

Enquiry into the colours of the MoGao murals at DunHuang from the Sui Dynasty, the Tang Dynasty and the Five Dynasties period

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ABSTRACT

In 1961 the site of the MoGao cave temples was recognised as one of the State Priority Protected Sites by the State Council of the People's Republic of China and was put under the protection of the national laws including the Law on the Protection of Cultural Relics. To a great extent, this was a result of the work of the DunHuang Academy, which was established in 1944 for research into and preservation of the site. In 1987 UNESCO added the MoGao Caves to its protected World Heritage Sites as one of intrinsic unmatched historic value to humanity. In the following year, the Getty Conservation Institute became involved in an international collaborative project aimed at furthering research into the site and expanding its conservation programme. The present paper enquires into the appearance of colours used in the representational system of the murals from periods of the Sui Dynasty (581-618 AD), the Tang Dynasty (618-907 AD) and the Five Dynasties (907-960 AD). The selected periods demarcate the golden era in the history of the MoGao temple complex. The historically grounded enquiry aims at gaining a deeper understanding of the DunHuang murals as emblematic of Chinese civilisation and increasing awareness of them amongst a non-Chinese speaking audience. The use of colour will be discussed in the context of the traditional 'five colour system'.

KEYWORDS DunHuang murals, Colour appearance, Chinese culture, Wuxing, Ancient Chinese art

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1. Introduction

DunHuang in the Gansu province is one of the oasis towns in northwest China. It was established as a garrison under Emperor Wu (141-87 BC) of the Han Dynasty in 111 BC as a defence against the Xiongnu, a confederation of nomadic, non-Han tribes. DunHuang was strategically placed, controlling the entrance from the west at the frontiers of the Hexi Corridor. The narrow Hexi passage led to the Chinese plains and the ancient capitals of Chang'an and Luoyang.

DunHuang was also at the crossroads of the ancient Southern Silk Road, the main route leading from India via Lhasa to Mongolia and Southern Siberia. This allowed continuous communications between central China and the Western regions, a term often employed by Chinese historians to refer to all the lands to the west of China, such as the Indian subcontinent, Central Asia, the Middle East and Europe.

Though the Silk Road aided military operations it was primarily intended for long-distance trade. The active exchange of material goods between many nations along the route inevitably provided the means and the opportunities for active cultural exchange. Ideas, beliefs, ideologies, technology, and art flowed easily from one country to another. One of the greatest impacts on China was the introduction of Mahāyāna Buddhism and the subsequent development of the school of Chinese Buddhism. It was introduced by travelling monks, believed to be from the region that was known as Gandhāra. Today the territory of Gandhāra is mainly within Pakistan, but some parts are also within the borders of Afghanistan (Fowler, 2005)

The introduction of Mahāyāna Buddhism resulted from the effort of numerous Buddhist missionary monks who began propagating the faith somewhere between the first and second century AD. By the fifth century AD, Buddhism had become established, gaining a privileged position amongst the array of beliefs and practices that already existed in China. A significant role in the propagation of the new religious belief was played by the Chinese nobility, who were amongst the first converts and had the means to sponsor the missionaries in their travels and work.

Where the development of Buddhism in China is concerned, there appears to have been a cross-fertilisation of ideas and beliefs, where the incorporation of elements and practices from the prevailing Taoist and Confucian schools resulted in the creation of a new strand of Mahāyāna Buddhism around the sixth century AD, the Chinese school of Mahāyāna, also known as Chan Buddhism (Lin, 2009). The Hexi Corridor and the interconnectivity of the Silk Road allowed this school of

Buddhism to be disseminated across China and eastwards to Japan (Zen Buddhism in Japanese) and southwards to Vietnam and Korea.

Both Confucianism and Taoism are Chinese philosophical schools of thought that date from around 550 BC. The two seem to complement each other in their attempts to find ways in which to refine, order and harmonise the life of humans either as individuals or as part of a social structure. Confucianism focuses on the creation of orderly social life via the rational organisation of the individual's life by following a framework of ethics and ritual. If those two are followed they build or transform the inner nature of human beings. There is no such concept as immortality or the afterlife as Confucianism is interested solely in the present. Taoism focuses on both the natural world and, through an understanding of it, gains an understanding of human nature. A balanced individual life creates a balanced society. It teaches that immortality is achievable via personal practices of meditation and self-knowledge. (Maspero, 1981: 46)

The ultimate goal of a Buddhist's life is achieving salvation. Mahāyāna Buddhism is a school that shows the way to the Pure Lands (Paradise) not only to those under monastic orders but also to those who are in the world. The permeation of ideas from both Confucianism and Taoism at the formative stage of Chinese Buddhism was made possible because of some liminal similarities with ideas at the heart of Buddhist doctrine, for example, Confucianism's concern with high ethical standards, reliance on specific rituals and adherence to spiritual discipline. With Taoism, the associations with the ideas of Mahāyāna Buddhism are even closer, for example, meditative practices and distancing from the secular world paving the way to immortality/ salvation (Lin, 2009).

From the very beginning, the missionaries disseminated Buddhism mainly by teaching and translating their holy scriptures into the Chinese language. The earliest preserved translation is from the second century AD. It seems to have arrived via the Empire of Kushan along the Silk Road. At that time Kushan occupied territory that at the present day includes Afghanistan, Pakistan, Nepal and northern India. Kushan patronised several religions, including Buddhism, hence the origin of the translated scripture.

The similarities in the conceptual frameworks allowed mainly Taoist but also Confucian terminology to be used in the translation of the Buddhist texts. The use of familiar Chinese terminology then helped in the acceptance of a theology that was principally foreign. (Fowler, 2005: 79) Moreover, this allowed the three ideologies to coexist rather than compete, other than during four periods of Buddhist religious persecution carried out within the first

five centuries after the establishment of Buddhism. They were unsuccessful attempts to return to Taoism, but inflicted great destruction on Buddhist monasteries and temples in the process (Li, 2011).

The oasis towns on the Hexi Corridor, which provided the major stations on the long and arduous journeys of the travelling monks, naturally assumed the role of spiritual hubs. Some of the missionaries eventually settled and founded shrines and monasteries. The latter were housed in grottoes carved into the sandstone rocky areas surrounding the oasis towns and gradually developed into grotto complexes.

There are about one hundred and fifty Buddhist complexes along the Hexi Corridor, more than in any other region in China. Four of those complexes are associated with DunHuang. They are: the MoGao Grottoes, with four hundred and ninety-five surviving cave temples in a relatively well-preserved state, though there are in total seven hundred and thirty five cave cells and temples; the Yulin Grottoes, which number forty two cave temples; the Western Qianfodong Grottoes, which number sixteen and the Eastern Thousand Buddha Grottoes, which number twenty three. At the last three complexes, the surviving caves have been over-painted at a period later than those which this paper is concerned to investigate.

The most significant of these complexes is The MoGao Buddhist complex in DunHuang, also known as the Caves of the Thousand Buddhas. At the beginning of the twentieth century it rose to fame by being associated with the discovery of the DunHuang manuscripts, all dating from between the fourth and eleventh centuries AD. They were discovered by the Taoist monk Wang Yuanlu. At that time he began persistently to petition the authorities in an attempt to draw their attention to the quality of the temples' decoration, the level of damage they had sustained and the urgent need for remedial work (Duan, 1994: 52)

Eventually, in 1941, a group of artists led by the prominent traditional Chinese painter Chang Dai-chien, worked on the creation of copies of the wall paintings mainly of the MoGao but also of some of the Yulin Grottoes. In 1943 an exhibition of their work brought to nationwide prominence the MoGao temples. The same year the DunHuang Art Institute was founded and in 1944 it was expanded to create the DunHuang Research Academy, which was established to preserve and research the MoGao caves.

Because of the sheer number of surviving cave temples, the wide time span through which those temples were developed and their relatively good level of preservation, the MoGao caves are considered, both nationally and internationally, to provide a compendium of Chinese art, particularly evidencing the evolution of Buddhist art in the

north-west region of China. In recognition of its significance in 1961, the site of the MoGao cave temples was made as one of the State Priority Protected Sites by the State Council of the People's Republic of China and was put under the protection of the national laws including the Law on the Protection of Cultural Relics.

Initially, international attention was drawn to the significance of the MoGao wall paintings as early as 1945 when some of the copies made by Chang Dai-chien were displayed throughout Europe by a European travelling exhibition of contemporary art organised by UNESCO. However, it took until 1987 for UNESCO finally to add the MoGao Caves to its protected World Heritage Sites as one of intrinsic unmatched historic value to humanity. In the following year, the Getty Conservation Institute became involved in a long-term international collaborative project aiming at furthering research into the site and expanding its conservation programme.

All the MoGao cave temples are elaborately decorated with murals, the total area being about 45,000 square metres, and over 2,000 coloured sculptures. In some of the temples, the decoration covers not just the walls but also the ceilings. One of the best accounts of the exquisite quality of the decoration at the site was given by a Persian emissary to the early fifteenth century court of the Ming Dynasty (1368-1644 AD), not long after the last of the MoGao temples was created in the Yuan period (1220-1368 AD). He arrived via the Silk Road and, having visited the MoGao murals, he noted that these were "of such character that all the painters of the world would be struck with wonder." (Maitra, 1970: 39)

The aim of this paper is to make an initial enquiry into the appearance of the colours used in the cave temples, limiting the scope of the enquiry to the Sui, the Tang and the Five Dynasties periods. This will be to evaluate the relative constancy in the use of certain colour hues in these caves. Using the suggested timeframe for the study will aid in gaining a further, historically grounded understanding of the use of colour in the period of the most intense development of the MoGao complex. Our hypothesis is that the number of colour hues used will be relatively constant. This is not just because of the limited number of pigments available, but also because of the influence of Taoist cosmology within Chinese culture.

2. Putting the MoGao murals in historic context

The MoGao complex was carved over 1,000 years (366-1386 AD) into the sandstone cliff that is almost two kilometres long and is about twenty-five kilometres southeast from the town of DunHuang. It has been accepted that the complex was modelled on the existing

Kizil cave Buddhist complex, situated sixty-five kilometres west from the town of Kucha. The Kizil grottoes were excavated into the rocks of the northern banks of the river Muzat. Scholars consider Kizil to be the earliest major Buddhist cave complex in China, with development occurring between the third and eighth centuries AD. It comprises a set of two hundred and thirty-six cave temples excavated into the rocks and extending for some two kilometres in a generally east-west direction. At present only one hundred and thirty-five of them are in good condition (Whitfield *et al.*, 2015: 55-93)

At the time of their creation, the Kizil cave temples were part of another Buddhist Kingdom, that of Kucha, though its territories are now part of the Aksu Prefecture, Xinjiang, China. However, the Tang Dynasty ruled Kucha after 658 AD and this caused a reversal, with its Central Plains culture increasingly influencing the paintings in the Kizil cave temples, evidenced by the adoption of styles and colours found in the seventh and eighth century AD decoration of the MoGao temple caves (Li 1994: 83-85).

As in the Kizil paintings, the decoration of the early MoGao temples reflects more Greco-Indian and Gandhāran influences and the facial features of the personages depicted are distinctly Indo-European. The later MoGao murals stylistically are more akin to the murals from the Persian Sassanian Empire (224-657 AD). Though the official religion of the Sassanian Empire was Zoroastrianism, in the far eastern part of the country both Buddhism and Hinduism were well established and widely practised. Those eastern parts were known also as Bactria (Song, 2013).

Bactria was part of the Silk Road network and held a key position between China, Persia, India and the Mediterranean world. It is believed that in the first stages of the propagation of Buddhism, craftsmen from India and Bactria worked in a number of Chinese Buddhist cave complexes. As in the case of Kizil, the personages depicted are distinctly Indo-European.

Other influences shaping the art of the Kizil caves are believed to have come from the cultures of South Asia and the coastal areas of China. The introduction of foreign formative ideas and aesthetic influences was aided by the fact that Kucha was an important commercial centre on the Silk Road. This enabled Kucha, and in particular the Kizil Buddhist complex, to play a major role in the dissemination along the Silk Road of Buddhist teaching and art. The early cave temples took a shape similar to that of the Bamiyan Buddhist caves in central Afghanistan and the murals suggested the influence of Gandhāra arts. The predominant colour used in the earliest Kizil caves is red, using cinnabar and red earths, while in the later murals there is an abundance of blue colours, deriving from lapis lazuli.

At MoGao the early murals mainly display the use of three chromatic colours in the construction of the pictorial compositions, as could also be seen in Kizil. Those were green (malachite), blue (lapis lazuli) and red (cinnabar). The expensive minerals necessary for the production of these colours were imported via the Silk Road.

The first MoGao grottoes were dug into the rocks in the fourth century AD by missionary monks. Apparently, they were just hermits' abodes. None of the very first caves survive but some from a slightly later period do. In total, only three of the earliest cave temples survive in reasonably good condition. They were built between 419 and 439 AD and are believed to have served not just individual hermits but several small monastic communities. These developed in the North Liang (397-439 AD), a dynastic state during the Sixteen Kingdoms period (366-439 AD). In total there are seven MoGao grottoes from that period.

In 439 AD, the Northern Wei Dynasty (386-534 AD) was successful in the unification of northern China. The state actively worked towards establishing Buddhism to replace the fading Confucianism, to reinforce unification and to create order out of the chaos of the preceding centuries. The speed of creation of the cave temples at MoGao accelerated and their size increased. About ten temple caves are identified as having been built at that time. The decoration of these has been constructed in an Indian style. For the next two dynasties that ruled northern China, the Western Wei Dynasty (535-556 AD) and the Northern Zhou Dynasty (557-580 AD) altogether twenty grottoes were constructed and decorated.

The following period, known as the Sui Dynasty (581-618 AD) marks the dawn of the golden era of Chinese civilisation and the MoGao complex in particular. The Dynasty was short-lived but had an aggressively expansive foreign policy and an extremely ambitious, far-sighted domestic policy aimed at expanding the infrastructure in order to boost the economy and defence. To begin with it unified the territories of northern and southern China. The most impressive project completed by the Dynasty, and one which had immeasurable effects on the economy through subsequent ages was the Great Canal. Another was the reconstruction of the Great Wall which, at that time, reached DunHuang (Guo, 2010).

The propagation and affirmation of Buddhism as a dominant religious belief was sought actively as both Sui Emperors declared themselves to be Buddhists. Consequently, the period was marked by the extensive repair and reconstruction of old Buddhist sites and the construction of new buildings. The imperial patronage was strongly felt in MoGao. During the thirty-seven-year rule of the Sui Dynasty the number of cave temples there

increased by eighty, though only seventy now survive. This meant that on average two grottoes were built and decorated each year at the MoGao site alone. Extensive building of monasteries and temples went on in the capital and at other Buddhist complexes.

Imperial patronage was apparent not only in the speed at which the temples were constructed. A number of the most beautiful cave temples are associated with the Sui Dynasty. The best quality of painting materials was used, allowing the colours to retain their fresh and bright appearance. A sense of opulence was complemented by the addition of gold leaf. However, the most significant aspect of the pictorial compositions is that they display the early stages of a specific Chinese style. The personages are presented in passive poses and they have distinctively Chinese facial features compared to the dynamic figures from the previous period, which are Indo-European in appearance.

These stylistic tendencies were expanded in the next dynastic period, that of the Tang Dynasty (618-907 AD). Generally, historians recognise four major stages in the development of the Tang Dynasty: (1) the Early Tang period (618-712 AD); (2) the High Tang period (713-766 AD); (3) the Middle Tang period (762-827 AD) and (4) the Late Tang period (828-907 AD). The Tang Dynasty is known as the golden period in ancient Chinese history and the apogee of Chinese Buddhism, of which there is abundant evidence at the MoGao site. During the Dynasty, which lasted for two hundred and eighty-five years, nearly two hundred and thirty new temples were built at the site.

Initially, the sites of temples left unfinished by the Sui Dynasty were completed; the murals in them appear stylistically to continue in the manner of the Sui artistic school. However, 642 AD saw the introduction of a new imperial fashion in religious painting, that prevailed in the capital's grand monasteries and was created by the most famous painters of the day. Though none of the capital's Buddhist sites survived the Late Tang devastation inflicted by the Taoist Emperor Wuzong (814-846 AD), the MoGao murals from the Early and High Tang periods are representative of this new style.

The pictorial scenes appear to be colourful and highly decorative, with elaborate and exquisitely presented detail and carefully balanced colour schemes. The depictions of deities and donors show a delicate three-dimensional treatment, especially of the facial elements of the personages (Wang, 2014). Together with the use of traditional compositions such as that of the Thousand Buddhas, there are innovative compositions that are believed to mirror compositions used in the capital. Most popular in this period seem to be those evoking the magnificence of the Buddhist paradise, the Pure Lands.

However, the style of the MoGao murals from the Middle Tang period is very different from that of the preceding two periods. This is because, although technically the period between 762 and 712 AD was still part of the Tang period, nevertheless from 781 AD the MoGao site was under the rule of the Emperor Trisong Detsen (755-797 AD), the 38th emperor of the Yarlung Tibetan Dynasty. He became instrumental in establishing Buddhism as a state religion. Forty-eight of the MoGao temples are believed to have been constructed during the nearly seventy years of Tibetan rule.

Although thematically the decoration of these temples followed the Pure Land scenes, the exuberance of the Early and High Tang was replaced by a somewhat cruder representational system. This appears to have been a result of the introduction of the Tibetan tantric or esoteric decorative school, in accordance with which each scene was contained within an ornamental floral border which created a crowded and rigid appearance.

When in 848 AD the Tibetans were expelled and Chinese rule was restored the DunHuang area gained greater political autonomy. This was two years after the reign of the Emperor Wuzong (814-846 AD) so the MoGao complex escaped the destruction of temples resulting from the persecution of Buddhism when tens of thousands of sites were destroyed across China. The next ruler, the Emperor Xuangzong (846-859 AD) re-established Buddhism as the dominant, state religion. Consequently, at the MoGao complex the building and the decoration of new temples continued (Dang, 2009).

In the period 848-906 AD, during the Late Tang Dynasty, about sixty temples were completed. The murals continued the Tibetan style but the colouring became much more delicate, even more than in the Early and High Tang periods. Some scholars take the view that this was a result of the continuous turbulence in the western region and the interruption of free trade along the Silk Road, which limited the availability of pigments (Xu, 2007). However, it could be argued that the personal preferences of the artist, the prevailing fashions at the time or the increased technical ability to grind the pigments to a much finer fraction might also have played a role in achieving the described appearance of the colours used.

With the fall of the Tang Dynasty in 907 AD the country disintegrated into a number of much smaller principalities. These were the Five Dynasties (North China) and the Ten Kingdoms (South China). The period of the northern Five Dynasties (907-960 AD) lasted just over fifty years during which a further thirty-two caves were excavated and decorated at MoGao. Twenty-six of them were completed during the governance of DunHuang by the Cao military family in the period 920 to 960 AD. Some of those twenty-

six are the largest temple caves carved into the rocks at that time. Another 300 existing caves were renovated or refashioned. Unfortunately, several of the earlier caves were incorporated in new construction and the original decorations were lost (Whitfield *et al.*, 2015: 87-89).

The significance of the period when DunHuang was ruled by the House of Cao is not just because they undertook such extensive works and expanded and maintained the MoGao Buddhist complex. Two other elements of their governance had a far greater impact on the development of the MoGao site and on the evolution of the Chinese style in Buddhist art of the region.

Firstly, the Cao family governed DunHuang for one hundred and twenty years, from 920 AD to 1040 AD. It follows that their reign extended well beyond the Five Dynasties, into the Song Dynasty (960-1279 AD). As they were the main patrons of the MoGao site it is not surprising that there is a stylistic continuity between the temple decoration from the Five Dynasties era and that of the Song.

Secondly, their significant influence in the evolution of Chinese Buddhist art was made possible by the fact that shortly after the House of Cao ascended to power they established their own painting academy, drawing into it the leading regional artists, hence the high quality of the temple decoration from the time of Cao, at least from the time of the Five Dynasties.

The last two eras which saw some development of the MoGao site were those of the Song (960-1279 AD) and Yuan (1279-1368 AD) Dynasties. The style of the Five Dynasties also continued to be influential during the Yuan Dynasty. The latter was the time when the development of the MoGao complex was concluded. This coincides with the end of the importance of the Silk Road to the Chinese and to international trade as shipping largely superseded land transport.

3. Enquiring into the colours of the murals the MoGao temples

The enquiry is confined to the periods of the Sui, the Tang and the Five Dynasties, which was the peak time in the development of the temple complex. The methodology used for this investigation was designed to overcome the constraints imposed by the Covid-19 pandemic by conducting the study using images created for the virtual museum of the MoGao caves (Dunhuang Research Academy, 2020). To carry out our investigation, those murals considered by scholarship to be particularly significant examples of Buddhist art from each period will be selected. Each colour in the selected digital images is

then identified as the nearest match within the Pantone Colour System using its digitalised version (Lei *et al.*, 2021). The use of colour will be discussed in the context of the traditional 'five colour system'.

3.1. Wuxing and the Chinese Traditional Five-Colour System

The Chinese term Wuxing (usually translated as 'five processes', 'five phases' or 'five elements') is used for a conceptual theory that has been a constant feature of traditional Chinese thought and culture. The five elements were considered to be independent, but at the same time interlinked. Before the Han Dynasty, when the initial idea was formed, the elements were associated with natural phenomena and seasonal changes, bringing an understanding of the workings and development of the Universe. These five elements were: Wood, Fire, Earth, Metal, and Water (see Table 1).

Element	Fire	Wood	Earth	Metal	Water
Colour	Red	Blue	Yellow	White	Black
Direction	South	East	Centre/middle	West	North
Season	Summer	Spring	Change of season	Autumn	Winter

Table 1. Relationship between the "five-colour system" and colour, direction and season.

The first proposed universal use of the 'five elements' conceptual system is found in "Book of Documents", one of the "Five Classics" written during the Zhou dynasty (1046-256 BC). In those texts were associations with directions, colours, spirits, and proper rituals that were later enshrined in the Confucian classics, in particular the books Shijing (Classic of Poetry) and Rites of Zhou, dating respectively from the eleventh to seventh centuries BC and the second century BC. Those were used initially to regulate early Chinese dyeing techniques for the production of maps and paintings during this period thus leading to the development of the traditional Chinese 'five-colour' system (Tseng 2003: 192-197). Moreover, Wuxing assisted in describing, analysing or regulating the relationship of the elements within different spheres of human life – political, social and cultural. For example it assisted in complying with rituals and numerous hierarchical regulations such as those relating to the use of colour in people's clothing or the colours of their ornaments. Thus colours began to occupy an important place in all aspects of Chinese culture (Chen, 2015: 369).

In brief, the five colour system includes three chromatic colours and two achromatic ones: red, blue, yellow, white, and black. In a broad sense, they are independent sets of colours. There does not seem to be a suggestion of their optical qualities and thus no interest in the visual interrelationship between them. Moreover, the three colours occupy only part of any

western colour system, but instead mirror the Wuxing conceptual system (Xiao, 2013: 185-187).

A relationship between the five colours and the five phases or elements in Wuxing was developed gradually. By its overarching nature Wuxing established a defining association between the five colours and natural phenomena and also concepts of space and time amongst others (Xiao, 2013: 191-195).

In painting, the mixing of pigments or the presence of natural impurities could result in 'secondary' colours, which are employed and are also considered within the 'five-colour system'. For example, green (blue + yellow), cyan (blue + white), red-orange (red + white), amber yellow (black + yellow), purple (black + red) as shown in Figure 1b. In the case of the mixing of chromatic and achromatic colour usually the chromatic one is the defining 'element'; in case of the colour green it is associated in tandem with the blues and cyans with Wood (Chen, 2015: 368-369).

Research shows that a number of mainly inorganic but also some organic pigments were used in the creation of the DunHuang murals from the three periods investigated here, the Sui, the Tang Dynasty and the Five Dynasties (Xu, 2007). For greater clarity the list of the main pigments so far identified is presented here in tabular form (see Table 2).

Pigment period / Colour	Sui Dynasty	Tang Dynasty	Five Dynasties
Red	Red clay Cinnabar Red lead	Haematite Cinnabar Red lead	Red clay Cinnabar Red lead
Blue	Lazurite Lapis lazuli Azurite	Lazurite Lapis lazuli Azurite	Lazurite Lapis lazuli Azurite
Green	Malachite	Malachite Verdigris	Malachite
Yellow	Ochre Orpiment Gold leaf Organic pigments	Ochre Orpiment Gold leaf Organic pigments	Ochre Orpiment Gold leaf Organic pigments
White	Kaolin White clay Talc	Calcite Kaolin Basic lead Oyster shell Gypsum	Kaolin Calcite Oyster shell Gypsum Talc Muscovite
Black	Carbon black Black lead Plant Soot	Carbon black Black lead Plant Soot	Carbon black Black lead Plant Soot

Table 2. List of pigments identified for the creation of the DunHuang murals from the Sui Dynasty; the Tang Dynasty and the Five Dynasties period.

These would have allowed the creation and use of the above-mentioned 'secondary' colours. However, in at least one such case, green, it appears that green-coloured pigments were used. This leaves open the question about the use of any other secondary colour(s), which will be determined in the next part of this investigation.

3.2. Appearance of the colours in the main palette of the MoGao murals from the Sui Dynasty to the Five Dynasties.

For the purpose of this enquiry two typical, well-preserved images from the Sui and two from the Five Dynasties periods were selected for examination. For the Tang Dynasty four images were examined, in accordance with the historic subdivision of the period into four distinct sub-periods: the Early, the High, the Middle and the Late Tang. The appearance of each colour in the selected digital images was identified as the nearest match within the Pantone Colour System using its digitalised version. The palette of each of the selected compositions was arranged along one the sides of each scene, bearing the Pantone code. The codes for uncoated paper were selected in order, to an extent, to take account of the matt surface texture of the murals (see Table 3). The nearest matches served to illustrate the appearance and also to act as a record to aid further systematisation of the MoGao colours.

Several variables determined the final appearance of the colours used in the murals of MoGao. Apart from the hue, determined by the molecular structure of a particular pigment, the other significant variables included the presence of impurities, the degree to which the mixing of different colours was employed and, of course, the base over which the coloured paint was applied. The latter will be determined by the way the painted surfaces were prepared initially.

Research shows that there were several steps before the final application of paint and that the preparatory procedure was identical throughout the history of the MoGao complex. The wall surfaces of the freshly dug cave walls would have been both very rough and vulnerable to exfoliation as the grottoes were carved into loosely-structured sandstone aggregate. To remedy the problem several layers of mud were applied. The first layer was a coarse one, a mixture of local sandy earth, straw and water. This was followed by a fine layer of washed clay mixed with fibres and water. Finally, the surface on which the paints were to be applied was prepared by another application of fine mud which was then covered with a thin, smooth layer of powdered kaolin, lime or gypsum.

During the Sui Dynasty the dominating hues of the murals are of cyan and green. Research suggests that the choice of hues at that time was likely to have been influenced from the northwestern regions of the Indian subcontinent, possibly Kashmir. The visual dominance of cyan and green is constructed by the sparing use of other chromatic colours. The chromatic colours that could be counted were usually three, as in the murals from the earlier periods. Though gold leaf has been used, because of its optical

qualities, it cannot be considered under any colour categories referred to here.

The third colour was usually red. It is to be found as a background colour to the paintings and consists of low quality cinnabar mixed with red clay. The best cinnabar appears to have been used most sparingly, just for painting the Buddha's lips.

Another characteristic of the murals from the Sui Dynasty that is worth mentioning is that not only were they stylistically different from the murals constructed in the previous historic period, the Northern Zhou, but more often than not they used colours created by mixing different pigments. That gave the colours a somewhat turbid appearance. However, in one instance, as with the appearance of the black colours in the Sui period the mixing of colours resulted in a much deeper colour. Research shows that the blacks were a composite of several chromatic colours and not created by the use of a single pigment. In this case the mixture was made by combining red, yellow, blue and green. This allowed for the creation of a variety of final appearances. The resultant colours could be classified as warm blacks or cool blacks, which allowed for a more balanced appearance of the final picture.

Two of the most representative images have been selected to illustrate this enquiry into the appearance of colours used in the art of the Sui Dynasty. The first is the West Mural of Cave 420 (see Fig. 1a). This composition is constructed over a red background using three colours - dark green, pink-green and grey-green - with different degrees of light and chromatic contrast. The pigments used were red earth, lapis lazuli and malachite. The browns that can be seen are achieved by a mixture of red earth with ink.

The other example of Sui art is from Cave 303 (see Fig. 1b). The compositional background used here is white, while red is used sparingly as a colour of flesh or of garments and furnishings. Again the blue of the roofs and the green of the landscape flora dominate the composition. Scholars consider that the use of a white background can most probably be the result of an influence that had arrived from the Western Regions via the Silk Road. The particular pigments used in the creation of the colours of this scene are talc and calcite, while red is derived from good quality red earths. Blues and greens are derived from lapis lazuli and malachite respectively.

In the Early Tang Dynasty (618-712 AD) the final preparation coat applied to the walls was a thin smooth layer of local iron-rich clay, rather than kaolin or gypsum. As the mural colours were applied over it the final appearance of the compositions appear to be much warmer than compositions from the Sui period and also than compositions from the later Tang periods.



Fig. 1a. Cave 420 in the Sui Dynasty (581-618 AD).



Fig. 1b. Cave 303 in the Sui Dynasty (581-618 AD).

The image that was analysed for the purposes of this paper is the central composition on the south wall of Cave 322 (Fig. 2a). Initial examination indicated that all the general hues in the traditional Chinese 'five colour system' were used in this mural, together with one of the 'secondary' colours, green. Moreover, a new combination of gold and earth yellow had been added. However, because of the specific optical properties of gold, for the purposes of this investigation only the appearance of the colour yellow was considered. Despite the already mentioned foreign influences on the DunHuang style, especially in the Early Tang period, it has to be stressed that the choice of colours is considered to have been primarily influenced by the local Chinese colour preferences (Zhou, 2000).

Over the High Tang period (713-766 AD) the DunHuang style was established. It is considered that ninety-seven caves were excavated and decorated during this period. The mural on the north side of Cave 217 (Fig. 2b) is well preserved and is one of the outstanding masterpieces of the murals executed at the most prosperous time of the Tang Dynasty. The overall tone of the whole painting is again warm, but more intense than that of the murals from

the Early Tang period as the colours were made with less mixing of pigments, thus appearing more saturated and vibrant (Zhou, 2000).



Fig. 2a. Colour palettes used in Tang Dynasty: Cave 322 in the Early Tang Period (618-712 AD).

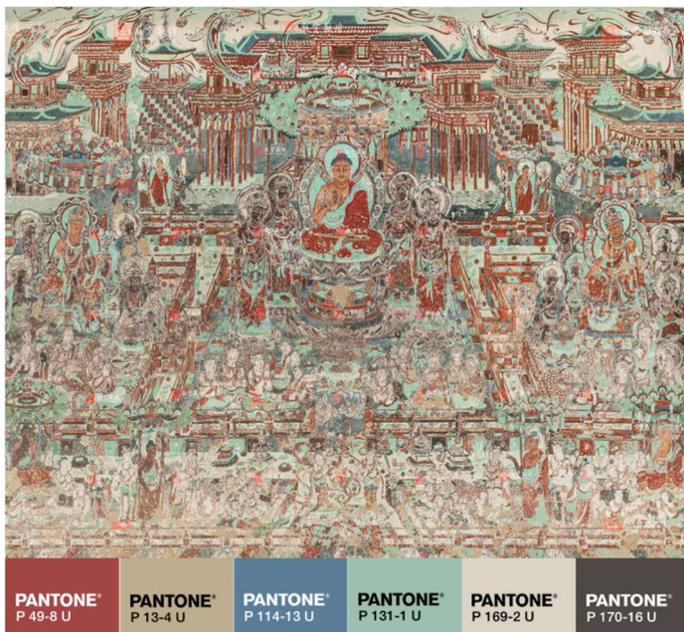


Fig. 2b. Colour palettes used in Tang Dynasty: Cave 217 in the High Tang Period (713-766 AD).

Moreover, there could be noted an even wider use of gold, compared to the previous period. Research considers that to be a result of the increase in the influence of Buddhism as a defining force in the structuring and maintenance of Chinese Imperial power. As a result gold leaf and vibrant,

‘secular’ colours perceived as ‘colours of wealth’ began to be widely used in paintings (Meng, 2008).

During the Middle Tang period (762-827 AD) fifty-five new cave temples were created. This was a period of continuous internal and external struggles as there were countless wars, battles and skirmishes with the Tibetan Empire (618-842 AD) resulting in considerable territorial losses. The political and economic instability in the period impacted on the production of art and the opulence and refinement of the murals made in the Early and especially in the prosperous High Tang Period was lost. The early golden and vibrant tones were replaced by a mainly lighter, paler palette. These light paints appear to have been thinly applied, with a dominance of flat green and yellow, and outlined with ink (Meng, 2008).

An example of the Middle Tang period mural art is the image of the central mural on the south wall of Cave 159 (Fig. 2c), where more obvious changes in the use and the appearance of colour can be noted.



Fig. 2c. Colour palettes used in Tang Dynasty: Cave 159 in the Middle Tang Period (762-827 AD).

Green was used on a much larger scale either as a single colour or in a number of very similar adjacent tones, though red and other warmer tones could also be found in the compositions. The base undercoat of the murals was now white earth and the intensity of the colours of the murals appeared to be greater. It could be argued that those changes are to some extent a consequence of periodic changes in the Wuxing rules in general and those

relating to art and its production in particular. At the same time, there were still some murals from the Middle Tang period that were painted over an iron-rich undercoat, as in the previous two periods (Meng, 2008).

In the Late Tang period (828-907 AD) DunHuang seventy one caves were excavated. This period saw a continuation of the style of the Middle Tang Dynasty that was dominated by light blue and green tones, as is illustrated in a mural from the decoration of Cave 12 (Fig. 2d). The influence of Tibetan religious art is still noticeable but there are stylistic changes. They have been attributed to the growing cross-fertilisation between the previously separate aesthetics of secular art found in the Western Regions of the Late Tang Empire and that of the existing style of religious paintings. Scholars concluded that this, on the one hand, revitalised the paintings from the period, compared to the Middle Tang period and, on the other hand, prepared the foundation for the emergence of the style of the Western Xia Dynasty (1038-1227 AD) and its significantly different use of colour (Meng, 2008).



Fig. 2d. Colour palettes used in Tang Dynasty: Cave 12 in the Late Tang Period (828-907 AD).

The use of pigments in the Five Dynasties period is similar to that of the Tang dynasty. However, often the colour is less complex in appearance. The colours are predominantly green, red, red-brown, brownish-red and white. The pigments used are again malachite green, red earth, kaolin and oyster shell. In some cases muscovite has been added (Xin, 2018). As in this period there is no use of gold leaf, it could be suggested that muscovite was used in order to add some glitter.

A scene from Cave 61 (Fig. 3a) is one of two selected to enquire into the appearance of the colours in the Five Dynasties frescoes. Here the composition seems to be

copied from another with the same subject, but from the Late Tang period. The composition is stylised and lacks the expressionist qualities of the earlier painting. The colours appear flatter and less bright than in the Tang period. This is a tendency that appears to have influenced the style of wall painting in the later dynastic periods of Song (960-1279 AD) and Yuan (1279-1368 AD).

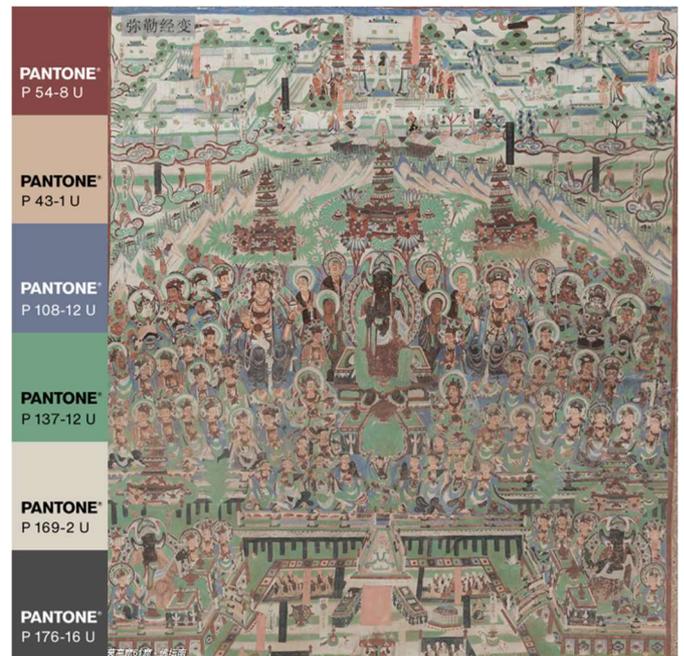


Fig. 3a. Colours used in the Five Dynasties period: Cave 61 in the Five Dynasties (907-960 AD).

The other scene is from Cave 6 (Fig. 3b). The colours are saturated and the dominant chromatic colours are red-orange and blue-green, but there are also two others, red and blue. From the achromatic colours it is white that dominates the picture. White has been used as the background colour and also as a flesh colour. It can be argued that the apparent brightness of the composition is influenced by the continuous juxtaposition of the red-orange and the blue-green. The two form a complementary pair on the Western wheel systematic classification of colours. Both colours are also individually classified as tertiary indicating that the artists must have derived these particular colour appearances by the mixing of pigments. In parallel with the colour contrast a light contrast is also created by the juxtaposition of the chromatic colours with white. Black was not used to create light contrast, but was limited to areas where it was used to define some decorative elements. For the red-orange colour, cinnabar, red earth and white were used. For the blue-green colour, a mixture of malachite, lapis lazuli and white was used. For the red colour the artists appear to have used red earth and for the blue colour, lapis lazuli. The white used in this scene has been found to derive mainly from lead white, but containing a significant level of impurities (Xu, 2007).



Fig. 3b. Colours used in the Five Dynasties period: Cave 6 in the Five Dynasties (907-960 AD).

The findings from the digital identification of the codes for the nearest matches within the Pantone Colour System are arranged in Table 3 below.

Cave no. / Colour	Sui Dynasty	
	Cave 420	Cave 303
Red	P 46 - 14 U	P 49 - 8 U
Yellow	-	P 29 - 1 U
Blue	P 103 - 5 U	P 106 - 16 U
Green	P 125 - 10 U	P 147 - 13 U
White	P 75 - 9 U	P 169 - 1 U
Black	P 78 - 16 U	P 176 - 16 U

Cave no. / Colour	Tang Dynasty			
	Cave 322	Cave 217	Cave 159	Cave 12
Red	P 54 - 11 U	P 49 - 8 U	P 38 - 15 U	P 64 - 16 U
Yellow	P 28 - 11 U	P 13 - 4 U	P 21 - 10 U	P 26 - 10 U
Blue	P 114 - 12 U	P 114 - 13 U	P 109 - 15 U	P 111 - 13 U
Green	P 130 - 12 U	P 131 - 1 U	P 130 - 05 U	P 121 - 13 U
White	P 51 - 1 U	P 169 - 2 U	P 179 - 2 U	P 169 - 2 U
Black	P 170 - 16 U	P 170 - 16 U	P 170 - 16 U	P 108 - 16 U

Cave no. / Colour	Five Dynasties	
	Cave 61	Cave 6
Red	P 54 - 8 U	P 50 - 7 U
Yellow	P 43 - 1 U	P 24 - 6 U
Blue	P 108 - 12 U	P 101 - 3 U
Green	P 137 - 12 U	P 127 - 12 U
White	P 179 - 2 U	P 39 - 9 U
Black	P 176 - 16 U	P 176 - 16 U

Table 3. Colour palettes, presenting in the closest match of the PANTONE® CMYK Uncoated guide set, of the DunHuang murals from the Sui Dynasty, Tang Dynasty and Five Dynasties Periods.

Closer examination indicates that the codes for the appearances of colours within the group of each hue vary only slightly. That is to say, the appearances are visually different, but the colours could be described as varying by saturation and lightness and/or generally subtle nuances. It could be argued that these differences are attributable to the use of minimal mixing of pigments and perhaps also to the constancy of the sources from which those pigments were derived. That is a subject for future investigation.

4. Discussion

From an examination of the existing scholarship on the use of colour in Chinese art and, in particular, the MoGao murals from the Sui to the Five Dynasties periods, it became apparent that thematically and stylistically the compositions of the MoGao caves absorbed many influences from Buddhist art mainly from Central Asia, India, Iran and Tibet. Moreover, while the colour scheme of the Sui murals is dominated by blues and greens throughout the Tang period, a greater range of colours was used. Whereas in the Early and High Tang periods the palettes were dominated by reds and yellows with the added use of physical gold, by contrast in the Middle and Late Tang periods the palettes became dominated by light blues and greens. In the Five Dynasties period one of the main qualities sought in the appearance of the scenes - and subsequently of the colours - seems to be brightness. In all periods the number of the actual colour hues was found to have been reduced to the minimum necessary to achieve the desired aesthetic result. The use of colour and light contrast has been identified in some cases as a tool to increase the visual impact of the compositions.

Furthermore, the enquiry indicated that the palettes were always constructed according to the Wuxing conceptual system that ruled every part of human life. Therefore, in every dynastic period, the palette followed the traditional Chinese 'five colour system' without deviation. Moreover, despite the considerable number of pigments found to have been used in the MoGao cave temples, there is only one 'secondary' colour which, it must be stressed, does appear to be part of the extended 'five colour system'. Even for that a separate pigment was used, rather than creating the colour by mixing two other pigments. It is only in the Sui and later in the Five Dynasties period that some mixing of pigments took place, but that was only to enhance the appearance, as in the case of the blacks used in the Sui, or to create more complex tertiary colours to achieve a colour contrast between two light colours, as in the particular example from the Five Dynasties. It can be concluded that the intensity and vibrancy of the colours had a special significance through all the historic periods examined here.

The present work is yet another step towards building an understanding and appreciation of the significance of the DunHuang complex as emblematic of Chinese civilisation.

Moreover, the results of this work prepare the ground for further investigation into the aesthetics of the representational system of these murals, as part of the national and world cultural heritage.

5. Conflict of interest declaration

Potential conflicts do not exist.

6. Funding source declaration

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References

陈彦青 著《观念之色》，北京大学出版社，2015年版 <Chen, Y. (2015) *The Colour of Ideas*, ISBN: 9787301258873>.

Dang, Y. (2009) 'A study on popular buddhist beliefs in Dunhuang during the Late Tang Dynasty, the Five Dynasties and the early Song Dynasty', *Doctoral Thesis*, Lanzhou: Lanzhou University.

Duan, W. (1994) *Dunhuang Art: Through the Eyes of Duan Wenjie*, New Delhi: Abhinav Publications.

Dunhuang Academy (2020) Available at: <https://www.e-dunhuang.com/> (Accessed: 14 June 2021).

Fowler, M. (2005) *Zen Buddhism: Beliefs and Practices*, Sussex: Sussex Academic Press.

Guo, X. (2010) The enlightenment of dunhuang fresco color research in Sui-Tang dynasties to modern color design, *Masters Thesis*, Beijing: Beijing Institute of Fashion Technology.

Lei, Z., Tantcheva-Burdge, E., Cheung, V. (2021) 'Investigation into the colours of the DunHuang from the Tang dynasty', *Proceedings of the 14th Congress of the International Colour Association*, pp. 1059-1064.

李广元 著《东方色彩研究》，黑龙江美术出版社，1994年版 <Li, G. (1994) *Oriental Color Research*, ISBN: 9787531802570>.

李四龙《论儒释道“三教合流”的类型》，北京大学学报（哲学社会科学版），2011年版 <Li, S. (2011) 'On the types of "Three Religions Converging"', *Journal of Peking University (Philosophy and Social Sciences Edition)*, 48(2), pp.42-43.

Lin, X. (2009) 'The conflict and integration of Confucianism, Buddhism and Taoism in Sui and Tang Dynasties', *Doctoral Thesis*, Xi'an, Shaanxi Normal University.

Maitra, K.M. [trans.] (1970) *A Persian Embassy to China: Being an Extract from Zubdatu't Tawarikh of Hafiz Abru*, New York: Paragon Book Reprint Corp.

Maspero, H. (1981) *Taoism and Chinese Religion*, Boston: University of Massachusetts Press.

Meng, J. (2008) 'Study on colour of DunHuang murals of Tibet Period', *Masters Thesis*, Lanzhou: Northwest Minzu University.

Song, F. (2013) A comparison of the art forms of Jataka stories in Kizil murals and Dunhuang murals, *Masters Thesis*, Xi'an: Shaanxi Normal University.

曾启雄 著《中国失落的色彩》，耶鲁国际文化出版，2003年版 <Tseng, C-H. (2003) *The Lost Colours of China*, ISBN: 9789578323452>.

Wang, J. (2014) 'Concave and convex shape system: preliminary study centered on the MoGao grottoes of Dunhuang frescoes is concave and convex drawing', *Doctoral Thesis*, Xi'an: Xi'an Academy of Fine Arts.

Whitfield, R., Whitfield, S. and Agnew, N. (2015) *Cave Temples of Mogao at Dunhuang: Art and History of the Silk Road*, Los Angeles: The Getty Conservation Institute.

肖世孟 著《先秦色彩研究》，人民出版社，2013年版 <Xiao, S. (2013) *Pre-Qin Dynasty Colour Research*, ISBN: 9787010121703>.

Xu, X. (2018) 'A preliminary study on the colors of the frescoes in the Mogao grottoes in Dunhuang during the Five Dynasties and Song Dynasties', *Proceedings of the 10th Asian Color Forum: Color, Innovation, Integration*, Tongxiang (China).

Xu, Y. (2007) 'Research significance on materials and techniques for the DunHuang murals', *Doctoral Thesis*, Lanzhou: Lanzhou University.

周大正 著《敦煌壁画与中国画色彩》，人民美术出版社，2000年版 <Zhou, D. (2000) *DunHuang Murals and the Colours of Chinese Paintings*, ISBN: 9787102021317>.