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Dilemma and Route Exploration of Cultural Heritage Conservation in the Context of Climate Change

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Abstract: Global climate change not only has a major and profound impact on human society, but also has an impact on cultural heritage that cannot be ignored. This article focuses on material cultural heritage. Under the current situation of cultural relics protection in China, it explores the impact of climate change on material cultural heritage such as movable cultural relics, immovable cultural relics, and buried undiscovered cultural relics, and briefly discusses the dilemma of protecting cultural relics and heritage under climate change, and put forward relevant protection countermeasures. It is anticipated that the research presented in this article will offer valuable guidance and serve as a reference for safeguarding cultural heritage and enhancing personnel training in response to climate change, while also laying the groundwork for preliminary explorations into cultural heritage preservation.

Keywords: Climate Change; Conservation Philosophy; Talent Development; Archaeological Big Data.

1. Current Status of Heritage Conservation

Cultural heritage not only records our past and exists in today's life, but also provides lessons and useful references for the future development of mankind, and is a cultural treasure and spiritual power that draws on the past to open up the present[1]. China's cultural relics and cultural heritage are as numerous as the stars, and are the physical witnesses of China's long history.

According to data from the Third National Cultural Relics Census, 108 million state-owned movable cultural relics and 767,000 immovable cultural relics have been registered. As of 2024, China has 57 world heritage sites, 2,352 national key cultural relics protection units, 142 national historical and cultural cities and 799 Chinese historical and cultural towns and villages. At the same time, the State Administration of Cultural Heritage has duly carried out the fourth national cultural relics census and the fifth national museum grading and assessment, and has stepped up its efforts to investigate and protect cultural relics.

Chinese culture has a long history. The research of 18 major "Archaeology of China" projects, such as the study of Xia culture and the process of Ba Shu civilization, has continued to deepen. According to the latest results of the fifth phase of the Chinese Civilization Exploration Project, which will be released at the end of 2023, starting around 5,800 years ago, various regions on the Chinese continent experienced a more pronounced social differentiation and entered an accelerated phase of civilization origins. Compared with the fourth phase of the Source Probe Project, the time span over which China can be traced back has been extended to 7800 years. At the same time, new forms of cultural relics, such as revolutionary relics and industrial remains, have emerged, together bearing witness to the development of Chinese civilization.

The geographical scope of archaeological excavations and research has continued to expand. Thanks to the development of science and technology, the archaeology of the No. 1 and No. 2 shipwrecks on the northwest land slope of the South China Sea marked a step forward in China's deep-sea archaeology to the world's advanced level, and multiple breakthroughs were made in underwater archaeology such as the Jiawu Shipwrecks and the Chalice Island Shipwrecks. We are steadily promoting frontier archaeology, underwater archaeology and joint archaeology between China and foreign countries, and conducting archaeological excavations and research on ancient city sites from the Han and Tang dynasties and beyond, as well as relics along the Silk Road, and ceremonial and production remains, so as to demonstrate in an all-round way the process of identifying with Chinese civilization and the Chinese nation in the frontier areas.

2. Impact of Climate Change on Heritage Conservation

On July 8, 2023, at the international forum "Climate Change and Extreme Weather Response", the China Meteorological Administration (CMA) released the "China Blue Book on Climate Change (2023)", pointing out that , the global warming trend is still continuing, and an analysis of the CMA's Global Surface Temperature Dataset shows that the global average temperature in 2022 will be 1.13°C above pre-industrial levels, the sixth highest since 1850 when meteorological observations were made; 2015 to 2022 are the eight warmest years since meteorological observations were made. pre-industrial level by 1.13°C, the sixth highest since meteorological observations were recorded in 1850; 2015 to 2022 were the eight warmest years since meteorological observations were recorded. The rate of warming in China is higher than the global level in the same period, and the average surface temperature in China in 2022 is 0.92°C higher than the normal value, which is one of the three warmest years since the beginning of the 20th century. from 1961 to 2022, the average annual precipitation in China has shown an increasing trend, and there are obvious regional differences in the changes in precipitation, with a significant increase in the average annual precipitation in Qinghai-Tibet and an overall decreasing trend in the average annual precipitation in the southwestern region. At the same time, the global concentration of major greenhouse gases increases year by

year.

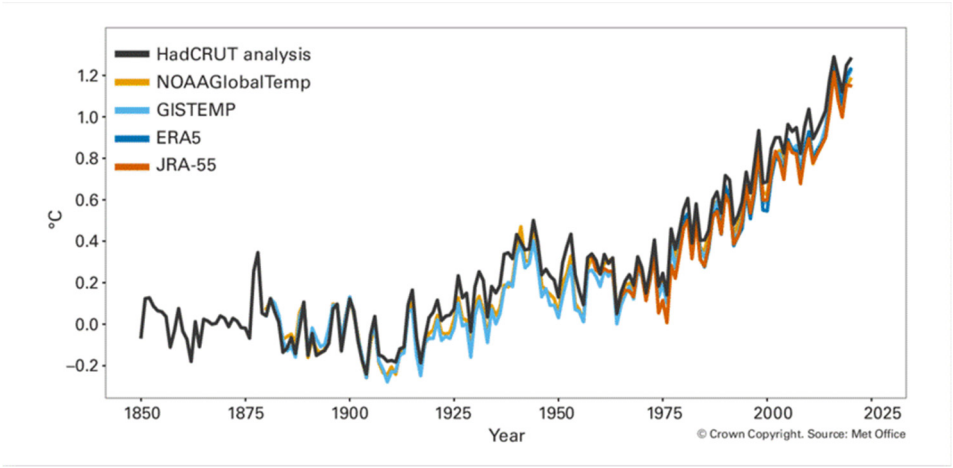

Fig 1. Global average temperature ranges from 1850 to 2022 (relative to 1850-1900 average)

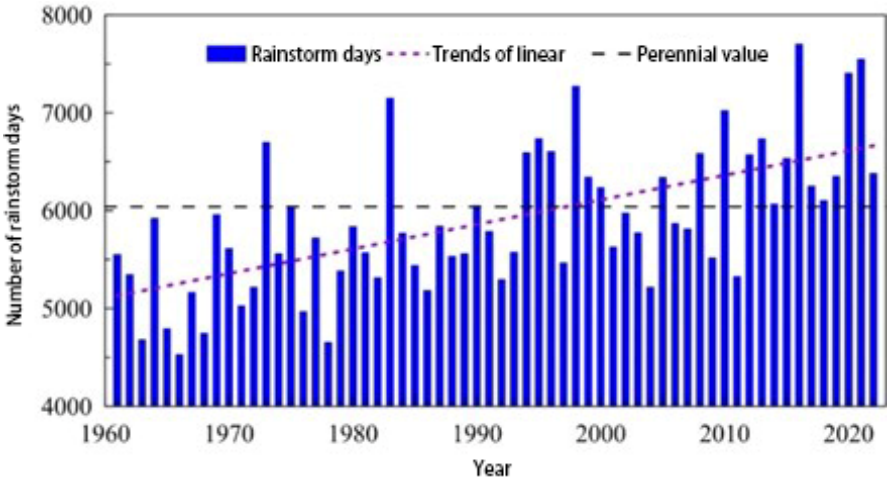

Fig 2. Annual cumulative number of storm station days in China from 1961 to 2022

Climate change is a global issue with far-reaching implications for human society and the natural environment. As an important part of cultural heritage, the conservation and management of cultural objects are seriously challenged by climate change. The United Nations Intergovernmental Panel on Climate Change (IPCC) released its latest report on March 20B, 2023. The report points out that the impacts of climate change on the natural environment and the development of human society are intensifying rapidly as global temperatures continue to rise. In fact, the "static" "should-be" climate environment is already an idealized state, and climate change has already altered climatic variables such as temperature, humidity, wind direction and speed, precipitation and radiation, and increased the frequency of disaster events. The actual environment in which cultural heritage is "located" has changed dramatically, and as experienced today, climate change has become a threat multiplier and exacerbated the expected rate of natural decay of cultural heritage. Although China has made a series of significant achievements in the field of cultural conservation, in the face of the complexity of the current situation of cultural heritage conservation in the context of climate change, it is important to better explore and conserve all types of immovable and curatorial artifacts, as well as to ensure the protection of cultural heritage. movable cultural relics and curated cultural relics, the task is heavy and far-reaching.

2.1. Impact of Climate Change on Movable Cultural Objects

Changes in temperature and humidity are an important factor affecting the preservation of movable cultural objects. Fluctuations in temperature and humidity caused by climate change can have adverse effects on cultural relics. Too high or too low temperature may make the cultural relics deformed, cracked, or produce cracks; too much or too little humidity may cause the cultural relics deformed, discolored or produce mold. Mold will be in the appropriate temperature and humidity of a large number of breeding, caused by the surface of the cultural relics of mold, Suzhou Silk Museum in the black group of flowers in the waistcoat is a typical representative[2]. There are some precious artifacts made of canvas, wood, paper, or leather, which are prone to mold and attract microorganisms and insects under warm and humid environments and will rot or deteriorate if not protected. Such changes not only affect the appearance and structure of the artifacts ,but may also cause irreversible damage to their value.

With the acceleration of industrialization and urbanization, pollution, such as air pollution, water pollution and soil pollution, can cause different degrees of damage to movable cultural relics. For example, acidic gases and particles in the air will corrode the surface of cultural relics; heavy metal ions and organic pollutants in the water body will discolor or deform the cultural relics; and the acidity and alkalinity and microbial communities in the soil may also have an adverse effect on the cultural relics. Even in the museum, In addition

to the original buried corrosion damage, the deterioration of the natural environment also seriously affects the quality of the museum environment, resulting in the deterioration of cultural relics materials, such as: drastic changes in climate or air conditioning system measures improperly caused by the museum micro-environmental temperature and humidity fluctuations significantly, atmospheric pollution or cultural relics collection and exhibition materials (display cabinets, storage cabinets, sacs and other production materials and decorative materials, etc.) emit pollutants to destroy the Museum micro-environment air quality, excessive lighting caused by the fading of cultural relics[3]. In addition, climate change may also exacerbate these environmental problems, thus increasing the damage to cultural relics.

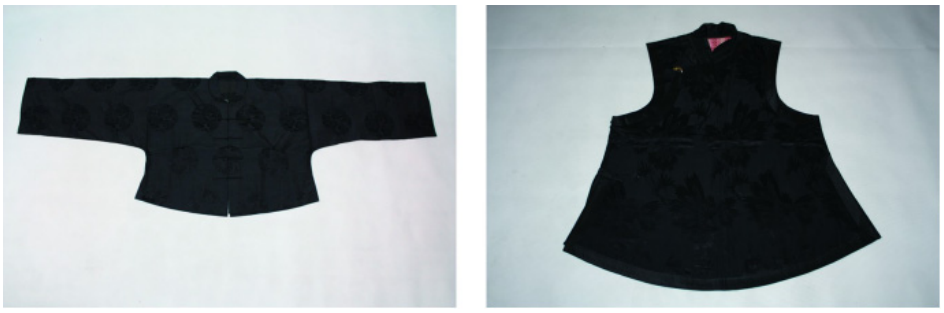

Fig 3. Mildy silk artifacts

2.2. Impact of Climate Change on Immovable Cultural Objects

Immovable cultural relics are susceptible to changes in the natural environment because they have been in an open-air or semi-open-air environment for a long time. Prolonged exposure to light can cause the surface of cultural relics to fade, change color or produce cracks. Ultraviolet rays are one of the main causes of fading of cultural relics, while infrared rays increase the temperature of cultural relics and accelerate their aging process. Solar radiation as well as changes in temperature and climate can affect the surface temperature of cultural relics, making the cracks of cultural relics increase, flaking and rupture, as well as causing fires that directly burn the cultural relics. The temperature difference between day and night is the main reason for the formation, development and peeling of the weathered crust and fissures on the surface of cultural relics [4]. Affected by solar radiation, the surface temperature distribution of cultural relics is not uniform, resulting in a clear azimuthal and seasonal distribution of weathering fissures, karst, plant cover, and other diseases on the surface of the large Rushena statue niche in the Longmen Grottoes [5]. Acid rain can also have a certain impact on cultural relics, causing very serious damage to cultural relics made of e.g. stone.

Fig 4. Leshan Giant Buddha sheds tears

Taking the Leshan Giant Buddha as an example, residents in Leshan, Sichuan Province, have witnessed the Giant Buddha "shedding tears", which is due to the serious corrosion of the stone statues by the acid rain formed by the local atmospheric pollution.

There has been a marked increase in extreme weather events brought about by climate change. Heavy rainfall may lead to landslides, posing a threat to cultural relics and heritage sites on the mountains; the increase in extreme precipitation can cause meteorological disasters such as torrential rains as well as geological disasters such as floods, landslides, and mudslides, resulting in contamination of cultural relics' surfaces, fragile fragmentation, and even collapsing and sinking, while flooding may submerge cultural relics and heritage sites in low-lying areas. On July 8, 2020, the Rainbow Bridge, which has a history of more than 800 years, and has been hailed as "the best version in the history of Chinese corridor bridges" as well as a national key cultural relics protection unit of the State Council, part of the Rainbow Bridge in Wu yuan, Jiangxi Province, was washed away by the mega flood. In October 2021, torrential rains occurred in Shanxi, and a total of 1,783 cultural relics across the province suffered from disasters such as roof leakage, cracked walls, foundation collapse, and collapsed walls. For example, the collapse of the walls of the ancient city of Pingyao, the architecture of the Jin Ancestral Temple, the Hall of Ten Thousand Buddhas in the Thousand Buddha Cave Grottoes, and the gatehouse of the Chong sheng Temple of the Guandi Temple in Xie Zhou were all subjected to varying degrees of persecution. Drought, on the other hand, may lead to the reduction of water sources for cultural relic sites, which has an impact on both the lives of residents and the preservation of cultural relics.

Fig 5. Before the Rainbow Bridge washed out

Fig 6. Rainbow Bridge after washout

Climate change will also have an impact on the environment in which immovable cultural heritage remains. As temperatures rise, microbial colonization of heritage sites increases, which may lead to problems such as decay and hair growth. Changes in humidity climate together with temperature climate change and changes in air pollutants act on cultural relics to contaminate their surfaces, increase their cracks, reduce their strength, cause corrosion on cultural relics, and destroy their surfaces and structures. The damage to immovable cultural relics is even more obvious, the Yungang Grottoes are located in the climatic conditions and long-term deposition of dust makes the surface of the stone statues and statues show dark gray or gray-black, and the dust changes part of the original mineral composition of the sandstone, so that the cultural relics structure is lax, and the weathering rate is increased[6].

Changes in wind direction and speed brought about by climate change have had a significant impact on cultural artifacts in different regions of China. For example, the gradual frequency of coastal typhoons in the southern region is an important aspect of climate change. China's ancient buildings are mostly made of earth and wood materials, which have become very fragile after centuries of wind and rain, and such cultural relics are more vulnerable to damage from extreme rainfall, with loose foundations, cracked walls and tilted collapses[7].

2.3. Impact of Climate Change on Buried Unexcavated Cultural Objects

Climate change seriously affects buried cultural relics. First, ancient Chinese tombs contain many valuable cultural relics that can be preserved for long periods of time under stable climatic conditions, but changes in the soil, geology, or hydrology because of climate change will seriously threaten the preservation of buried cultural relics. For example, rising temperatures may accelerate the oxidation of cultural relics, leading to faster damage. Warming climate leads to shallower permafrost and higher soil temperatures, and burial objects in ancient tombs in the north, which were originally preserved due to low temperatures, are prone to mold and deterioration. Excessive precipitation may dampen artifacts, leading to deformation, discoloration, or cracks, and some areas with increased precipitation will see elevated water tables submerge ancient tombs. Warming and humidification of the climate in Xinjiang will lead to the decay of dried corpses and deterioration of burial objects in some ancient tombs. Excessive winds may weather the surfaces of artifacts, causing them to become brittle. Sulfur dioxide gas in contact with surface water, not only will penetrate into the underground water sources, seriously contaminated the entire body of water underground, and in the process, the head of the body of water is also acid, alkali and other different pollutants, these pollutants through the form of cyclic emissions, resulting in the proliferation of sewage, so that the underground cultural relics have been damaged, these damages are irreversible, the excavation of cultural relics for and the protection of It also brings obstacles to the work of excavation and protection of cultural relics, resulting in the continuous decline of the storage and development value of cultural relics[8].

Climate change may also trigger natural disasters, such as floods, landslides, mudslides, etc., which may directly damage the locations where cultural relics are buried, resulting in the exposure or destruction of cultural relics. For example, floods triggered by heavy rains may wash out artifacts, resulting in their exposure or loss.

Climate change may also affect human action in the excavation and conservation of cultural objects. For example, a warming climate may lead to the thawing of permafrost, which may make artifacts buried in permafrost fragile and vulnerable. At the same time, climate change may affect the timing and location of archaeological excavations, such as the need to reassess the distribution and state of conservation of artifacts in certain areas, as climate change may lead to a change in the area of distribution of artifacts.

3. Dilemmas

3.1. Simultaneous Rapid Climb in the Number of Excavated Artifacts

All provinces and municipalities across the country are vigorously promoting archaeological front work, and the dramatic increase in archaeological projects has led to a simultaneous and rapid rise in the number of unearthed artifacts.2021 In October 2021, the General Office of the State Council issued the "14th Five-Year Plan for the Protection of Cultural Relics and Scientific and Technological Innovation," which requires that "land approved by the cultural relics department that may be subject to the existence of historic In October 2021, the General Office of the State Council issued the "14th Five-Year Plan" for the Protection of Cultural Relics and Technological Innovation, which requires that "land approved by the cultural relics department as possibly containing historical and cultural relics should be subject to the system of 'archaeology first and then transfer', and should in principle not be stored or transferred until archaeological investigations, exploration, and excavation have been completed according to law. Based on the system of "archaeology first and then transfer", with the vigorous development of China's capital construction, the Three Gorges Project, the South-to-North Water Diversion Project, the construction of highways and railroads all over the country, urban construction, etc., a large number of cultural relics are constantly discovered and unearthed, from underground and underwater excavated cultural relics to the ancient ruins, ancient buildings, and important historical sites of the modern era. Protection of cultural relics unearthed in the scope of capital construction, tens of thousands of pieces each year. In many capital construction projects also unearthed a whole piece of ancient burials and batches of important cultural relics, 2023, Wujiang District completed a total of more than 40 plots of about 3.32 million square meters of land archaeological exploration, found 1 Songze remains, 1 remains from the Eastern Zhou to the Ming and Qing Dynasties, 1 remains of the Tang and Song dynasties, in advance of the discovery and protection of the underground cultural relics remains, Wujiang civilization to explore the

source of the provision of a strong support. The number and varieties of unearthed cultural relics are also increasing, ranging from copper, jade, pottery, stoneware, bone tools to ironware, gold and silver. Among them, the number of copper artifacts alone reaches thousands every year. According to the State Administration of Cultural Heritage, from the early days of the founding of New China to the 1980s, the number of cultural relics unearthed through infrastructure projects in the country each year was only a few hundred or thousands of pieces. From the 80's, with the rapid development of economic construction, infrastructure projects have found a sharp increase in cultural relics, and now the number of cultural relics found in the annual infrastructure, than the early years of the founding of new China has increased many times.

3.2. Backlog of Information, Results Too Late for Presentation

As climate change intensifies, many cultural heritage sites have been discovered, while climate change places greater demands on heritage preservation and research. On the one hand, many cultural relics are too late to be presented to the society in time due to historical reasons and insufficient number of professional technicians. During the period of salvage protection of cultural relics in the Three Gorges Reservoir Area, thousands of cultural relics workers from more than 200 institutions across the country participated, and a total of more than 1,100 cultural relics were protected and about 250,000 pieces (sets) of cultural relics were safely unearthed. However, there are still many salvages excavated cultural relics piled up in warehouses in Fuling, Zhongxian, Fengjie and other district and county museums in the Three Gorges Reservoir Area, and some have even been stored in warehouses for more than 20 years, and some of the Three Gorges cultural relics' research reports are still not completed. On the other hand, climate change has led to a more fragile state of preservation of cultural relics sites, while geological disasters have triggered many salvage excavations that require more timely and effective protection. There is a huge contradiction between the limited archaeological excavation and scientific research strength and the large-scale capital construction. The former requires slow and careful work, while the latter "strives for the best", which is a contradiction in terms of time, strength, and work requirements[9]. This makes archaeologists need to carry out excavation and conservation work more quickly, leading to an increase in the amount of excavation data, which in turn leads to a backlog of archaeological data, the results of which are too late to be presented to the community.

3.3. Lack of Timely Restoration of Excavated Artifacts

Chinese archaeology in archaeological excavation and acceptance of extra-territorial theories and methods are in the state of running all the way, the archaeological community in the adherence to the tradition of cultural genealogy collation and acceptance of new ideas and new concepts, in the archaeological report, archaeological theory and methodology, the study of the origin of civilization and so on in the understanding of the situation of the more confusing, so that the archaeological excavation data collation, the publication of archaeological reports, such a basic and key link are ignored and Marginalization, not done. Due to the limitations of knowledge and technology, archaeological excavation on the ancient cultural heritage originally accompanied by varying degrees of change or destruction. At present, the preservation of movable cultural relics unearthed at archaeological excavation sites has been neglected and marginalized.

A lot of experience has been accumulated in the protection of immovable cultural relics, but the protection of immovable cultural relics at the site of archaeological excavation, especially at the first time, has not yet had a better experience and technical methods to follow[10]. Nowadays, climate change has accelerated the destruction of cultural relics, resulting in these important cultural relics not being effectively protected and timely restored, firstly, because of the lack of attention and secondly, because of the lack of scientific and technological means. Climate change is affecting human action on the excavation and protection of cultural relics, and the census and protection of immovable cultural relics are facing great challenges. Of the nearly 770,000 immovable cultural relics in existence, more than 50 per cent are in a worrying state of preservation, of which 17.77 per cent are in a poor state of preservation; 8.43 per cent are in a poor state of preservation, and many cultural relics and monuments have not been restored in a timely manner.

3.4. Slow Progress in Archaeological Big Data Research

Climate change has led to environmental degradation and the destruction or burial of many heritage sites, making it difficult for archaeologists to obtain high-quality information on artifacts and sites. Climate change has also led to an increase in a number of extreme weather events and natural disasters, which have increased the likelihood of damage to heritage sites, further making data collection more difficult. As a result of the difficulties in data collection and impaired quality, practitioners need longer research cycles to obtain adequate data and information.

Environmental changes and changes in the state of cultural artifacts brought about by climate change are such that traditional archaeological techniques and methods may no longer be applicable. Climate change leads to accelerated environmental changes and the changing state of cultural heritage sites, requiring constant updating of data and research results. The study of archaeological big data requires the use of technological tools that keep pace with the times, such as artificial intelligence and machine learning. However, these technologies require a high technical threshold and experience accumulation, professional talents, and technical support. At the same time, these technologies also require a lot of money and time for research and development and testing. Cross-industry cooperation and exchanges are still relatively limited, which also affects the research progress of archaeological big data to a certain extent.

3.5. Gaps between the Interpretation of the Value of Archaeological Materials and Their International Dissemination and the Needs of the Country

At present, there is still much room for improvement in the excavation and interpretation of the value of archaeological data. Because archaeological research involves a wide range of fields and has a long history, the value of many archaeological data has not been fully explored and interpreted, and it is unable to meet the needs of the country

in terms of history and culture, economic development and other aspects. At the same time, there is a certain degree of disconnection between archaeological research work and national needs. Archaeological research should be more closely integrated with the country's economic and social development needs, and provide stronger support for cultural heritage, historical research, and national governance. Moreover, the international dissemination of archaeological data is relatively lagging behind, and many valuable archaeological data have not been widely recognized and acknowledged by the international community, for example, many advanced foreign experiences and practices in dealing with extreme weather have not been studied and introduced in a timely manner, which not only affects the international reputation of Chinese archaeology, but also restricts the possibilities of international cooperation and exchanges.

4. Protection and Countermeasures

4.1. Establishing an Innovative Concept of Protection

Climate change poses unprecedented challenges to the conservation of cultural heritage globally. We need to establish an innovative conservation philosophy to enhance the adaptability and durability of cultural objects. There is a need to recognize the threats posed by climate change to cultural heritage and to enhance the sense of mission and urgency. There is a need to continuously innovate and learn to develop new conservation techniques, which include the development of new conservation materials, the improvement of existing restoration methods and the development of digital monitoring and early warning systems. Preventive conservation is an important part of the innovative conservation concept of cultural relics, transforming the concept of cultural relics conservation from passive restoration to active prevention. The risk of damage to cultural relics is reduced and the preservation life of cultural relics is extended by means of environmental control, regular testing, and risk assessment. Strengthen preventive conservation measures, such as improving the preservation environment of cultural relics, strengthening the infrastructure construction of cultural relics as well as improving the seismic and flood-resistant capacity of cultural relics. In the restoration process of cultural relics, we need to promote the concept of low-carbon restoration. This means that we need to adopt low-energy and low-emission restoration methods to reduce the impact on the environment, which can be achieved through the use of renewable energy, reduction of waste generation and optimization of energy consumption.

4.2. Innovative Mechanisms for the Protection of Cultural Relics and Monuments

In order to deal with the threats posed by climate change to the protection of cultural relics, a database has been established in conjunction with territorial spatial planning, and the collection and protection of information has been properly archived. Spatial control measures for the protection of immovable cultural relics have been implemented in territorial spatial planning, and the protection scope of cultural relics protection units and construction control zones, underground cultural relics burial zones, and underwater cultural relics protection zones have been coordinately delineated and incorporated into the "one map" of territorial spatial planning. It will improve the resource management mechanism for movable cultural relics, perfect the mechanism for collecting, registering, and grading museum collections, do a good job of investigating private collections of cultural relics, carry out a special investigation into the resources of cultural relics lost overseas, and optimize the system for handing over archaeologically unearthed cultural relics and relics involved in crimes. Carry out a survey of revolutionary cultural relics resources. Strengthen the protection of military cultural relics, industrial heritage, agricultural relics, water conservancy heritage, and scientific and technological heritage. Further improve the protection mechanism of famous historical and cultural cities, towns and villages, historical and cultural neighborhoods, and historical buildings. Innovate the working mechanism for the protection of cultural relics and monuments at the frontline of archaeology and at the forefront of cultural relics protection and restoration and overcome the fundamental difficulties. Changes in the protection of cultural relics in the new era require us to make corresponding adjustments and adaptations in scientific understanding, technical methods, implementation programs and actions with regard to cultural relics diseases, hazard risks, loss assessment, restoration processes, as well as preservation techniques and methods. By strengthening the digital storage and management of cultural relics, conducting in-depth research and analysis of the historical background and environmental factors of cultural relics, and strengthening the monitoring and management of cultural relics, these precious cultural heritages can be better preserved and handed down.

4.3. Support for Multi-Platform Cooperation

Strengthening the international cooperation network for the protection of cultural relics, in particular, cultural relics such as the "Belt and Road", which is cross-regional and covers a wide range of cultural types, are related to each other to varying degrees, which provides the basis for the establishment of a platform for international cooperation in research and protection. It should actively promote and guide the cooperation between international organizations, institutions, heritage conservation institutions, universities and social forces at all levels, and establish a sound cooperation mechanism. Communication and cooperation between parties can be promoted by building cooperation platforms and organizing cooperation forums. Meanwhile, it should also strengthen the supervision and assessment of cooperation projects, formulate more flexible laws and regulations on cultural relics protection, simplify the procedures for handing over cultural relics, and relax the restrictions on the use of cultural relics, etc., so as to promote the smooth implementation of cooperation projects. Ensure the rationality and effectiveness of cooperation. Through these preferential measures and the provision of venues, cooperation among heritage conservation institutions at all levels, universities and social forces can be effectively promoted to jointly advance the development of heritage conservation. At the same time, experience should also be summarized in practice and relevant policies and measures should be constantly improved to adapt to the new situation and new needs of cultural relics protection work.

4.4. Establishment of a System of Restorers of Cultural Relics to Train Talents

Archaeologists are the main body of archaeological and

conservation work, and how their comprehensive quality determines the ultimate effectiveness of heritage conservation.

Continuously strengthen the construction of archaeological personnel and establish a professional certification system for cultural relic restorers. Professional qualification certificates will be issued to qualified personnel to ensure that they have the ability and quality to engage in the restoration of cultural relics, and to enhance their sense of pride and mission. Through strengthening the construction of disciplines and teaching reforms, improve the quality of faculty and talent training in the discipline of archaeology, and provide talent protection for archaeological research and development.

Cultivate a group of high-quality archaeological and restoration talents with an international outlook and interdisciplinary background. Strengthen exchanges and cooperation with other countries in the international arena, introduce advanced restoration concepts and techniques, improve the overall level of restoration of Chinese cultural relics, and teach key conservation techniques and advanced methods at home and abroad. In this way, we will face the new requirements under climate change and enhance the professional level of our staff.

In addition, archaeological teams should work closely with colleges and universities. The restoration of cultural relics should be introduced in colleges and vocational schools, a comprehensive discipline system should be established, a large number of advanced and comprehensive archaeological professionals should be trained, and practical training opportunities should be actively provided, including participation in actual cultural relics restoration projects and visits to museums and archaeological sites, in order to improve graduates' practical skills and experience.

At the same time, the archaeological unit also want to create incentives for talent, through a variety of ways to stimulate the work of cultural relics restoration staff enthusiasm and sense of responsibility, to attract more talented people into the team, for the archaeological excavation site of cultural relics protection work to make more contributions.

4.5. Establishment of a Sound Information Sharing and Data Service Platform

Through multidisciplinary cross-fertilization and innovative research methods and technical means, the historical and cultural connotations and values of archaeological materials can be better revealed. Under the general trend of climate change, it is necessary to draw on the theoretical foundations of other disciplines, such as architecture, physics, chemistry, and atmospheric science, in order to deeply excavate and interpret the value of archaeological materials, strengthen archaeological research and improve the understanding of the value of archaeological materials and the ability to excavate them.

Digital empowerment of archaeological research and cultural relics protection, highlighting the results of collective wisdom and joint collaboration. We will strengthen the construction of archaeological information infrastructure, establish a perfect information sharing and data service platform as soon as possible, and form a benign interaction and group efforts within the industry. Through digital technology and informationization means, improve the management, utilization and sharing of archaeological data, and provide better support for academic research and international dissemination.

The China-Portugal Joint Laboratory for Heritage Conservation Science "Belt and Road" of the City University of Macao, a national heritage research platform, has actively established an interdisciplinary and cross-field information-sharing platform. On the basis of digitization and informatization of its collections, it has not only taken the initiative to strengthen inter-library intercollegiate exchanges with the local Macao Museum and the University of Macao through the establishment of a digital museum and the use of virtual reality and digital mapping, but has also further cooperated with Sun Yat-sen University and the University of Évora of Portugal in carrying out domestic and international scientific research projects, making use of the advantages of the Greater Bay Area to assist in the conservation and utilization of cultural relics.

5. Conclusion

Climate change poses a serious threat to cultural relics, and we need to rethink and adjust conservation concepts and methods. In order to maximize the value, archaeologists and all related professionals in the new era should develop targeted conservation responses based on existing problems. By recognizing the impact of climate change, the limitations of traditional conservation methods, the shift in conservation philosophy, innovative conservation methods and practices, and the importance of policy and international cooperation, we can respond to this challenge more effectively. This is not only a matter of respect for our heritage, but also a responsibility to our history and future.

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