>th</sup> c.)    <b>V</b> _Città del Vaticano, Biblioteca Apostolica, Reg. lat. 2079 (12 <sup>th</sup> c.)    <b>Ob</b> _Oxford, Bodleian Library, Bodley 679 (13 <sup>th</sup> c.)    <b>Od</b> _Oxford, Bodleian Library, Digby 162 (13 <sup>th</sup> c.).	
1	<b>Lu:</b> f. 220v, r.7    <b>S:</b> f. 28v, r.16    <b>C:</b> f. 41v, r.12    <b>V:</b> f. 85v, r.29    <b>L:</b> f. 99r, r.24    <b>Ob:</b> f. 27r, r.1
2	<b>Lu:</b> f. 224r, r.4    <b>S:</b> f. 15v, r.4    <b>C:</b> f. 25v, r. 16    <b>V:</b> f. 76v, r.3    <b>Ob:</b> f. 29r, r.43    <b>Od:</b> f. 20ra, r.17
3	<b>Lu:</b> f. 224v, r.21    <b>S:</b> f. 46r, r.8    <b>C:</b> f. 35r, r.12    <b>V:</b> f. 77r, r.30    <b>L:</b> f. 94r, r.22    <b>Ob:</b> f. 28v, r.45
4	<b>Lu:</b> f. 225r, r. 24    <b>K:</b> f. 1r    <b>S:</b> f. 48r, r. 12    <b>C:</b> f. 37v, r. 8    <b>L:</b> f. 96v, r. 23    <b>Ob:</b> f. 29v, r. 22
5	<b>Lu:</b> f. 225r, r. 28    <b>K:</b> f. 1r    <b>S:</b> f. 48r, r.9    <b>C:</b> f. 37v, r. 5    <b>V:</b> f. 78r, r. 26    <b>L:</b> f. 96r, r. 20    <b>Ob:</b> f. 29v, r.10
6	<b>Lu:</b> f. 225r, r. 24    <b>K:</b> f. 1r    <b>S:</b> f. 48r, r. 12    <b>C:</b> f. 37v, r. 8    <b>L:</b> f. 96v, r. 23    <b>Ob:</b> f. 29v, r. 22
7	<b>Lu:</b> f. 225v, r. 4    <b>K:</b> f. 1v    <b>S:</b> f. 48v, r. 17    <b>C:</b> f. 38r, r. 17    <b>V:</b> f. 78v, r. 12    <b>L:</b> f. 97r, r. 7    <b>Ob:</b> f. 29v, r.25
8	<b>V:</b> f. 77r, r.30
9	<b>S:</b> f. 47r, r.5    <b>C:</b> f. 36r, r.16    <b>V:</b> f. 77v, r.23    <b>L:</b> f. 95r, r. 20    <b>Ob:</b> f. 29r, r. 16
10	<b>S:</b> f. 47r, r. 15    <b>C:</b> f. 36v, r. 16    <b>V:</b> f. 77v, r. 30    <b>L:</b> f. 95v, r.8    <b>Ob:</b> f. 29r, r.23
11	<b>S:</b> f. 47v, r. 5    <b>C:</b> f. 36v, r.19    <b>V:</b> f. 78r, r.4    <b>L:</b> f. 95v, r. 21    <b>Ob:</b> f. 29r, r. 30
12	<b>S:</b> f. 47v, r. 17    <b>C:</b> f. 37r, r.14    <b>V:</b> f. 78r, r. 14    <b>L:</b> f. 95v, r.12    <b>Ob:</b> f.29r, r.41
13	<b>S:</b> f. 47v, r.19    <b>C:</b> f. 37r, r.15    <b>V:</b> f. 78r, r.16    <b>L:</b> f. 96r, r.15    <b>Ob:</b> f. 29r, r. 42
14	<b>S:</b> f. 48r, r.1    <b>K:</b> f. 1r    <b>C:</b> f. 37r, r.17    <b>V:</b> f. 78r, r.18    <b>L:</b> f. 96r, r.17    <b>Ob:</b> f. 29r, r.38
15	<b>S:</b> f. 49r, r. 7    <b>K:</b> f. 1v    <b>C:</b> f. 38v, r. 5    <b>V:</b> f. 78v, r.21    <b>L:</b> f. 97r, r. 14    <b>Ob:</b> f. 29v, r.31
16	<b>S:</b> f. 50v, r.9    <b>C:</b> f. 40v, r. 18    <b>V:</b> f. 79r, r. 34    <b>L:</b> f. 99r, r. 6    <b>Ob:</b> f. 30r, r. 19
17	<b>C:</b> f. 63v, r. 20

Table 4: Concordances of the term *lazurin* in CLT's MSS.

### **The semantic field of 'blue' colour terms and coloured substances in the *Compositiones lucenses* tradition**

The terminology provided by CLT for 'blue' coloured substances or colour terms is even more complex and certainly variegated. Together with *lazurin* analysed above, the same twelve MSS use other six substance/colour terms: *lulax*, *venetus*, *cianus*, *indicus*, *hyacinthus*, *sapphirus*. These terms appear in at least forty-four text-units. A closer look at the data reveals that only a few terms seem so clearly related as to give a specific and recognisable meaning. For instance, the use of *venetus* is triggered by 'blue' coloured substances or products. In stark contrast, all other terms may indicate both a finished product – such as an organic dye, a mineral mixture, or a stone – as well as the corresponding percept colour. A better understanding of 'blue' colour terms may be achieved through additional work,

comparing the set of lexemes of the CLT with that of the coeval literary sources on colours and pigments, but this is beyond the aims of the present work.

## Conclusions

Many conclusions are possible and we restrain ourselves to a couple of specific inferences and three methodological considerations.

The first two conclusions are as follows i.e.:

i) As far as the geographical distribution of the use of *lazurite* on MSS in Western Europe is concerned, the literature is far from satisfactory. Nevertheless it seems safe to state that a time gap of about three centuries separate the oldest uses of *lazurite* in Byzantine MSS and Latin Medieval MSS. The Latin Western transition from a 'blue' dye/pigment to *lazurite* occurred in the 11<sup>th</sup> century in France, Germany and England, and a century later in Italy.

ii) The oldest utilisations of *lazurite* in Byzantine MSS and Asian murals predated the Islamic invasions. From a chronological standpoint it seems plausible that the Persian word *lajward* became a Greek loanword without necessarily being translated into Arabic. Nevertheless the Spanish word *azul* (*açul*) draws back to the Arabic word *lazurd* [72], due to a long period of linguistic exchange occurred in the medieval Iberian Peninsula between Latin, Spanish and Arabic languages. The history of *lajward*'s heirs in the various European languages in medieval and Renaissance times deserves more attention.

From a more general point of view, we can state three conclusions, i.e.:

Firstly, an approach that considers the various social uses of lapis and ground lapis, together with the key words connected to such social utilisations, can lead to a coherent and interpretive view. The relationships between different arts are likely to be the causal mechanism for rationalising specific uses of ground lapis, and particularly the origin of *ultramarine 'blue'* that is a specific kind of ground lapis.

Secondly, from an analytical standpoint, many techniques enable us to detect *in situ* the presence of *lazurite* in cultural heritage items with non-destructive methods; nevertheless a greater understanding of the social uses of ground *lapis lazuli* requires the detection of the mineral phases that accompany the lazurite. This is not a simple problem; nonetheless one cannot distinguish *ultramarine 'blue'* from simple ground lapis without such an analysis. The interchangeable use of the terms *lazurite*, *ultramarine 'blue'* and *lapis lazuli* by the greater part of present literature blurs the problem at stake and should be overcome.

Thirdly, from an anthropological standpoint, the hypothesis that medieval recipe books on pigments and dyes were addressed to artisans is untenable, because apprentice procedures involve a shift away from cognitive readings of practice towards body readings [73, 74]. Anyway the time gap of seven centuries between the first use of *lazurite* as a painting pigment and the first medieval recipes, and the kinds of authors or scribes of these MSS (physicians and alchemists) are pieces of evidence against any use of these recipes in the workshop, at least up to the 13<sup>th</sup> century.

Most likely the process of transmitting practical knowledge had been mediated by two different mechanisms, that is, recipe books written and read by educated people (friars, nuns, physicians and alchemists) and apprenticeship mechanisms. The two sets of mechanisms may be convergent, parallel and sometimes divergent. A case of divergence is the decreasing use of Egyptian 'blue' in the course of medieval times, until its extinction on murals and MSS, although a recipe for fabricating it was available in Vitruvius' *De Architectura* and its abridgement by Faventinus. Similar divergent cases are the social uses of Maya 'blue' [75, 76], and the Hebrew colorant called *tekhelet* [77].

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