

# **HARNESSING SCIENCE AND TECHNOLOGY FOR PRESERVATION AND CONSERVATION OF CULTURAL HERITAGE IN MALAYSIA**

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## **Introduction**

Malaysia's heritage is extraordinarily rich. Heritage links people, places and things from our history to the present and to the future. We work diligently at collecting and preserving the artifacts, written records, oral traditions, special places and lands that make up the Malaysia's history. Over the years our concept of cultural heritage and its role as a central part of the experience of our communities has expanded from a focus on objects and monuments to include our social structures, ways of life, beliefs and systems of knowledge. We seek answers in our attempts to promote the understanding and unity among people that have made our country a nation regardless of ethnic origins and religious affiliations, and to prolong the life essence of our rich heritage. We found a simple but yet, a meaningful answer; *Harnessing Science and Technology for Preservation and Conservation of Cultural Heritage in Malaysia.*

Conservation has gained an increasing importance world over, as there is greater awareness and a sense of urgency about the need to conserve and preserve cultural heritages. In 1979 Burra Charter, it stated:

*' Conservation means all the process of looking after a place so as to retain its cultural significance. It includes maintenance, and may, according to circumstances, include*

*preservation, restoration, reconstruction adaptation and interpretation and will commonly be a combination of more than one of those’.*

*‘ Place means site, area, building, or other work, group of buildings or other works together with pertinent contents and surroundings.’*

*‘Cultural significance means aesthetic, historic, scientific or social value for past, present or future generation.’*

The first cycle of conservation is the identification of objects. It involves researches, historians, conservators as well as scientists, in search for full picture of the object provenance. All these people compile information to create a foundation of knowledge upon which all future care depends. The information gained from accurate detailed registration of object’s provenance by historical and scientific research can have numerous applications in the conservation process of the object.

Recent years are witnessing unprecedented growth in various fields of science and technology in Malaysia, such as materials technology, medical sciences, biotechnology, information and communications technology. Whichever perspective is used, it is clear that science forms an integral part of Malaysia’s culture, in the past as well as now. Fulfilling a vital function as a carrier of knowledge and methodology, sciences places on our shoulders a strong obligation towards future generations. As Malaysians, we have been formed by our cultural heritage. Clearly, we must protect that heritage and continue to enrich and develop it, incorporating new knowledge, new insights, new ideas and new experience.

It is our belief that the cultural heritage of each nation is a part of the irreplaceable wealth of humankind. As such, it is worthy of our greatest efforts to preserve and to maintain it, whether it is found in historic sites, historic urban districts, cultural landscapes, buildings of unusual aesthetic value, archaeological sites, museums, libraries,

archives, or other repositories of human memory. And to this day, we found and believe that scientific approach is worthy of such task.

## **Harnessing Science and Technology for Preservation and Conservation of Cultural Heritage in Malaysia : Past and Present**

### ***I. Archaeological Conservation***

Contrary to common belief, an archaeologist does not stop searching after a discovery. Instead, archaeology goes deeper than the finding of artifacts. Once an artifact is discovered, archaeologists try to seek answers for several issues; its origin, settlement, cultural evolution, technological development, social classification as well as belief. Those issues would forever remain in haze if archaeology tries to stand on its own without blending with other disciplines.

Fortunately in Malaysia, the assimilation of archeology with other disciplines particularly in science and technology has rooted since 1960s. Since then, new scientific approaches involve technological innovations were introduced and applied. Partnership and co-operation were being made with experts from different disciplines such as from the school of Geology, Biology and Chemistry. As a result, a comprehensive and detailed analysis and rich data interpretation are made with strong, valid, and supportive scientific evidence.

Artifacts are the bridges to the past. Yet, their life phase is uncertain. Thus, conservation and preservation are necessary to prolong their life essence. In Malaysia, scientific approaches in conservation using chemical and mineral analysis are applied in archaeological artifacts. Aimed to investigate the original sources, structures, and temperatures, the tools used are X-Ray Fluorescence Spectroscopy (XRF), X-Ray Diffraction (XRD), Atomic Absorption Spectroscopy (AAS), Inductive Coupled Plasma-

Atomic Emission Spectroscopy (ICP-AAS), Quantitative Colour Difference Analysis (UV/VIS), and Scanning Electron Microscopy (SEM).

Some equipment mentioned have been used on pottery sherds in Gua Angin, Jerantut, 741 , Pahang. Compositional and morphological analysis showed the same development in pottery technology over several thousand years in Gua Angin. Local pottery shows similarities with foreign pottery in some technology for example the firing method, thickness and porosity.

In 1999, a joint project on archaeological and conservation works at Kota Kuala Kedah site have been established between the Department of Museums and Antiquities and Geology Department from National Malaysia University. The project aimed to investigate and analyze the depth of monument structure as well detecting other sources or possible existence underneath. Indeed, this method or generally known as geophysics approach have often been used to assist in excavation. Common geophysics methods applied are geo-electric, magnetic detection, and radar. Magnetic detection method is effective in detecting artifacts containing a high level of magnetic reaction like metals or those artifacts made from bronze. Nevertheless, its effectiveness depends on the size, depth and strength of the artifacts.

## ***II Underwater Conservation***

Underwater artifacts which remain undisturbed on the seabed for centuries provide vital information about the past. However, once an underwater artifact is taken out from its original residence, it would be weak against the temperature and its level of exposure to rapid decay or deterioration is very high. They suffered from salt efflorescence causing loss of surface detail in the object itself. This phenomena is well known and a plethora of data exists will describe it as nature, composition and cure. The challenge of scientific approach to be to understand the past by studying material traces without making any further deterioration on the objects.

Currently, a joint project between Department of Museums and Antiquities and MINT is established in developing a research on conservation of marine artifacts. Several programs have been laid out; intend to pursue technical and scientific studies of maritime objects. Researches are purposely carried out to find means and methods in stabilization and reintegration of deteriorated underwater artifacts as well providing a good environmental condition for those artifacts. Highly specialized teamwork is appointed with a deep knowledge pertaining the corrosion mechanisms and the processes of controlling the degradation of artifacts. Specific equipments are chosen for the projects includes; optical microscope, scanning electron microscope, radiography, X-ray fluorescence, Image analyzer, scanning vibrating probe, portable corrosion measurement system as well as corrosion analyzer.

The Department of Museum and Antiquities also formed an understanding with FRIM or Forest Research Institute Malaysia, one of the leading institutions in tropical forestry research, both within the country and abroad. Founded by British colonial forest scientist in 1929, the former Forest Research Institute with Dr F.W. Foxworthy as its first chief research officer, became a statutory body governed by the Malaysia Forestry Research and Development Board under the Ministry of Primary Industries in 1985 and then in 2004, FRIM became a statutory body governed under Ministry of Natural Resources and Environment. Wood-based artifacts from shipwrecks are sent to FRIM to for identification process of the wood types, age and structures.

### ***III Monument and Artefacts Conservation***

*‘ To restore a building is not to preserve it, to repair or to rebuild it, it is to reinstate it in a condition of completeness which could never have existed at any given time ‘*

*(Viollet-le-Duc , Carcassone.)*

Historic Buildings have the qualities of low energy consumption, loose fit and long life, so the lessons learned from their study are relevant to modern architecture, which should aim at the same qualities. They teach us that buildings work as spatial environmental systems and must be understood as a whole. There is no dichotomy between modern buildings and historic buildings - they both are used and abused.

Monuments and historical buildings are part of the precious national heritage. Thus, it is desirable to preserve and conserve them in its original fabric. However, the level of exposure of the historical buildings such as bricks and mortars to the process of decay and deterioration is very high if urgent steps to conservation are not taken immediately. Inherent environment, nature of the ground, material structural defect, and physical, mechanical and chemical weathering as well biodeterioration are part and parcels of intrinsic causes leading to the deterioration of monument and historical building. Similarly, such degradation is also caused by an exintrinsic causes, composing of man vandalism, natural catastrophe, climate and water pollution as well as biological growth.

Fortunately, a history of preservation and conservation of monuments has stepped forward from being merely sticking on visual observations and destructive tests of core sample. MINT has been developing a new scientific method for preservation of archaeological and environmental applications. NIPGAT or 'neutron-induced prompt gamma-ray technique' can be used for in-situ quantitative determination and analysis of industrial, environmental and archaeological materials as well as location of contaminants, particularly water and soluble salt in building materials. Compare to conventional methods, this new technique provides an accurate and reliable data as well as offers an excellence level of sensitivity. Hence, it is useful and suitable in providing solution for investigation of deterioration of monuments or historic buildings especially for investigating moisture and chloride problem.

Furthermore, NDT or Nondestructive testing has been developed and introduced in conservation and preservation of buildings materials. Presently, non-destructive testing

(NDT) methods in general are widely used in several industry branches. Aircrafts, nuclear facilities, chemical plants, electronic devices and other safety critical installations are tested regularly and non-destructively requiring fast and reliable testing technologies. Also, as an integral part of quality assurance and quality control implementations, NDT is an indispensable tool. NDT is highly advanced and a variety of methods is available for metallic or composite materials.

Regarding historical buildings in Malaysia, NDT focuses on the roots or sources of decay caused by age and environmental attacks. For instance, detection of corrosion holds the major priority in metal-based objects is one of NDT methods. Furthermore, NDT methods also involve ultrasonic, radar, thermography, visual experiment as well as radiography. Other than aiming for conservation and preservation purpose, NDT also provides several important information on historical objects such as structures, methodologies and quality of the object itself.

Kota Cornwallis in Pulau Pinang is one of the good example of the implementation of scientific approach to conservation of historical buildings. Several methods are used comprising of sample matching, compressive test and microbiology studies and XRF. Remote Sensing technique has been applied at Tanjung Dawai aimed to detect the depth of the river in which alluvial soils and a theory of possible shipwrecks have been identified.

## **Harnessing Science and Technology for Preservation and Conservation of Cultural Heritage in Malaysia : The Future**

The Department of Museum and Antiquities holds the responsibilities to preserve and disseminate knowledge on towards conserving, preserving and historical, cultural and natural heritage in its effort to instill awareness among the public on richness of the country's historical, cultural and natural heritage. These efforts will assist to create a

harmonious society with high morality and also helps the government to promote and develop the tourism industry. While MINT, a short form for Malaysian Institute for Nuclear Technology Research is a national research institute whose core activities are based on nuclear science and technology and other related technologies. Both are supported by professionals and supporting staffs, trained in their own respective areas.

The Department of Museums and Antiquities has currently form an understanding with MINT in which several joint projects have been discussed and would be put into action. Teamwork that comprised of both organizations would work together in which the co-existing of scientific and historical approach would be expected to provide excellence result in conservation and preservation of cultural heritage in Malaysia. The projects cover from conservation of cannon, analysis of chemical composition of bead, detection of buried objects by Ground Penetrating Radar (GPR), ceramics, radiocarbon dating, bricks, fossils, and metal. Some historical sites in Malaysia have been chosen as a ground for the project experimentation and researches namely Gua Nagamas, Rumah Raja Bilah, Kota Tampan, Kota Cornwallis, Setapak Horse, Lembah Bujang and Kota Kuala Muda.

### *I Conservation of Material Science : Cannon, Ceramics, Fossils and Metal*

It is proposed that regarding the conservation cannon , several scientific approach are going to be taken covering the identification of cannon, a measurement standard, database and photographs. It involves aspects like material identification, diameters, wall thickness, and calculation of actual length and weight of cannon as well as a case study that would confined to historical forts such as cannon at Kota Kuala kedah.

A research on fossil discovered in Gua Naga Mas is going to be taken using both historical and scientific approach. Type, age, preservation and conservation method of the fossil are the major interest of both parties. Radiography is one of the suggested technique but its actual implementation is still under careful observation and experimentation.

Bricks industry has rooted in Malaysia since the sixth century. It disappeared in fourteenth century after the fall of Lembah Bujang but later, emerged again in eighteenth century. Therefore, it is suggested that a research on brick industry would be thoroughly and carefully planned on its origin, technology and porosity to seek information in order to fill in the gape between those phases . A paperwork have been presented on research of deterioration of bricks structures particularly on the containment of salt and water, which are the driving force for deterioration. This system, if succeed in its implementation, would make it possible for an accurate identification of the original source or place of the object.

## ***II Analysis of Chemical Composition of Beads***

*' Some members of our group felt that we should be skeptical about chemical treatments, because we are at quite a primitive stage in understanding such treatment and that physical methods of structural stabilization should be preferred wherever possible'*

*(Tim Padfield, 1992 Dahlem Conference)*

The objective is to gather a composition data of the origin, elements and features of bead. Furthermore, the mineral composition and types are taken into main consideration. Samples are taken to identify the mechanism process of beads includes colors, shapes, sizes and materials. The project is already started since July 2004 as samples were taken from excavation site at Sungai Mas and will continue with the involvement of both sides.

## ***III Detection of Buried Objects by Ground Penetrating Radar (GPR)***

GPR or Ground Penetrating Radar is a broad band, impulse radar system that has been specifically designed to penetrate earthen materials. The radar transmits high frequency, short duration pulses of energy into the ground from a coupled antenna.

Transient electromagnetic waves are reflected, refracted, and diffracted in the subsurface by changes in electrical conductivity and dielectric properties. Travel times of reflected, refracted and diffracted waves are analyzed to give depths, geometry and material type information. The energy returning to the antenna is processed within the control unit and displayed on graphic paper.

## ***V Radiocarbon Dating***

Radiocarbon dating has proven itself to be the most widely interesting of dating methods, notwithstanding that its time range of application is only 50,000 years or so. Carbon 14 or C14 establishes data on chronologies of glaciations and sedimentation, past sea levels and ancient climates. C14 also tells us about the sources and intensity of man-made pollution of the atmosphere, land, rivers, lakes and oceans, and the periodicity of earthquakes, floods and storminess.

Previously, in order to determine the age of specific object, archaeological artifacts were sent abroad for radiocarbon dating. However, a development of radiocarbon dating in MINT make it possible for our archeological artifacts being analyzed locally. It is continuous project between Department of Museum and Antiquities and MINT involving expert from both sides.

## ***VII Seminars and Workshops***

Previously, several seminars, workshops and meetings have been held between both organizations in order to achieve better understanding in integration of science and historical approach towards conservation of cultural heritage. Following that, workshops and training are going to be actively held to increase the public awareness on the importance of science in the conservation and preservation of cultural heritage in Malaysia.

Furthermore, it is impossible to talk about a vision of conservation of cultural heritage in twenty first century without considering the impact of Information Technology. We have already seen the benefits of publishing preprint papers on the Internet for the 'Preventive As proposed in V&A Conservation Journal ;

*' When collaborative and Internet technologies develop in the future, the conservation of an object could be debated by remote conservators using video conferencing, and conservation techniques tested on 3D rendered models before physical treatment'*

## **Challenges in Harnessing Science and Technology for Preservation and Conservation of Cultural Heritage in Malaysia**

It is our expectation in harnessing science and technology in the preservation and conservation of cultural heritage in Malaysia to prolong the lifespan of our valuable cultural heritage and to instill love and pride among the public to the roots and origins. However, it is easily said than done. Challenges are inevitable especially when our ambition are constrained by lack of knowledge, experts, funds and awareness from the public itself.

Weathering vegetation growth, climate, vandalism, the very growth of human civilization, involving as it does the building of dams, highways, airports, pipelines, sky-scraper and the renewal urban programmers and the accompanying problem as the shortage of funds, improper conservation techniques implemented and without proper documentation, lack of qualified personnel and officers in charge are overburden with work. This leading to poor practical achievement or has a great effect to quality and reality of conservation of our cultural heritage.

## ***I Lack of distribution of Intellectual Knowledge and Commitment***

In Malaysia, often much information is available but results of relevance to objects of art and archaeology are scattered through the literature of many disciplines in several languages. Furthermore, the absence of commercial or technological importance for many of these results means that they often do not find their way into recently published books on relevant topics, such as coatings technology.

The historical and scientific "vectors" converge as much as possible in the same methodological direction, so as to realize the maximum reciprocal interaction and advantage. These are many possibilities for the development of new non-destructive procedures and equipment in the restoration field. However, scarce commitment is given, by the academic world, to the practical-technological field of conservation, deemed unproductive on a scientific basis.

## ***II Lack of Proper Documentation***

Documentation is the key element of conservation and preservation process. A simple error or omission may twist important factual evidences into non-existence. Hence, proper documentation is essential to ensure a systematic arrangement of events, both historical and scientific.

## ***III Lack of Qualified Personnel and Officers in Charge***

Conservators must have those qualities ; appreciation and respect for cultural property of all kinds-their historic and sociological significance, their aesthetic qualities, and the technology of their production. They must have aptitude for scientific and technical subjects and patience for meticulous and tedious work. Also, a good manual dexterity and color vision and intelligence and sensitivity for making sound judgments as well as an ability to communicate effectively are essential in conservation and preservation of cultural heritage. Sadly, though possessing some good qualities, many

officers lack of more important elements in conservation particularly in scientific approach. That leads to the improper practice of conservation techniques.

As Ian Rowlin wrote in 1945; ‘ *One should make sure at the very outset that there is a truly philosophic basis so that ‘conservators’ should not be only be a good practitioners, but scholars as well, knowing not only what they do, but why they do it, and prepared to discuss fundamental questions effectively with their opposite numbers in aesthetics, art history and forth’.*

## ***VI Lack of awareness, support and attention from public***

There is a wrong conception among public, which views museums as a keeper of old things. Bored with a dull museum atmosphere, they prefer to go to theme parks and entertainments center, which surely provides more enjoyable time. The ignorance of the association of scientific and historical approach in cultural heritage is common in public way of thinking. Lack of promotion and education pave the way to the absence of the awareness and support from the public.

## **Conclusion**

In spite of challenges, Malaysia would strongly aims to retain and prolong the well being of national cultural heritage by promoting the importance of conservation and preservation of cultural heritage through scientific research among masses particularly to the younger generation through mass media, seminars and workshops as well as an awareness program in schools and universities. The training and continuing professional development must continue throughout a conservator's career. Determination and dedication, supplemented by sufficient knowledge would be a driving force in overcoming any challenge and threat in harnessing of science and technology for preservation and conservation of cultural heritage in Malaysia.

Indeed, if we are to remain true to our cultural heritage, then our science and technology edge must remain sharp in present as well as in the future. In order to do that, they must be governed by an adequate ongoing support and sustained investment. Only with this, we will succeed.

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