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The Use of Blue in the Ajanta Paintings

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Abstract: Blue pigments, scarcer and more expensive than many other colours in antiquity, have played an important role in global art history. In this research, I examine how the colour blue, confirmed to be lapis lazuli, was used in the wall paintings of the Buddhist caves at Ajanta. Blue is completely absent in the paintings of the 1st century BCE. Among the paintings of the 5th century CE, it was sparingly used for small details in the centrally located caves (Caves XVI and XVII), while applied in larger amounts in the peripheral caves of Ajanta (Caves I, II and XXVI). In order to explain the sudden appearance of lapis lazuli in the Ajanta paintings, historical aspects, such as trade routes and political change, are also considered in this paper.

Keywords: Ajanta paintings, Lapis lazuli, Lazurite, Natural ultramarine, Indigo, Indian art, Trade

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Introduction

Blue pigments, historically rare and more expensive than other colours, have played an important role in global art history. In this paper, I examine how the colour blue – specifically derived from lapis lazuli – was used in paintings of the Ajanta cave complex, located in today's Maharashtra, India. The site consists of 30 Buddhist caves cut into a sheer, horseshoe-shaped cliff (**Fig. 1**). The caves fall into two distinct phases: the earliest caves, numbered IX–XIII, date to the 1st century BCE; while the remainder belongs to the second phase, dated to the latter half of the 5th century,[1] the relative chronology of which will be discussed below. The ornamentation of all the caves, including both sculptures and paintings, was undertaken contemporaneously with their construction (e.g. Schlingloff 2000: 15, 74).

Fig. 1. Panoramic view of Ajanta. Photograph © Mercedes Tortorici.

Interestingly, the paintings in the earliest caves reveal no evidence of blue pigment use. Even later additions to Caves IX and X, primarily depictions of Buddha figures dated to the 5th century, show no trace of any intensive blue. In contrast, among the other caves from the 5th century that do employ blue pigment, distinct differences in its application can be observed. While some caves use blue sparingly for small details, others incorporate it more extensively, applying it to larger surfaces, such as whole backgrounds or to adorn textiles and ornamental motifs.

The blue from lapis lazuli

The pigment used for blue in the Ajanta murals has been confirmed to be lapis lazuli, according to modern tests carried out by the Archaeological Survey of India and experts from Italy and Japan.[2] Singh is certain that every instance

[1] All dates are CE unless otherwise mentioned.

[2] Conservators from the *Istituto Centrale per il Restauro* (Rome, Italy), in collaboration with the Archaeological Survey of India, conducted tests for lapis lazuli in Cave XVII and published their findings in 2008 (Artioli et al. 2008: 4–5, 8, fig. 6). Subsequently, the Indo-Japanese

of blue at Ajanta is lapis lazuli, regardless of its intensity, including the light and the greyish hues (Manager Rajdeo Singh, personal communication, 8 February 2023). He also confirmed that samples from several caves were collected and analysed using Raman spectroscopy, as well as examined under a stereomicroscope (Manager Rajdeo Singh, personal communication, 21 May 2025).

The terminology used to describe the blue from lapis lazuli in paintings presents a challenge. The blue pigment extracted from the lapis lazuli stone is usually termed ultramarine. But since this term is often confused with the synthetic ultramarine pigment developed in the 19th century, many scholars have chosen to refer to the natural pigment extracted from the stone not as "ultramarine" but simply as lapis lazuli. I consider it important to distinguish between ground lapis lazuli and natural ultramarine, i.e. extracted lazurite (see below). I will use the term "natural ultramarine" when referring to extracted lazurite, and "lapis lazuli pigment" or simply "lapis lazuli" in cases where the distinction is uncertain.

Lapis lazuli as a precious stone was highly valued in many ancient cultures, the Egyptian and Mesopotamian civilisations being the earliest prolific consumers. In ancient times, the Sar-e-Sang mines in Badakhshan (modern-day Afghanistan) were the sole known source of this stone,[3] which was exported to distant parts of Eurasia from prehistoric times onwards. The trade of lapis lazuli in the Mediterranean is mentioned in the *Periplus of the Erythraean Sea*, dated to the 1st century (Schoff 1912: 38, sec. 39). Lapis lazuli beads have also been discovered in various regions of South Asia, dating to periods far earlier than Ajanta's earliest phase (Lahiri 1992: 274, 335, 355). The term *rājāvarta*, derived from the Persian *lājvard*, is used to refer to lapis lazuli in many Sanskrit scientific texts and *kāvya* literature (Buddruss 1980). Given the prominence of lapis lazuli in many ancient cultures, it raises the question of why it was rarely used as a pigment in paintings. The reason for this may be that the natural ultramarine pigment had not yet been employed: the simple grinding of the lapis lazuli stone, unless it is of very high quality, produces a grey-blue colour rather than the intense sought-after blue (Plesters 1966: 63).

Lapis lazuli rock is composed of various minerals, such as calcite, iron pyrite, lazurite, mica and pyroxene, with lazurite being the single component responsible for its distinctive blue colour. To achieve the characteristic deep, vibrant blue, lazurite must be meticulously extracted from the rock. This extraction process is both time-consuming and intricate, which accounts for the pigment's high value

Project for the Conservation and Scientific Investigation of the Paintings of Ajanta focused on Caves II and IX, identifying the presence of lapis lazuli in Cave II (Rana and Yamauchi 2015). I am not aware of tests carried out for other caves.

3 Today, there are other lapis lazuli mines that were not known in ancient times, such as those in Chile.

and expense in ancient times. The precise time and place where this technique was developed remain uncertain. There are no literary sources providing clear instructions for the extraction of lazurite prior to the 14th century (Plesters 1966: 63). In the Mediterranean world, extensive records detail the production of other pigments, such as Egyptian blue, a cuprorivaite derivative. This suggests that ultramarine may have been primarily imported. Indeed, the term "ultramarine", derived from the Latin *ultramarinus* (meaning "beyond the sea" or "overseas") originally referred to imported commodities (Plesters 1966: 62). Moti Chandra supports a similar view for the Indian subcontinent, noting that Sanskrit literature contains no references to the manufacture of natural ultramarine pigment (Chandra 1919: 82). Lapis lazuli is mentioned as a pigment for painting in several sources, including the Buddhist Sanskrit Gilgit Manuscript from the 5th to the 6th centuries (Buddruss 1980: 9–10), the *Citrasūtra* of the *Viṣṇudharmottarapurāṇa* from the 6th to 7th centuries,[4] and the Buddhist Sanskrit-Tibetan *Mahāvyutpatti* from the 8th century (Buddruss 1980: 11). In the context of pigments and paintings, the same term used for lapis lazuli – *rājāvarta* – was employed.

It is also important to address the methods employed to identify the lapis lazuli or the natural ultramarine pigment. Prior to the 1970s, the identification of lapis lazuli as a pigment relied on detecting certain metals (copper, cobalt, iron, aluminium) or elements (silicon or sulphur). However, as these are also commonly found in materials such as clay, this approach often led to false conclusions regarding the presence of lapis lazuli. Modern technologies, such as Raman spectroscopy, allow for the precise identification of the pigment (Delamare 2013: 104). In the tests conducted on the paintings and sculptures considered for this article, it is not explicitly stated whether the material used is simply ground lapis lazuli or pure lazurite, except for the tests carried out in the Kizil caves in Central Asian Kucha (see below).

A history of lapis lazuli in paintings

The earliest known use of lapis lazuli in painting is found in Mycenaean frescoes from Gla, Greece (ca. 13th century BCE), where the pigment was discovered in a purple hue (Brysbaert 2006). Although less common than other blue pigments, lapis lazuli also appears in other Greek cultural artifacts, such as a 5th-century BCE marble vase from Athens depicting a charioteer wearing a dark blue garment (Brecoulaki 2014: 20). In Roman wall paintings from Pompeii, destroyed by the eruption of Mount Vesuvius in 79, modern testing has revealed the presence of lapis lazuli in white samples from the frame of a fresco depicting a hen, currently housed at the Museo Archeologico Nazionale di Napoli (Aliatis et al. 2011: 1541). A greyish-blue pigment from a relief in Hadda

[4] *Viṣṇudharmottarapurāṇa III,* Adhyāya 40, 25 (Mukherji 2001: 137).

(Tapa-i-Kafariha Monastery, Afghanistan), dated to the 2nd–3rd centuries, also indicates the presence of lapis lazuli. The pigment here was mixed with a white material, likely to produce a pale blue colour (Pannuzi et al. 2019: 55). Italian researchers found lapis lazuli on stucco architectural decorations of Gandharan art. They confirmed that lapis lazuli was exclusively used for blue pigments in these objects (Lluveras-Tenorio et al. 2022: 499). These samples, collected from the Swat Valley in present-day Pakistan, date to between the 2nd and 4th centuries. Tests for lapis lazuli were also made on fragments of paintings with a very intense blue found at Kara Tepe, in today's Uzbekistan (Birstein 1982: 107–108). They are dated to the 4th century.

However, in most of these examples, the deep, lustrous blue typically associated with natural ultramarine is not evident, suggesting that the lazurite extraction process may not have been employed. It is plausible that, in the cases of Gla, Pompeii and Hadda, the entire lapis lazuli stone was ground and then mixed with other pigments. There are further examples that cannot be overlooked, as they are frequently cited in literature about lapis lazuli in painting. However, to my knowledge, these lack modern testing to confirm its presence. Such examples include fragments of wall paintings or objects from Mansur Depe[5] (Turkmenistan) and Fayaz Tepe[6] (Uzbekistan), as well as examples from Sri Lanka.[7]

[5] Lapierre (1990) cites Mansur Depe as an example of the earliest use of natural ultramarine in wall paintings. This site has been dated by Koshelenko et al. (1989: 49) to between the 2nd century BCE and the 3rd century. According to descriptions by Russian experts, the paintings include blue pigments (Berlin et al. 1968: 49). However, to my knowledge, no modern testing has been conducted to confirm whether the pigment is natural ultramarine. The first paintings at Mansur Depe were created shortly after the building's construction, while later layers were added following multiple fires (Koshelenko 1989: 47). Consequently, it is important to consider the possibility that the blue layers could be later additions.
Regarding the use of blue pigments at Nisa, located just a few kilometres from Mansur Depe, Lippolis notes that preliminary analyses conducted in the early 2000s on fragments of clay sculptures identified the light blue pigment as Egyptian blue. However, a systematic survey of the blue fragments from clay sculptures or architectural elements has not yet been carried out. Thus, the use of lapis lazuli at Nisa cannot be entirely ruled out (Carlo Lippolis, personal communication, 23 December 2024). Egyptian blue, an artificial pigment made by combining quartz, sand, and copper, was widely known and used not only in ancient Egypt but also extensively throughout the Roman world.

[6] Fragments of wall paintings from Fayaz Tepe also exhibit an intense, shiny blue, suggestive of natural ultramarine. To date and to my knowledge, no tests have been conducted to date to confirm this. Fayaz Tepe was dated to the 1st–2nd centuries CE by Al'baum (for a detailed discussion of the chronology and a comprehensive description of the murals, see Lo Muzio 2008), while Lo Muzio has proposed a later chronology, suggesting the 4th century as a *terminus post quem* (Lo Muzio 2008: 201). It therefore remains possible that the paintings were added at a later stage.

[7] In Sri Lanka, lapis lazuli is believed to have been used in the painted slabs of the Jetavana Stupa, which dates to the early 4th century (Ratnayake 1993: 84). However, to my knowledge, no chemical tests have been conducted to confirm this.

The Bingling Caves, dated based on inscriptions to the Western Qin Period in the early 5th century, also feature lapis lazuli in their paintings (Li 2005: 46). Nevertheless, I cannot exclude the possibility that certain parts of the original mural were repainted at a later time or that the paintings featuring blue correspond to a later period.

The 5th century paintings at Ajanta provide some of the earliest well preserved and unequivocal examples of lapis lazuli used in wall art. Given the intensity of the colour in most cases, I believe the pigment to be natural ultramarine, rather than simply ground lapis lazuli. Contemporary with Ajanta, the paintings in the Bagh Caves, located in Madhya Pradesh, India, also exhibit a similar intense blue, though this has not yet been tested using modern technologies.

Sculptures from Tepe Narenj painted in blue, dated between the 5th and early 7th centuries, were analysed by the Italian Archaeological Mission in Afghanistan directed by Anna Filigenzi. The results of chemical analyses confirmed the use of lapis lazuli as a pigment (Giulia Forgione, personal communication, 30 December 2024).

Later than the Ajanta paintings are the wall paintings at Bamiyan (Afghanistan) and Kucha (Xinjiang, China), which are also notable examples of the use of lapis lazuli blue. The Kucha paintings, like those at Ajanta, display two distinct phases: an earlier phase without blue pigment and a later phase, beginning in the 6th century, characterised by the extensive use of lapis lazuli blue (Konczak-Nagel forthcoming). Among the sites discussed, the Kizil Caves represent the only confirmed instance where natural ultramarine pigment, rather than merely ground lapis lazuli, was used. This conclusion is supported by the archaeological discovery of a block of ultramarine pigment at the site (Zhou et al. 2019).[8]

Other blue pigments: indigo and azurite

The exclusive use of lapis lazuli for blue in the Ajanta paintings raises another question: why is indigo, the most prominently used blue pigment in India, absent from the aforementioned artworks?

Despite India being a major exporter of indigo, at least as a dye,[9] historical Indian art texts, such as the *Śilparatna*, specifically describe indigo as unsuitable for paintings on a lime plastered wall (Giuliano 2013: 100). As an organic pigment, indigo presents additional challenges for detection compared to mineral-based pigments. While traces of an organic blue, such as indigo, might exist in certain

8 I thank Ines Konczak-Nagel for this reference.

9 A dye is meant to be dissolved in water, in which the textiles or other objects are soaked to gain the colour.

green and black mixtures in the Ajanta paintings (Giovanili et al. 2012: 36), its presence remains uncertain and requires further study.

Indigo can be extracted from several different plant species in the genus *Indigofera* that grow all over the world. After a very complicated extraction process, the dried tincture could either be used as a dye or a pigment. Historically, one of the most famous indigo-bearing plants was the *Indigofera tinctoria* cultivated in India, from which the colour indigo took its name: the Greek *indikon* and the Latin *indicum*, meaning "coming from India". Indian indigo was mainly used as a dye for textiles. Indian blue-dyed textiles where even exported from India to the Roman world (Wild 2006: 183; Sidebotham 2011: 243–244).

The oldest find of indigo as a pigment is from Mycenaean Greek painted plaster from the Late Bronze Age (Brysbaert and Vandenabeele 2004: 691). The ivories of Begram, dated to circa 1st century, were painted with indigo (Passmore 2012: 44). Other early samples of this pigment were found on some antique shields from Dura Europos dated to the 3rd century (Gunnison et al. 2020: 140), in the Mayan frescoes at Bonampak in Mexico also dated to the 3rd century (Eastaugh et al. 2004: 195),[10] and in the mural paintings of the Xinjiang region in the P.R. of China from the 6th century (Riederer 1977: 375ff). Since the different samples of indigo derive from different *indigofera* plants, it is very difficult to trace a linear history of indigo production and use, and make conclusions about possible intercultural relations which may have affected the industry. For example, even though contemporaneous, it is evident that the Mayan indigo found in Mexico had absolutely nothing to do with the pigment used in Dura Europos.

As an organic pigment, indigo has a low resistance to light (Schweppe 1997: 88) and loses its intensity when exposed to UV radiation (see for instance, Ogura et al. 2019: 9). Perhaps for this reason, samples of paintings from the Kizil Caves 198–199 (*Teufelshöhle*) analysed by Riederer (1977: 375) showed that indigo results in a grey-blue colour.[11]

Nevertheless, in India, indigo use as a pigment seems to lack any precedent in wall painting until the 18th century (Sharma and Singh 2021). Azurite, a mineral often found in many areas of the Indian subcontinent, is also absent from the Ajanta paintings (Giuliano 2013: 100). As mentioned earlier, the only blue pigment used at Ajanta is lapis lazuli.

[10] This blue pigment, the so-called "Mayan blue" is not pure indigo, but an artificial combination of indigo (from *Indigofera suffruticosa*) and palygorskite (attapulgite), which makes the pigment very resistant to wear and fading.

[11] Riederer (1977: 388) also notes that indigo samples were always found mixed with ultramarine blue.

Blue in the visual language of Ajanta

From a visual language perspective, it seems that specific conventions governed the use of blue in the Ajanta caves. Sometimes, this colour was used symbolically to emphasise the sacredness of significant figures, such as in nimbi (**Fig. 2**), the backgrounds of certain deities and the Buddha's hair in some sculptures (**Fig. 3**). With the same intention to enhance, blue was applied in ornaments framing important scenes or figures (**Fig. 4**).

Blue is also used in a more a naturalistic way to depict textiles (**Fig. 5**). As mentioned before, India was the major exporter of indigo as a dye, and Indian blue-dyed textiles reproducing ornamental motifs depicted at Ajanta were found at the Roman port of Berenike, on the Red Sea in Egypt (Wild 2006: 183; Sidebotham 2011: 243–244). It is therefore reasonable to conclude that blue textiles, dyed with indigo, were worn by the population in India. In the paintings at Ajanta, however, these indigo-dyed textiles are not depicted using indigo itself – due to its unsuitability as a pigment – but are instead represented with lapis lazuli.

It is noteworthy that the presence of blue attire in Ajanta paintings does not necessarily indicate social distinctions; it can be observed both among royalty and beggars. Ornaments, beads of necklaces, armbands and girdles are very often blue (**Fig. 6**). Blue is also associated with musical instruments, such as cymbals and flutes (**Fig. 7a, b**). In addition, its use to depict metal weapons, like swords (**Fig. 8**), was a convention that was passed on to Central Asian Kucha.

The colour blue is used either in the details, like a single blue bean in the centre of a necklace (**Fig. 6**), or a delicate blue flower in the ornamental composition of a ceiling (**Fig. 9**); or on larger surfaces, like a celestial background (**Fig. 10**) or an architectural element of a depicted scene (**Fig. 11**).

In short, the colour blue was usually used either with a symbolic or a naturalistic intention. In only two rare cases, it was used to achieve a certain effect in the visual composition, like rhythm or balance. That can be seen in the *Mahāprātihārya* (Schlingloff No. 91)[12] mural in Cave XVI, which depicts the arrival and departure of King Prasenajit's entourage, and features blue on swords, musical instruments and the eyelids of some of the figures. The blue details create a visual rhythm that suggests the musical rhythm of a performance (**Fig. 7a**). It is also interesting to note that blue is used in another musical performance depicted on a side wall of Cave I (Tortorici 2022) to enhance the visual rhythm and, at the same time, balance the visual composition (**Fig. 12**).

[12] For the narrative paintings, I am following the identifications in Schlingloff (2000).

Fig. 2. Ajanta Cave XXVI, triforium, left. Buddhas' nimbi. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Ajanta: cave by cave visual analyses[13]

The caves without blue

The paintings from the 1st century BCE in **Caves IX** and **X** exhibit a conspicuous absence of blue pigment. In the later additions to these caves, attributed to the 5th century, the nimbi and Buddha's throne, which in other caves are rendered in blue, appear instead in green. Similarly, the stones in necklaces are red rather than the blue seen elsewhere. While some areas in the background might contain traces of blue, it remains unclear whether these hues are grey-blue, light blue or simply grey. Even if a light blue were present, it would differ significantly from the deep, vibrant blue seen in other locations.

Caves XII, **XIII** and the small **Cave XXX**, also dating to the 1st century BCE, lack paintings and are coated only with red plaster. Similarly, several caves – particularly the unfinished ones – from the 5th century are devoid of any paintings. For instance, **Cave III** is largely incomplete and entirely

[13] The present research was done mainly based on the available visual material of the Ajanta Archives at the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road", and photographs available on online public sources.

Fig. 3. Ajanta Cave XX, shrine. Main Buddha sculpture with traces of blue on the hair. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" /Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Fig. 4. Ajanta Cave XXVI, triforium, left. Detail of blue on carved reliefs. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

unornamented, while **Cave XVIII** serves as a passageway between **Caves XVII** and **XIX** and features no decoration. Likewise, **Caves XXV** and the entirely inaccessible **Cave XXVIII** remain unfinished and unadorned.

Several unfinished caves also feature reliefs but no paintings. **Cave V**, though unfinished, includes carved depictions of loving couples and goddesses on the doorframe, but the interior remains incomplete and undecorated. **Cave XXIII**, likewise unfinished, lacks both a central Buddha figure and wall paintings. While some pillars in the porch and main hall display carved reliefs, none retain any traces of blue pigment. Similarly, **Cave XXIV**, though partially cut, features intricately ornamented pillars on the veranda and main hall, as well as depictions of loving couples and goddesses on the porch. However, no evidence of painted surfaces is present.

Among the caves that contain painted ornamentation, the richly sculpted antechamber of **Cave IV** features standing Buddhas and other high reliefs, while the shrine contains a seated Buddha flanked by whisk-holding attendants.

Fig. 5. Ajanta Cave II, main hall, right side wall. Blue undergarments and cushion of painted figures. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Despite the presence of painted remnants on these sculptures, no blue pigment can be identified.

In **Lower Cave VI**, no blue is visible in the wall paintings of the antechamber. A very dark blue hue is present only in certain ornamental patterns and carvings (see below). Similarly, the antechamber and shrine of **Cave VII** are adorned with carvings, and the main Buddha figure is flanked by sculptures, but no traces of blue pigment are visible. While remnants of paintings exist in the halo of the main Buddha and on the porch ceiling, these are heavily discoloured, rendering any identification of colours impossible.

Cave XV includes some paintings on the ceilings of the shrine and antechamber, but no blue pigment can be discerned. The Buddha figure in the main shrine and later reliefs similarly lack traces of blue. **Cave XXVII** contains faint remnants of greenish or turquoise pigment in a ceiling painting, with no other visible decoration.

Fig. 6. Ajanta Cave I, main hall, left side wall. Necklace, armlet and girdle with blue details. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Fig. 7a. Ajanta Cave XVI, main hall, left rear wall. Scene from the *Mahāprātihārya.* Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Cave XXIX, which is highly inaccessible and was discovered later, is situated in the elevated area above **Cave XXI**. This cave remains largely unfinished, with only a portion of the vault visible. Based on the sole available photograph (Spink 2009: Fig. 184), no discernible paintings can be identified.

The caves with blue

Ajanta **Cave I** features the most extensive and prolific use of an intense blue pigment. Many murals in this cave include at least some elements – if not large surfaces – painted with a deep, lustrous blue. This vivid hue is also applied to various details such as garments, cushions, jewellery, and architectural features like columns and roofs. The use of this pigment is widespread, appearing on nearly every wall and column with only a few exceptions. No traces of blue are present in the depictions of *Nāgakumāra* (Schlingloff No. 76) and *Prabhāsa* (Schlingloff No. 53), which occupy a significant portion of the right wall in the main hall, or in the mural depicting the *Mahāprātihārya* (Schlingloff No. 88), located on the right wall of the antechamber. In addition, the background colour in the depiction of *Sudhana* (Schlingloff No. 40) on the left front wall of the cave remains uncertain. Depending on the photographic material, it

Fig. 7b. Ajanta Cave XVI, main hall, left rear wall. Scene from the *Mahāprātihārya.* Drawing © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Matthias Helmdach. The CC BY-ND 4.0 licence does not apply to this picture.

appears as either a grey-blue or green/turquoise (**Fig. 13**). However, the intense blue observed elsewhere in the cave seems absent in the surviving portions of this particular mural.[14] A similar turquoise colour is also present on the ceiling of the main hall, where no traces of intense blue can be found.

[14] The section of Sudhana depicted on the left sidewall features significant use of blue; however, Schlingloff's (2000, 2013) identification of this part as Sudhana narrative should be called into question (Tortorici 2022).

Fig. 8. Ajanta Cave XVII, veranda, left side wall. Blue sword. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

The interior of **Cave II** contains several examples of murals incorporating blue pigment. These include small details on the crown of a *bodhisatva*,[15] various other pieces of jewellery, floral motifs, textiles (**Fig. 5**) and architectural elements (**Fig. 11**).[16] In the main hall, most of the murals feature at least some details in blue, except for a single painting on the right sidewall (depiction of *Ruru*, Schlingloff No. 16) and three on the left sidewall: two murals depicting rows of Buddhas and the unfinished wall-painting depicting the story of the *Bhagavatprasūti* (Schlingloff No. 65). In this particular wall painting, the clothing and ornaments are remarkably pale compared with other paintings in Ajanta. For instance, the central bead of necklaces worn by figures, which is typically blue or red elsewhere, appears plain white or light grey in these cases. The ceiling of the right-side chapel dedicated to Hārītī is adorned with ornamentation in a rich, intense blue. The sculpture of Hārītī herself inside appears to retain traces of dark blue on her hair (see photograph in Takata 1971: 101).

15 The spelling of Bodhisatva with one *t* is intentional. See Bhattacharya (2010).

16 For describing non-narrative and ornamental motives, I am following the identifications of Zin (2003).

Fig. 9. Ajanta Cave XXI, main hall, ceiling. Ornamental floral motifs. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

The sidewalls of the antechamber present murals without blue, while the reliefs depicting loving couples at the entrance of the shrine present backgrounds of an intensive blue. Inside the shrine, the Buddha sculpture is flanked by two sculpted whisk-holding attendants, both of whom retain traces of blue pigment in their hair. The backgrounds behind these figures are also painted in blue, and the Buddha's nimbus similarly shows remnants of this vibrant hue. All other paintings in the shrine lack any intense blue.

At front of the cave, the paintings inside the left (depicting the stories of *Kṣāntivādin* and *Maitrībala*, Schlingloff No. 34 and 52) and right chapels (depicting the stories of *Bhūridatta* and *Prabhāsa*, Schlingloff No. 61 and 54), located on either side of the veranda, are not well preserved and seem to lack any blue. However, in the veranda the use of blue is more extensive, appearing in the backgrounds of *bodhisatva* landscapes (**Fig. 10**), depictions of Indra's heaven, and the ceiling's ornamental patterns. In addition, the reliefs on the upper wall of the veranda's right side show faint traces of blue paint.

Fig. 10. Ajanta Cave II, veranda, left rear wall. Celestial background. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Ajanta **Cave VI** is unique in that it comprises two levels, one above the other. As previously mentioned, the wall paintings of the **Lower Cave VI** do not exhibit any intensive blue. However, some of the ornamentation displays a very dark blue colour, which appears almost black depending on the light conditions. For example, in the side ornamentation of the shrine's entrance is a checked pattern that contains traces of this dark hue. Moreover, the carvings on the shrine's entrance retain remnants of dark blue paint.

In contrast, **Upper Cave VI** features a striking use of a vibrant, shiny blue pigment. The main Buddha sculpture exhibits traces of blue in its background, particularly beneath the Buddha's right arm. In the antechamber, a minor standing Buddha on the left wall displays a thin blue line on its nimbus. A lateral chapel located on the right side of the front transept showcases blue pigment in several notable ways. On the doorframe of this chapel, the figures depicted to the right of the entrance have blue-painted backgrounds (**Fig. 14**). Their ornaments and attire also include blue details, such as the belt of the male figure on the left, the central bead of the necklace worn by the female figure on the left,

Fig. 11. Ajanta Cave II, main hall, right side wall. Textiles with blue details and architectural elements. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

and elements of the male figure on the right. The reliefs on the right wall of this lateral shrine further reveal traces of blue on the backgrounds and on the nimbi of the seated Buddha figures. Notably, this lateral chapel currently displays the most extensive use of blue pigment in Upper Cave VI.

In the paintings located on the veranda of **Cave XI**, a grey-blue hue is used as the background for the Bodhisatva landscapes. However, no traces of the intense blue pigment are found here.

In **Cave XVI**, only two mural paintings feature the use of blue pigment. On the left rear wall, in the depiction of the *Mahāprātihārya* (Schlingloff No. 91), blue was applied to the lotus at the Buddha's feet, parts of the ornaments of the *nāga*s, and the dress of King Prasenajit. In the adjacent scene, blue can also be observed on the swords, some musical instruments and the eyelids of several figures (**Fig. 7a, b**). On the right-side wall of the cave, the entire life story of the Buddha is illustrated (Schlingloff No. 64). This large mural, comprising more than thirty scenes – only a few of which are missing due to deterioration –

Fig. 12. Ajanta Cave I, main hall, left side wall. Musical performance. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

contains just one scene where blue pigment is evident. This scene (**Fig. 15**) was identified by Foucher (1921: 222–223) as depicting the Buddha's conception, in which the Bodhisatva enters the womb of his sleeping mother in the form of an elephant. In contrast, Schlingloff (2000, 2013) interpreted it as the renunciation scene, portraying the future Buddha gazing at his wife for the last time before departing the palace. The female figure is shown sleeping, with her feet resting on an oval cushion and her head supported by a blue pillow. At least one of the columns beside her bed is also painted blue.

Ajanta **Cave XVII** contains a greater amount of blue pigment compared to Cave XVI. The hair of the main Buddha sculpture located in the shrine shows traces of blue pigment. At least eight murals feature blue details, including the depiction of the story of *Sutasoma* (Schlingloff No. 57) on the left rear wall; the stories of *Viśvantara* and *Haṃsa* (Schlingloff No. 43 and No. 14) on the left side wall; the story of *Mṛga* (Schlingloff No. 19) on the right front wall, a *yakṣiṇī* on the first pilaster of the right-side wall, and numerous murals on almost every wall of the veranda. The blue-painted elements include various textiles such as

Fig. 13. Ajanta Cave I, main hall, front left wall. Turquoise background behind figures. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

dresses, cushions and pillows, as well as jewellery like necklaces and armbands, animals, swords and depicted architectural elements. Notably, the depiction of the wheel of rebirth (*saṃsāracakra*, Zin 2003, vol 1: 440–456) on the left-side wall of the veranda stands out. Here, blue is employed not only for small details within the representations of each realm but also for entire small figures, such as cows and male deities (**Fig. 16**). The *cakra* itself – the circle encircling all the realms – features blue ornamentation.

The paintings in **Cave XIX**, which depict seated Buddha figures on the side walls, also incorporate blue details, such as throne cushions, nimbi and various ornaments. Similarly, the relief sculptures display blue accents, including decorative elements on figures and framing details around the sculptures. This suggests that decorating sculptures with blue pigment was a common practice.

A similar pattern can be observed in **Cave XX**, where subtle traces of blue are visible in the Buddha's hair (**Fig. 3**) and his background – on the throne, cushion and nimbus. One of the goddesses carved into the shrine's doorframe also exhibits remnants of blue pigment.

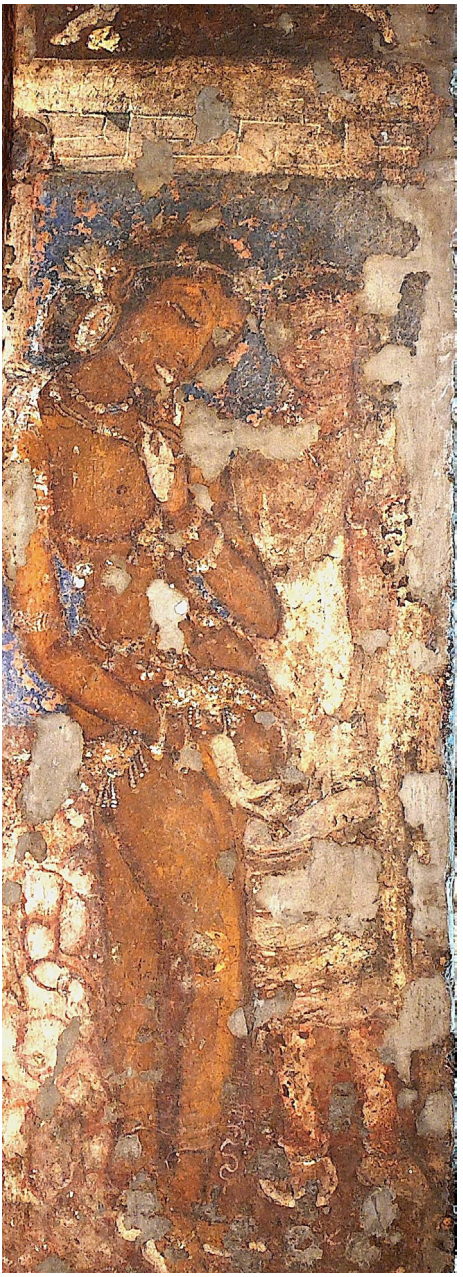

Fig. 14. Ajanta Upper Cave VI. Right side chapel, doorframe. *Yakṣinī* with blue background and details. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

In **Cave XXI**, the ceiling displays blue ornamentation in the form of volutes and flowers (**Fig. 9**). A painting on the left side wall also features blue details, such as backgrounds and jewellery worn by some of the depicted figures.

Cave XXII features traces of vibrant blue pigment. Notably, remnants of this intense blue can be observed in a relief depicting a Buddha located on the left rear wall of the main hall, beneath the Buddha's arm. In addition, some of the Buddha figures painted on the right rear wall of the main hall are depicted with a blue cushion on their back.

Cave XXVI's ceiling is richly painted with intensive blue ornamentation. While the rest of the cave is carved, its sculptures also retain traces of blue. For example, on the triforium near the central *stūpa*, remnants of blue paint on the reliefs suggest that not only the Buddhas' nimbi but also the framing and dividing ornamentation were originally entirely covered in blue pigment (**Figs 2** and **4**).

Fig. 15. Ajanta Cave XVI, main hall, right side wall. *Bhagavan*, "renunciation" scene. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

The relative chronology of Ajanta

The cave-by-cave analysis described above reveals that blue was entirely absent in the earliest paintings of the 1st century BCE located in Caves IX and X. Moreover, some caves from the 5th century, such as Cave IV, Lower Cave VI and Cave XV, exhibit a complete absence of blue pigment.

Among the caves boasting blue, some differences can be observed: caves located at the centre of Ajanta display a moderate use of blue, whereas caves on the eastern side, such as Caves I and II, show a significantly higher concentration. A similar pattern is observed at the opposite end of the site in Caves XXI and XXVI, where remnants of blue paint on the sculptural reliefs suggest that these decorations were predominantly covered with blue. The possibility that this blue pigment was applied during later periods over sculptures seems unlikely, since Ajanta was abruptly abandoned. Cave VI exhibits a striking distinction between its two levels: the lower cave entirely lacks blue pigment, while the upper cave shows a profuse application of blue, particularly in a lateral chapel.

Fig. 16. Ajanta Cave XVII, veranda. *Saṃsāracakra*, the divine realm. Photograph © Ajanta Archives of the Saxon Academy of Sciences and Humanities, Research Centre "Buddhist Murals of Kucha on the Northern Silk Road" / Andreas Stellmacher. The CC BY-ND 4.0 licence does not apply to this picture.

Several scholars have attempted to establish a relative chronology for the Ajanta caves of the 5th century to determine the sequence in which they were created. Based on stylistic analyses of the paintings, Kramrisch (1937), for instance, suggests that Caves XVI and XVII predate Caves I and II. The caves that Spink (2007) considers to be the earliest of this phase – Cave IV, Lower Cave VI, and Cave XV – lack any significant use of intensive blue. In contrast, the caves he identifies as later exhibit a prolific application of blue.[17] While his intricate and arguably unrealistic "short chronology" of 16 years (Spink 1992) is hard to accept, his relative chronology aligns with my observations regarding the use of blue.

[17] Although Cave XXVI is regarded by Spink (2007: 312) as one of the earliest of the second period, its sculptural decoration with intensive blue is described as "clearly late, contributing to the widespread perception that this cave represents one of Ajanta's most recent undertakings" (Spink 2009: 58). A comparable situation is observed in Cave XI, which, despite being an earlier excavation (Spink 2007: 141), features veranda paintings in a grey-blue that belong to a later phase of ornamentation (Spink 2007: 157–159).

From this, it can be concluded that the earliest 5th-century caves show no significant use of blue, whereas the later caves display a gradual increase in its use. Given that all the caves from the second phase of Ajanta date to the latter half of the 5th century, this suggests a sudden rise in the availability of lapis lazuli pigment in the region during this period.

Historical context

The Indian trade routes

It is well established that India maintained from ancient times extensive trade connections with various parts of the world. The northern Indian trade route, known as the Uttarāpatha, connected the Punjab region to the confluence of the Ganges and Yamuna rivers. Rather than being a single pathway, it comprised a complex network of shifting routes, as is well documented in Sanskrit literature. Another significant trade route was the Dakṣināpatha, which linked the northern region through the Deccan plateau with southern India. Notably, the Ajanta caves were situated along this route, and numerous other important Buddhist sites, such as Bharhut, were either directly located on it, in close proximity to it (e.g. Sanchi), or indirectly connected through other routes (e.g. Nasik, Karli, Junnar).

Indian trade with the Roman Empire also is well-documented (see Evers 2017). The aforementioned *Periplus of the Erythraean Sea* provides detailed descriptions of numerous Indian ports where goods were both imported from and exported to the Roman Empire, with specific mention of the various commodities involved (Schoff 1912). Additionally, as mentioned before, Indian textiles were discovered at the Roman port of Berenike (Sidebotham 2011: 243–244). Both Indo-Iranian (see for instance Kumar 2023) as well as Southeast Asian (e.g. Ray 2021) trade connections were also very well established by the times of Ajanta's second phase.

Therefore, the sudden increase in the availability of lapis lazuli in India during the second half of the 5th century cannot be attributed to the emergence of new trade routes in Indian territory, as these routes had been in place for many centuries by that time. Nevertheless, a certain change occurred in the north: based on Chinese pilgrim accounts, there was a change in the pilgrim route from China to Gandhara at the beginning of the 6th century. While the previous route arrived in Gandhara from the northeast, the route described in the years 518–520 came from the north. This means, that by the end of Ajanta's second phase, the last years of the 5th century and the beginning of the 6th, the route passed through Zebāk and Chitrāl, closer than ever to the Badakshan mines. Later in the 6th century, the route changed again, tending to the west (Kuwayama 2006). Although Kuwayama (2006) only refers to pilgrim routes, it is very possible that the trade routes also experienced a change.

The political landscape

While the Indian trade network remained stable during the 5th century, the political landscape underwent significant changes. The fall of the Gupta Empire, which controlled much of northern India and maintained numerous alliances across the subcontinent, brought about a radical transformation of the political landscape. Ajanta, located within the territory of the Western Vākāṭakas, was likely impacted by the political upheavals occurring in the northern regions.

The Gupta Empire reigned over vast expanses of India during the 4th and 5th centuries. Marriage alliances with the Nāgas in the West and the Eastern Vākāṭakas in Central India enabled the Guptas to control the connections between overland networks and ports in Western India. After a period of relative stability in the first half of the 5th century, the Gupta dynasty experienced a sudden decline due to various factors, including internal strife, external threats and the increasing autonomy of regional subordinates (Neelis 2011: 155). The primary external threat during this time came from nomadic groups invading from the north. By the reign of Skandagupta (456–467), the "Hūṇas" – as they are referred to in Sanskrit sources and inscriptions – were exerting significant pressure. This is exemplified by the Bhitari stone pillar inscription, in which Skandagupta claims to have defeated them (Bakker 2020: 14, 41).

The group referred to as "Hūṇas*"* appear to have identified itself as the Alchon, based on numismatic evidence. The Alchon distinguished themselves from the Kidarites.[18] They were also connected to the Hephthalites,[19] as suggested by numismatic evidence: Hephthalite coins found in Bactria bear the same clan symbol (*tamga*) that appears on Alchon coinage (Alram 2016: 98).

The Alchon reached northern South Asia, including the Kabul Valley, Gandhara, Punjab, Gujarat and Malwa. Although little is known about the nature of their relationship with the Kidarites, there is no evidence to suggest that the two groups did not coexist peacefully (Pfisterer 2013: 42, Alram 2016: 71). Grenet (2002: 212–213) observes a proliferation of Indian cultural elements in Bactria and Sogdia during the fifth century, which may further indicate close contact between the Alchon[20] in India and the Kidarites and Hephthalites in these regions. A silver vessel dated to the second half of the 5th century

[18] The Kidarites began minting their own coinage in the second half of the fourth century and established a presence in Bactria and Sogdia, later extending their influence as far as Uddiyana in the Swat Valley, as well as Gandhara and Taxila in present-day Pakistan (Alram 2016: 35–36).

[19] The Hephtalites constituted another branch of the Huns that conquered Bactria in the latter half of the 5th century and subsequently expanded into Sogdia and Tokharistan.

[20] The author refers to the Alchon as Hephthalites but discusses Alchon rulers such as Toramāṇa, Mihirakula, and Khiṅgila in his paper (Grenet 2002: 211–212).

and discovered in Swat depicts two Kidarite elite members hunting alongside two members of the Alchon elite (Göbl 1967 II: 263–265, Marschak 1986: 32–33, Alram 2016: 71, Bakker 2020: 24–25), an image that has been interpreted as evidence of peaceful coexistence between the two groups (Errington 2010: 149).

Despite their fierce reputation, Hephthalites, Kidarites and Alchon served as both political and cultural intermediaries between India, Iran and Central Asia. They played a pivotal role in fostering trade and facilitating the spread of Buddhism (Neelis 2011: 169).

The Alchon fought against the Guptas and extended their reach into former Gupta territories, including Gujarat and Madhya Pradesh. Several dynasties from northern India acknowledged the authority of these invaders (Ferrier 2015: 185–186).[21] The Alchon's presence in India is documented in several inscriptions, including Buddhist donations (Melzer 2006), highlighting their influence on the cultural landscape. However, their dominance in India was short lived. By the mid-6th century, concurrently with the decline of the Hephthalites in Central Asia, the Alchon's power in India began to wane (Bakker 2020: 98).

Trade seems to have been florescent during Alchon's domination in northern India. Kuwayama (2002: 111–112) notes that the Alchon[22] engaged in conflict with Kashmir not to acquire territory, but to gain control over trade with the Salt Range region.

By the late 4th century, the Alchon had taken control of the Kabulistan region. Initially, they began minting their own coins following Sasanian models. The earliest Alchon coins bear the legend *alchanno* added to the Sasanian design, while subsequent issues feature the Alchon *tamgha* on the right (Pfisterer 2013: 32–33). In a later phase, the Alchon began issuing coins with entirely new designs, portraying their kings with the characteristically elongated skull. They also introduced coins bearing Indian Brāhmī legends, some of which are bilingual, with inscriptions in both Brāhmī and Bactrian. Although the texts in the two scripts do not replicate each other, but rather complement one another (Pfisterer 2013: 35), their bilingualism serves as evidence of the Alchon's transcultural intentions.

A copper-plate inscription dating to the reign of Toramāṇa, one of the Alchon rulers, records a donation made by a group of local traders as well as long-distance merchants arriving from all directions, including individuals with non-Indian names (Chakravarti 2008: 396–397). This inscription was discovered

[21] Ferrier refers to the northern invaders in India as Hephthalites and does not mention the name Alchon.

[22] The author refers to this group as the Hephthalites rather than the Alchon.

in Sanjeli, present-day Gujarat. The record not only suggests the existence of long-distance trade networks but also indicates a general flourishing of trade in a region under Alchon occupation.

Through their trade and political networks, the Alchon acted as political and cultural intermediaries between India and Central Asia, contributing to the development of transregional trade (Neelis 2011: 161).

Bakker (2020: 80) suggests that the Alchon's strength lay not solely in their military prowess but in their acumen as traders. Their connexions with Central Asia likely amplified the volume of goods exchanged within the pre-existing Indian trade network, possibly introducing new commodities, like the once rare and costly natural ultramarine pigment.

Conclusion

The technology to extract lazurite from lapis lazuli probably did not exist before the early centuries of the Common Era. The tested lazurite from Gla or Pompeii might have simply been ground lapis lazuli stone, since the evidence from both sites lacks the typical intensive blue of ultramarine. The oldest and most clearly preserved examples of natural ultramarine in wall paintings are the Kara Tepe paintings of the 4th century and those in the Bingling caves of the 5th century, provided that the dating is accurate, and the caves have not been repainted at a later stage. The next certain examples, and the oldest on the Indian Subcontinent, would be the Ajanta paintings in the latter half of the 5th century. The examples of Sanskrit literature mentioning lapis lazuli as a pigment for painting are all dated between the 5th and the 8th centuries, support the idea that natural ultramarine was not popular in South India before this time.

For this reason, I propose that the process of extracting lazurite from lapis lazuli to produce the intense blue of natural ultramarine pigment likely developed no earlier than the 4th century. This hypothesis is based on examples such as those from Kara Tepe, where an intense ultramarine colour is observed, although these have not yet been scientifically tested. Therefore, it is plausible that ground lapis lazuli continued to be used in certain contexts where the natural ultramarine pigment was unaffordable.

The main conclusion of this article is derived from observations of the Ajanta caves. The earliest paintings from the second phase, dating to the mid-5th century, along with additions and over-paintings in earlier caves, lack blue pigment. However, caves in their vicinity, which appear to be only slightly later, exhibit a moderate use of blue. In contrast, caves displaying extensive use of blue are located on both outlying sides of the "horse-shoe" and are associated with the latest phase of construction and decoration. This study does not seek

to establish a revised chronology or definitive dates but rather to support the accepted relative chronology for the development of these caves during the second half of the 5th century.

A sudden increment of natural ultramarine in India towards the end of the 5th century may be explained through the florescence of trade during the Alchon domination of northern India. Brancaccio (2013: 114) suggests that Buddhist monks played a significant role in the diffusion of artistic motifs. It cannot be ruled out, therefore, that it was monastics themselves who brought the pigment from the north. The sudden increase in the availability of the pigment could, consequently, be attributed to increased exchanges among monks and nuns. Around the end of the 5th century, Brancaccio (2011) notes a growing influence of the Gandharan region on India,[23] which implies stronger connections with the Gandharan territories. She further attributes these connections to the presence of the Alchon (Brancaccio 2011: 105–107).

The basic idea that the increased availability of lapis lazuli as the result of the increased wealth of donors and their ability to spend larger amounts on the expensive natural ultramarine can also not be dismissed. Increased wealth could be also result of trade, which would be, again, due to the influence of the Alchon.

Yet, another question lingers unanswered: the Ellora caves, dating later than Ajanta to the 6th and 7th centuries, and the paintings in Badami, which also date to this period, exhibit no traces of blue pigment (Sharma and Singh 2021, Table 3).[24] Why did this pigment, once prevalent during the Ajanta period, vanish from Indian art for a century?

The Alchon's power dissipated following the fall of Toramāṇa (ca. 500–520) and his son Mihirakula (ca. 520–550), coinciding with the decline of Hephthalite authority in Central Asia during the mid-6th century. Was the retreat of the Alchon also responsible for the lack of natural ultramarine in India during the 7th century? I leave this question open for future research.

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[23] Brancaccio refers for instance to the monumental *parinirvāṇa* sculptures of the 5th century, most of them concentrated today in Afghanistan, but also present in Indian Caves in Ajanta and Aurangabad, both in Maharashtra (Brancaccio 2011: 198–199). A fragment of wall-painting found at Jinan Wali Dheri, in today's Pakistan, shows a style extremely close to those of Ajanta (Brancaccio 2013: 111).

[24] The dating offered in this table for the Bagh Caves as the 7th century cannot be accepted. The paintings are contemporary to Ajanta.

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Abbreviations

Schlingloff = Schlingloff (2000, 2013: vol. I).

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