

# A Comparative Study on The Localization of The Creation of Dunhuang Cave Temples from The Perspective of Typology and Its Protection Suggestions

Zhengjie Bao<sup>1,\*</sup>, Jingyi Ao<sup>2</sup>

<sup>1</sup> School of Art and Design, Shanghai University of Engineering and Technology, Shanghai, China

<sup>2</sup> University of Angers Joint Institute at Ningbo University, Ningbo University, Ningbo, China

**Abstract:** As an important variant of Chinese classical religious architecture, compared with the Indian Ajanta Caves as its prototype, the Dunhuang Cave Temple has undergone considerable localization in the independent evolution of the millennium, which is reflected in the embodiment of the central tower and the The shape of the top of the bucket, the gradually decentralised traffic flow and the subject matter of the paintings. This paper attempts to analyze this from the perspective of typology combined with the shape and fresco style of some of the Mogao Grottoes, and further discusses some feasible measures for the protection of relevant cultural relics.

**Keywords:** Mogao Grottoes, Ajanta Grottoes, Typology, Central pylon, Covered-bucket roof.

## 1. Introduction

Ancient Chinese architecture has a long history and glorious achievements, it is the material carrier of Chinese civilization and an important reference for contemporary architectural theory. In a broad sense, the Dunhuang cave temple complex includes 552 grottoes such as Mogao Grottoes, West Thousand Buddha Caves, and Yulin Grottoes, as well as their internal structures and reliefs. In addition, the murals in the cave cover an area of nearly 50,000 square meters, with various contents, including Buddha statues, Buddhist scriptures, stories, traditional myths, etc. They systematically reflect the Buddhist art system and development of the Dunhuang cave temples over a thousand years.

## 2. A general Introduction to Typology

The analysis of buildings and settlements from the perspective of typology has a great influence in the academic circle. It perceives the order structure of the urban physical environment as a meaningful entity, so it can be regarded as a representative law of the organization of the urban physical environment, but the typology also focuses on individual buildings and their details. In practice, it works by inheriting a representative architectural form, fragment or outline, and these fragments are reorganized to respond to the context of the place. In the early days, the architect Aldo Rossi was influenced by Jung's archetypalism (with which Jung described the primitive collective unconscious) to introduce "archetypes" into the field of architecture. Today, the theoretical framework of this discipline is mainly composed of two parts: one is the neo-rationalism that seeks "archetypes" from history, emphasizing the universality of common acceptance; the other is the search for "prototypes" from regions Neo-regionalism emphasizes the specificity of regional distinctions. [1]

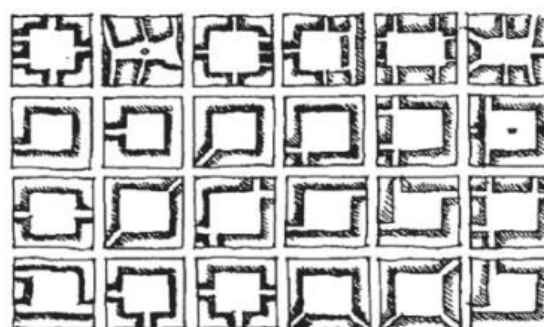


Figure 1. Schematic diagram of the four types of squares summarized by R. Creel

This figure presents a representative study based on building typology, namely the four types of squares of "medium, partial, side, and oblique" summed up by R. Creel based on the long-term evolution of urban squares.

On the whole, the research on the cave temples in Dunhuang area (including Mogao Grottoes, Maijishan Grottoes, Yulin Grottoes, etc.) is based on the verification of the art forms, themes and other objects of specific caves or cave groups. Sexual analysis is relatively rare. Therefore, this research can better understand the compositional principles that affect the material space of Dunhuang cave temples in the context of the spread of Buddhism to the east, and then realize the protection of the collective memory contained in such religious buildings in the follow-up protection and renewal work, and realize the related cultural identity.

## 3. Historical Background and Typological Analysis of The Archetypes of Cave Temples

The construction of the Dunhuang Grottoes Temple and other Buddhist grottoes in China generally began in the period of the Sixteen Kingdoms from the 4th to the 7th century, of which the Mogao Grottoes were the earliest (366 AD, the second year of the Jianyuan period of Fujian), which is similar to the Eastern Buddhism. The historical process and direction of the biography are consistent. It is generally believed that

Buddhism entered China through the Silk Road at that time, and the most representative events were the Han Ming Emperor Yongping seeking the law and the subsequent construction of the White Horse Temple in Luoyang. Although they have all experienced a long time span, the construction of the main cave temple complexes in China started at a similar time to the order in which Buddhism entered the mainland (that is, it gradually progressed backwards from west to east, the Mogao Grottoes were in AD 366 and the Maiji Mountains 384 AD for the Grottoes, 453 AD for the Yungang Grottoes, and 494 AD for the Longmen Grottoes) [2]. As the first group of grotto temples in China, and the climate environment is similar to that of the Western Regions, the Dunhuang grotto temples were inevitably deeply influenced by the existing grotto temples (such as the Kizil Thousand Buddha Caves) in the Qiuci and Hexi areas in the early stage of construction. The direct source of the latter artistic style is the ancient Indian Buddhist grottoes that flourished from the time of the kingdoms to the Mauryan Dynasty.

From the earliest Barabar Grottoes to the most representative Ajanta Grottoes, the ancient Indian Buddhist rock carvings have realized the transition from imitating wooden monasteries without enlarging the space inside the caves to the post-Hellenic era arches-square column space. As late as the 2nd-3rd century AD, the Buddhist grottoes in India had completed the differentiation of the Zhiti caves (used for prayers by believers) and the Vihara caves (with monastic houses for food and lodging). Among them, the former are mostly rectangular or square planes with vaulted domes, and there are small stupa or stupa at the center point for worship. The latter has a square plan and a monk's room that is vertically recessed around it, and sets up Buddhist halls of different shapes at the main entrance. At the same time, the larger-scale grotto groups generally have the above two kinds of grottoes at the same time. It can be seen that in ancient India, which is the place of origin, the functions of Buddhist cave temples have been widely intersected.

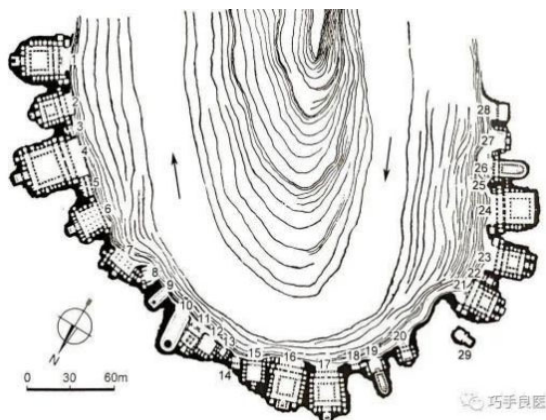


Figure 2. The general plan of the Ajanta Grottoes surveyed and mapped by later generations

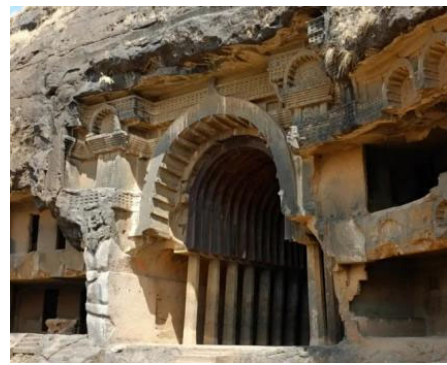


Figure 3. Exterior view of the entrance to the Barabar Grottoes

The typological analysis of the aforementioned cave temples should also be based on the division of functions (ie worship and accommodation). Existing studies generally believe that the prototype of the Zhiti Cave comes from the Zhiti Hall with a circular plane. Take the Baillard Church in the time of King Ashoka as an example. The center of the site is a stupa, surrounded by 27 octagonal wooden pillars, and the outermost is a wall. There is also a circular passage between the wall and the wooden column. There are doorways on the east side of the column and the outer wall, and the roof is decorated with tiles. Later, in order to adapt to the deep space of the mountain wall, the slug waves were put into the interior, so their depth generally increased. Therefore, the type of traffic flow of this worship space can be regarded as a clockwise or counterclockwise loop. Although there is a gap between the inner space of the column and the surrounding corridor, the enclosed space inside the column is still endowed with a more sacred meaning. [3-4]

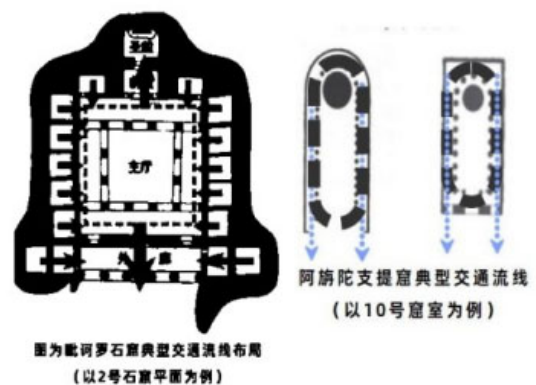


Figure 4. Typical traffic flow layout of ancient Indian grottoes

Correspondingly, the Vihara Grottoes used for residence also show an obvious centralized space: the surrounding monks' houses are independent of each other, and each has a separate centripetal passage leading to the atrium for morning prayers Space (Buddha). Until the late 7th century of the construction of the Ajanta Grottoes, the Vihara Grottoes maintained a relatively high proportion (about 83%), and their main functional spaces were gradually shaped into the outer corridors, the main hall, the front hall and the sanctuary. . In this sense, the Vihara Grotto partially assumes the function of the "sacred space" of the Zhiti Grottoes, which is also reflected in the construction practice of the multi-room monks' houses in Dunhuang represented by the Mogao Grottoes. [5]

#### 4. Study on the Shape of Mogao Grottoes in the Evolution - Taking Caves 254, 285, 420, 246 and 003 of the Mogao Grottoes for example

Different from the Indian Buddhist rock carvings influenced by the architectural/figurative style of the Hellenistic era or the cave temples in the Qiuci area as a transitional state (including central pillar caves, square caves, statue caves, monks' caves, etc. And its top is a vertical coupon or a dome top), the Mogao Grottoes tended to imitate the ancient architecture and interior space structure of the

Central Plains in the early stage of construction. In the 4th and 5th centuries at the beginning of the excavation, the objects of this imitation were mainly Han-style wooden heavy buildings, early Buddhist temples, and the turbulent waves that had undergone changes after retelling. The early caves of the Mogao Grottoes were mainly flat-topped, dome-like and squat-topped. After the development of the herringbone slope and the compound herringbone slope, the unique shape of the herringbone slope and the central column appeared in the Northern Dynasty. For a long time since then, the cave temples in this area have maintained the pattern of the dome-shaped sloping roof as the mainstream and have been continuously improved. [6]

**Table 1.** Perspective analysis of the existing data, in which the Y-axis variable is the average of the ratio of surface width to depth for each age

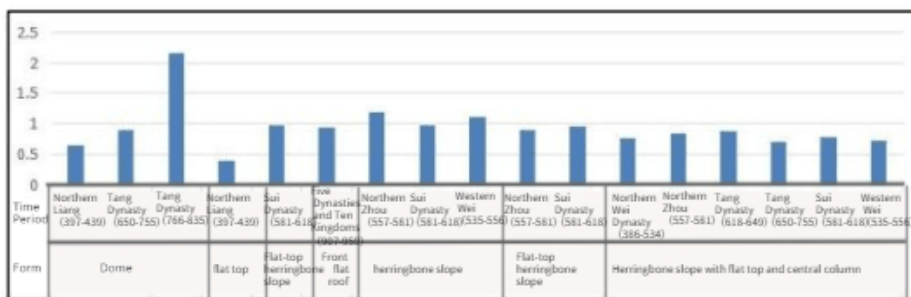


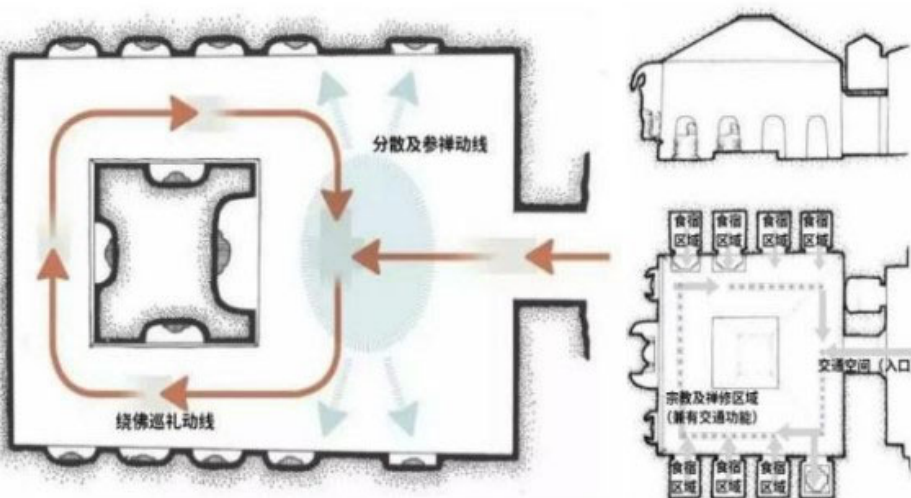
Table 1 : Perspective analysis table of existing data, in which the Y-axis variable is the average of the ratio of the width to the depth of the grotto in different years .

(Note: The years marked here are all after AD)

#### 4.1. Typological Links between Technology and Cave Formation

The Sinicization of the Mogao Grottoes in Duhuang is an ongoing process. Taking the change of the slope of the gable roof (and the dome) and the dome-shaped roof as an example, the research of Yang Hehe shows that the slope of most caves is around 20°-40°, and the upper limit of the cave slope does not exceed 45°. At the same time, compared with the former, the slope of the dome-shaped cave has an increase of about 5°-10°. When the slope of the cave roof is small (less than 15°), the cave roof structure is prone to collapse due to relatively greater tensile stress. Although the large angle of the cave roof slope can ensure the stability of the structure, it

limits the extension of the horizontal space of the cave [7]. On this basis, in order to ensure the stability of the top of the cave and sufficient space for activities in the cave, the ratio of the vertical to the horizontal distance of the cave slope is gradually fixed at 0.35-0.8, that is, the slope angle of 20°-40°. An analysis of 45 caves from the Northern Wei Dynasty to the Five Dynasties and Ten Kingdoms shows that 20% (namely 9) of the caves have a ratio of width to depth >1. In addition to a cave in the mid-Tang Dynasty, which used a concave top due to its huge width, the layout of a gabled slope or a gabled slope with a flat roof was generally adopted, which is considered to be related to the arrangement of personnel space in Buddhist activities (The slope of the top of the cave will make the entrance space cramped).



**Figure 5.** Schematic diagram of the internal construction mechanism of the Mogao Grottoes in Dunhuang

## 4.2. An Analysis of the Styles of the Grotto Temples in the Wei and Jin Dynasties

Caves 254 and 285 of the Mogao Grottoes were built in the Northern Wei and Western Wei periods, respectively, and belong to the earlier representative works. Among them, Cave 254 is the earliest central tower-shaped cave in the Mogao Grottoes. The front of the cave is covered with a herringbone roof, and wooden bucket arches are supported at the north and south ends of the herringbone. There are several raised rafters on the east and west sides as decorative components, and the rafters are decorated with the patterns of heaven and man holding lotus flowers and honeysuckle. [8] The main room of Cave 285 is a dome-shaped cave with a square plane. There is a square altar built in the Yuan Dynasty in the center of the cave, and four small meditation rooms are excavated symmetrically on the south and north walls. The picture shows the spatial form types and traffic flow analysis of the central tower-shaped and the over-the-top-shaped caves represented by these two grottoes. As can be seen from the figure below, although there is no special tower core column in Cave 285, the practice of raising the floor slightly in the central area and the recessed monks' houses and Buddhist shrines still ensure the settlement plane in the shape of a zigzag. The layout, coupled with the fact that there is only one entrance and exit on the east side, has established a multi-center closed space pattern similar to the Vihara Grottoes.

The statues and paintings of this period largely reproduce the content of Indian Buddhist classics and legends, mainly represented by the Satan in Cave 254 who sacrificed his body to feed the tiger, and the "Five Hundred Robbers" [9] in Cave 285 as the main representatives, but among them traditional Chinese themes (including Fuxi and Nvwa) have been involved, and the mainland elements that have appeared at the same time include clay sculptures painted with sitting statues of Zen monks and canopy-style caisson wells.

## 4.3. An Analysis of the Style of the Grotto Temples in the Sui and Tang Dynasties

As shown in the picture below, Cave 420 was created in the Sui Dynasty, and some frescoes were repainted in the Western Xia period. The main room of the cave has a dome-shaped roof with a niche on the south, west and north walls. The west wall inherits the three-segment layout since the Northern Dynasties. Bodhisattva and offering people, and the middle section occupying most of the wall has more content, including scriptures, offering offerings to Bodhisattva, thousands of Buddhas and Dharma pictures. At the same time, it is worth noting that the changes of the Lotus Sutra and the Changes of the Vimalakirti Sutra in the frescoes were both created in the Sui Dynasty and flourished in the Tang Dynasty. Since the cave does not have a central column structure or a living area on the edge, the spatial layout of the cave lacks an absolute visual center, but the niches in the three directions mentioned above will inevitably lead visitors to penetrate into the interior of the cave or surround the side walls. Row. From the perspective of typology, compared with the initial stage of construction, the form of cave settlements in this period increased the decentralized, back-shaped streamlined single-branch caves. The use of this plane structure and the flat roof of the overturned bucket top/herringbone slope expands the effective use space of the Mogao Grottoes' rock carvings.



Figure 6. Inside of Cave 420

On the façade, the sloping hard mountain eaves developed in the Tang Dynasty are organically combined with it, which has achieved the miracle of the world's largest indoor clay Buddha statue in Cave 096 of the Mogao Grottoes.

## 4.4. Analysis on the Style of Cave Temples in The Period of Multi-ethnic coexistence(907-1368AD)

After being rebuilt in Western Xia period, Cave 246 of the Mogao Grottoes had a herringbone roof at the front and a flat roof at the back with a complex shape with a central tower. [10] Due to the height of the entrance space, the inward orientation of the cave is enhanced compared to the previous centralized back plane. In terms of details, the Buddha niche facing the east of the central column is in the shape of a tent with a roof. Inside the niche, there are statues of Sakyamuni, many treasures sitting side by side.

The main types of symbols of this period include the green-ground flower pattern and the image of the Thousand Buddhas. In addition, it should be noted that the typical images of other grotto murals in the same period also include a large number of simple-style Pure Land Changes, Gaochang Uyghur donors and their accessories. The above artistic styles can also be found in Caves 148, 237 and 409 of Mogao Grottoes, Cave 16 of West Thousand Buddha Caves, Cave 39 of Yulin Grottoes, etc.

Although they have an inheritance relationship with the Uighur Grottoes in Xizhou in terms of character modeling, they have absorbed the artistic techniques of the Han nationality in line modeling in terms of painting methods, thus forming this unique style. The picture shows the plan mapping of Cave 246 of the Mogao Grottoes and its comparison with the backlight effect of the typical frescoes of Cave E.102 in Bezeklik.

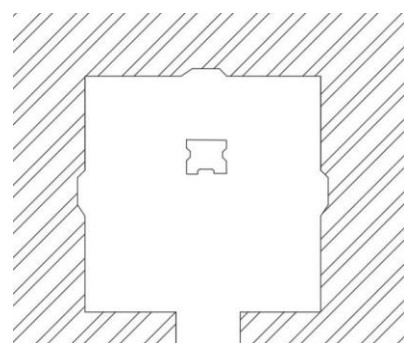


Figure 7. Plane Mapping of Mogao Grottoes No. 246



**Figure 8.** Comparison of backlight effects between Mogao Grottoes No. 246 and the typical frescoes of Bezeklik Cave E.102

As the latest masterpiece of Mogao Grottoes, Grotto 003 (built in the late Yuan Dynasty) is currently closed and this makes the existing research materials relatively scarce. However, according to the panoramic view provided by Digital Dunhuang (A VR product supported by the scenic spot, type “数字敦煌” in your browser to get it), the cave maintains the consistent top of the main chamber, and at the same time, the angle between the cover and the horizontal plane has increased [11]. Compared with the previous arrangement of ceiling caisson and painted murals, this grotto has added a bas-relief with dragon as the main theme at the zenith as the visual focus. Another visual focus is the

practising eight-armed Guanyin Bodhisattva in the top niche on the west wall. At the same time, the north and south walls are painted with a thousand-armed thousand-eyed Guanyin scripture transformation. Brahma, three-headed six-armed Kong and other images can be seen everywhere around. It can be seen that the statue-making skills of the Yuan Dynasty increased the proportion of high-relief or independent statues in the caves, and the practice of placing a dome-shaped top in the niche was inherited from the Western Xia Period, which showed the craftsmen of this period. The same architectural vocabulary organic combination in different application scenarios. This method saves labor and reduces the possibility of Buddha statues being stolen.

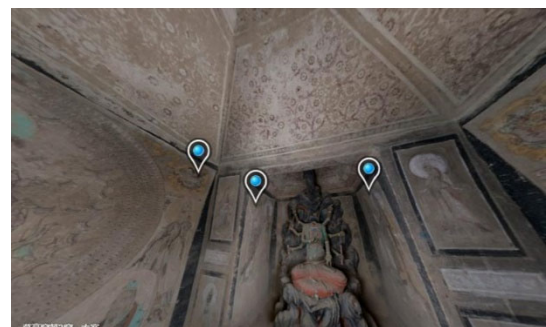
**Table 2.** Analysis and summary of representative shapes of Mogao Grottoes in Dunhuang in different periods

Number	Construction Age	Formation	masterpiece	Spatial layout
254	Northern Wei Dynasty	central column	Satan sacrifices himself to feed tigers	Back shape plane (rectangular)
285	Western Wei Dynasty	bucket top shape	Fuxi & Nvwa	Back shape plane (square)
420	Sui Dynasty	bucket top shape	The Transformation of the Lotus Sutra and the Transformation of the Nirvana Sutra	Back shape plane + inward moving line
246	Northern Wei Dynasty (rebuilt in Western Xia Period)	central column	Flowers and Thousand Buddhas	Centralized back-shaped plane (three caves)
003	Yuan Dynasty	bucket top shape & dome	Eight-armed Guanyin	Stereopolycentric

Note: This table is a summary

As the only rock carving work with Guanyin as the theme in the Mogao Grottoes, the cave has no obvious traffic flow lines, and it is difficult to be defined by spatial forms such as "axial compound". Changes and the setting of an anisotropic visual center, the founder of this cave has successfully created an image of Guanyin responding to the different needs of all living beings and with infinite wisdom. Also worth noting is the portrait of Immortal Bosau on the east wall. He used to be a pagan of Buddhism. Falling into the hell because of killing, he was eventually liberated by Buddha and converted to Buddhism. Compared with the image of the Brahmin disciples with hair in high buns, shirtless, skinny and ugly in the early Mogao Grottoes paintings, the immortal Brahma in this picture has a high bun on his head, wears a lotus crown, and wears a green sleeved robe with a cross collar. To a greater extent, it is based on Taoism. This shows the profound influence of Tantric Buddhism and other local religions in China on the construction of cave temples during the multi-

ethnic co-existence period. The picture shows the panorama of Cave 003 in digital Dunhuang and image of Immortal Bosau.



**Figure 9.** Panorama of Cave 003 in Digital Dunhuang



Figure 10. Immortal Bosau in Cave 003

#### 4.5. Conclusions

Through the analysis of the shapes of the caves built in the Mogao Grottoes in various historical periods since the Northern Wei Dynasty, it is not difficult to find that the Mogao Grottoes in each period have appeared suitable for local culture and owners in terms of technology, settlement type, painting and painted sculpture themes. The evolution of values, for example, since the Sui and Tang dynasties, the dome-shaped caves with an angle of 20° to 40° with the horizontal plane have gradually become the mainstream. The ratio is similar to the ratio of the Zhiti Caves and the Vihara Caves of the ancient Indian Buddhist grottoes. At the same time, although the ancient Indian Buddhist stories have always maintained a certain number, the content of the Central Plains/Western Regions (now Xinjiang Autonomous Region) has always been increasing. As for the layout of space, the craftsmen started from the earliest back-shaped plane, and gradually expanded to different shapes such as one-axis multi-visual center, axis compound, and inward orientation, which became an important functional space for colorful sculptures and murals.

### 5. Heritage Protection Suggestions for Cave Temples based on typology

Since the late Qing Dynasty, the re-excavation and protection of the Dunhuang Grottoes, especially the Mogao Grottoes, has become the main work of a considerable number of domestic experts and scholars. Due to the long-term burial by wind and sand and the dry climate, the structure and murals of the grottoes have relatively good occurrence conditions. But despite this, the above-mentioned cultural relics still suffer from weathering caused by acid rain, caustic soda (sodium chloride erosion from bottom to top, leading to pigment layer cracks) and other problems. In addition, the carbon dioxide concentration, temperature and humidity changes caused by the entry of a large number of tourists will inevitably accelerate the potential damage to the murals and structural details of the grotto. At present, the analysis of the

development mechanism of cultural relics and diseases in the caves has been relatively detailed. Liu Hongli's research believes that the periodic changes of rainfall in the Dunhuang area will cause the continuous "down-up" periodic changes of formation water vapor, and then accelerate the soluble salt crystallization-dissolution process. This research is more representative in the research on the protection of cultural relics in arid areas during the same period. [12]

From the perspective of existing law, the International Conference of Architects and Technicians (ICOM) held in Venice, Italy in 1964 adopted the International Charter on the Protection and Restoration of Monuments and Sites. Compared with only some chapters in the Athens Charter that involve the protection of relevant cultural relics, the former clarifies the concept of historical heritage buildings, and clearly proposes that in addition to historical buildings, the concept of historical monuments should also be included.

Including urban and rural environments from which a unique civilization or historical event evidence can be identified, emphasizing its connection with historical locations and event backgrounds. Since then, the charter has been perfected by ICOMOS conferences in Florence, Washington and other places [13-14]. The "Convention for the Protection of the World Cultural and Natural Heritage" adopted in 1972 formulated the nomination principles for relevant cultural relics (both material and intangible) to be included in the "World Heritage List". [15]

The protection of cultural relics in contemporary society is closely related to the formation of modern nation-states and the inevitable national identity in the sense of social science. From the perspective of local politics, economy and culture, predecessors have further refined the three principles of authenticity, minimal intervention and reversibility, which are also applicable to the protection of the Mogao Grottoes in Dunhuang. The reconstruction of the Acropolis after Greek independence was deliberately restored to its condition after the victory of the Greek-Persian War, while its condition during the Byzantine period (administrative center) and the Ottoman occupation period (mosque and governor's palace) was largely unrestored, It has caused criticism from the architectural and archaeological circles. In contrast, the Mogao Grottoes in Dunhuang, a rock carving complex, were built on the basis of the same main ethnic group/religion in various periods of history. Therefore, it is necessary to extract different types of architectural fragments and protect these historical sites with restorative measures. [16]

According to China's "Cultural Relics Protection Law", revolutionary sites, memorial buildings, ancient tombs, ancient buildings, cave temples, stone carvings, etc. (including annexes of buildings) approved as cultural relics protection units are being repaired, maintained, and relocated. The principle of not changing the original state of cultural relics must be observed. Large-scale excavations such as large-scale infrastructure and archaeology are subject to this regulation. From the 1950s to the 1980s, the most common form of conservation of vernacular architecture in China was the descriptive survey, which focused on the surveying and mapping of relevant architectural cases and details [17]. However, since most of the classical buildings in various regions appeared in the form of groups (such as the Forbidden City or the courtyard-style courtyard in southern Jiangsu), typology quickly became an important research method after it was introduced into China. However, it should be noted that due to the synchronic characteristics of the building type itself,

even the differences in details under the same category are multi-dimensional. Therefore, for the Mogao Grottoes, Maijishan Grottoes and other religious buildings that have formed the status quo after a long historical period Groups must have different historical periods as an additional categorical dimension. At the academic level, platforms such as Dunhuang Research Institute and Digital Dunhuang have provided relatively complete academic resources, including but not limited to survey-based digital resources and regularly updated related research journals and exchanges. At the offline screening level, the Dunhuang Grottoes Cultural Relics Protection Research and Exhibition Center, which was built based on modern architectural theory, has won a high evaluation. Relevant research believes that the facade of the pavilion reflects the thousand-year-old art of the Mogao Grottoes through the cohesion of shapes rather than the flow of tortuous and tactful "lines". It also avoided the common problems of simple symbolic stacking or one-sided pursuit of eternal commemoration. The extensive use of local materials and the high-reduction imitation of representative grottoes are also one of its representative characteristics. The museum still has a large number of permanent and special exhibitions on display and attracts many tourists.[18]

In addition, based on contemporary Internet communication methods, the construction and artistic style of the Mogao Grottoes can also be further extracted as symbols, and recreated through movies/live broadcasts/short videos, or organically combined with existing entertainment industry IPs, etc., establish a new media communication matrix centered on Feitian or Jingbian stories. Dunhuang culture itself has profound cultural connotations, providing fertile soil for the establishment and growth of IP. Secondly, the digital management and dissemination of intangible cultural heritage skills conforms to the development trend of the Internet society and should be put on the agenda. Through blockchain, 5G and other technologies, Dunhuang culture and modern digital technology can be combined with each other, injecting new power into non-genetic inheritance. Furthermore, the fashionable dissemination of Dunhuang intangible cultural heritage art, from simply artistic packaging to transforming innovative thinking, to truly explore the "healing" characteristics of Dunhuang culture, so that the younger generation can pay for Dunhuang art with true feelings.

To sum up, from the perspective of typology, the research on the shape of Mogao Grottoes, the evolution of art and the existing resources should rely on the current way of people's communication while maintaining a high level, so as to achieve mutual benefit and win-win for all parties in industry, academia and research and tourists.

## References

- [1] Wang Liangliang, Yang Yanqing, Han Jie. An analysis of market square types in Fujian and Guangdong overseas Chinese hometown based on architectural typology[J]. *Urban Architecture*, 2021,18(25):42-48.DOI:10.19892/j.cnki.csjz.2021.25.08.
- [2] Yan Tingting. A review of the spatial and temporal distribution characteristics of the grotto temples in Gansu [J]. *Journal*, 2007, 27(2): 224-225. DOI: 10.3969/j.issn.1671-0908.2007.02.141.
- [3] Liu Hui. A comparative study on the shape of the Ajanta Grottoes and Vihara in Dunhuang [J]. *Research in Chinese Art*, 2019(3):47-53.
- [4] Guo Jingna, Wei Zheng. Research on Indian factors and related issues in the formation of the five caves in Tanyao, Yungang [J]. *Dunhuang Research*, 2020(4):38-43.
- [5] Myer, Prudence R. *The Journal of Asian Studies*, vol. 28, no. 2, 1969, pp. 429–30. JSTOR, <https://doi.org/10.2307/294304>. Accessed 29 Jul. 2022.
- [6] Sun Yihua. Investigation and research on the remains of the caves of the Mogao Grottoes [J]. *Dunhuang Research*, 2019(6):17-24.
- [7] Yang Hehe, Wang Qiheng. An Analysis of the Architectural Form and Structural Characteristics of the Mogao Grottoes in Dunhuang [J]. *Journal of Northwestern University (Natural Science Edition)*, 2022,52(2):199-212.DOI:10.16152/j.cnki.xdxbzr.2022-02-005.
- [8] Yu Shengji, Wu Jian, Wang Jiangzi. Stereoscopic photographic collection and image processing in the narrow space of Mogao Grottoes in Dunhuang—Taking the digitization of Mogao Grottoes 254 as an example [J]. *Dunhuang Research*, 2012(6): 108-112. DOI: 10.3969/j.issn.1000-4106.2012.06.015.
- [9] Yang Wenbo. Re-examination of the Fahua Statue in Cave 420 of the Mogao Grottoes: Centered on the Nirvana Figure on the Top of the Cave [J]. *Fayin*, 2021(8):33-38.
- [10] Chen Juxia. Research on Cave 246 of Mogao Grottoes [J]. *Dunhuang Research*, 2019(3):1-16.
- [11] Zhu Yuemei. The appraisal meeting of "Archaeological Research in the North Area of Mogao Grottoes in Dunhuang"
- [12] Liu Hongli, Wang Xudong, Zhang Mingquan, et al. Research on rainfall distribution and infiltration characteristics of Mogao Grottoes in Dunhuang [J]. *Cultural Relics Protection and Archaeological Science*, 2016, 28(2): 32-37. DOI: 10.3969/j.issn.1005-1538.2016.02.005.
- [13] Gleason, Kathryn. "The Landscape as Ruin: The Resiliency of Design." *SiteLINES: A Journal of Place*, vol. 11, no. 2, 2016, pp.16–19. JSTOR, <http://www.jstor.org/stable/24889516>. Accessed 29 Jul. 2022.
- [14] Lv Zhou. The spirit of authenticity of the Venice Charter [J]. *Chinese Cultural Relics Research*, 2014(2):18-20. DOI:10.3969/j.issn.1674-9677.2014.02.005.
- [15] "World Heritage Convention." *Botanic Gardens Conservation News*, vol. 3, no. 2, 1999, pp. 41–43. JSTOR, <http://www.jstor.org/stable/24753841>. Accessed 29 Jul. 2022.
- [16] Pan Xi. Encounters in Sociality: An Analysis of Structuralism in Anthropology and Architecture [J]. *Chinese Journal of Architecture*, 2020(6):4-8. DOI:10.19819/j.cnki.ISSN0529-1399.202006002
- [17] Lv Yafang, Pan Junping. The development direction and trend of legislation in the field of cultural relics—From the perspective of "Cultural Relics Protection Law (Revised Draft)" [J]. *Journal of North China University (Social Science Edition)*, 2022,38(3): 124-128. DOI: 10.3969/j.issn.1673-1646.2022.03.022.
- [18] Xu Lu. The regional expression of landscape architecture from the creation of the Dunhuang Grottoes Cultural Relics Protection Research Exhibition Center [C]. //Proceedings of the 2009 Academic Annual Conference of the Landscape Architecture Professional Committee of the Jiangsu Society of Civil Engineering and Architecture. 2009:10- 13.