

ARE BUDDHA STATUES IN REMAINS LIVING HERITAGE FOR LOCAL BUDDHIST PEOPLE?

- CASE STUDY ON THE CONSERVATION OF THE GIANT BUDDHA STATUE AT SUKHOTHAI HISTORICAL PARK IN THAILAND -

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It is needless to say that the Buddha statue is respected religiously by Buddhist people. Under the such situation, how should and can Buddha statues in remains be conserved? What kind of interventional conservation treatments can be applied? Are they historical monuments or living religious objects?

For the reference in considering this problem, a case study on the conservation of a giant Buddha statue in remains is introduced here.

Case Study

Conservation of the Giant Buddha Statue at Sukhothai Historical Park in Thailand

1. Introduction

Sukhothai historic site located in the center area of Thailand is the ancient city of Sukhothai Kingdom which prospered in the 13 to 14 century. More than 300 brick structural remains are left inside and outside the city wall which is 1.8km east to west and 1.6km north to south. Excavation and Conservation works of Sukhothai historic site have been going on since 1950s. Especially from 1977 to 1987, large scale international conservation project was carried out. The site was recorded on the World Cultural Heritage List of UNESCO in 1991.

Wat Sri Chum is a temple located just outside of the north side of the city wall. The main hall made of brick is 23m square and 15m high, and the thickness of its wall is 3m. The roof part of the hall was lost. A giant Buddha statue which is 15m high is installed tightly in the hall. The Buddha statue, which is called Pra Achana, is one of the most huge and important statues in Sukhotai historic site. However, the statue had been suffering from extreme discoloration (greenish blackening) and fragilization of the surface layer because of numerous growth of microorganisms (mosses, algae, lichens, etc.) on its surface.

Thus, cleaning, consolidation and hydrophobization treatment to the surface layer of the statue were carried out by the joint team of the Fine Arts Department, Thailand and the National Research Institute for Cultural Properties, Tokyo, Japan.

2. Condition of the Statue

The core structure of the statue is made of bricks and the

shape of Buddha is made of stucco (lime plaster) on the core structure. Since the temple was abandoned, the statue had remained partially destroyed. From 1953 to 1956, the statue was restored by the traditional materials and techniques.

Tremendous microorganisms (mosses, algae, lichens, etc.) were growing on the surface of the statue. In the rainy season when enough water drenches the statue, the microorganisms got active and the surface looked a green carpet. In the dry (photo 1) season when little water is supplied, the microorganisms got into a state of suspended animation and blackened. Thus, the statue was discolored into greenish black except its armpits, its back and some part of its face, and had a very strange appearance. And mechanical deterioration (fragilization of the surface, especially the horizontal surface) occurred by the growth of microorganisms.

3. Investigation of the Environmental Condition

3.1 Climate of Sukhothai

Climate of Thailand is divided into two seasons that are the rainy season (from middle of May to middle of October) and the dry season (from middle of October to middle of May). In the center area of Thailand where Sukhothai is located, maximum temperature is more than 30°C with strong sunshine through the year. A lot of rain falls in the rainy season. In this case, it does not continue to rain for many hours, but it rains intensively within a few hours. Little rain falls in the dry season.

3.2 Environmental Condition in the Main Hall of Wat Sri Chum

The statue is inside the main hall. Since the hall is closed except a narrow front entrance and its roof part (the original roof is lost), air movement is quite slow in the hall. Rain water and sunshine come directly into the hall because the roof part is lost and open. Thus, the large amount of water penetrates into the statue when it rains, but the water can not evaporate out soon because of slow air movement in the hall. In such a situation, sunshine comes into the hall to make the condition in the hall hot and humid. These conditions are very suitable for microorganisms to grow actively.

3.3 Investigation of the Action of Ground Water

When considering conservation measures to a monument in

the open, it is important to know if ground water comes up into the monument or not. Measurement of ground water level and mechanical analysis of the surrounding soil were carried out. And they reveal that the ground water level is quite low and the soil has a coarse grain size. From these results and the fact that the base of the statue is quite high, it is considered that ground water is unlikely to come up into the statue by capillarity. Thus it is considered that water penetration into the statue can be stopped by protecting it from the rain water.

3.4 Investigation of Microorganisms

Moist areas of the statue was covered with greenish black crust and patinas. The microscopic investigation revealed that these crusts and patinas consist of mosses and algae. Their presence was more apparent on the horizontal surfaces. Mosses developed rapidly on the surface that was rich in humus deposit. The principal sources of such deposit was the accumulation of airborne particles, dead microorganisms and bird droppings. The plaster surface underneath was badly deteriorated.

The algae were investigated by direct observation under optical microscope. The most common algae are cyanobacteria or blue-green algae. The unicellular forms are mainly *Chroococcus*, *Gloeocapsa*, *Gloeothrix*, *Microcystis*, *Myxosarcina*, *Synechocystis*. The major filamentous forms are *Lyngbya*, *Phormidium*, *Scytonema* and several unidentified species. They form dark, blackish, felty coatings. Green algae are also present, to a lesser extent, on moist areas. Several genus of pennate diatoms are also identified. Most of them belong to genus *Pinnularia*, *Nitzschia*, *Cocconeis*.

4. Basic Idea for Conservation Measure

Since the discoloration and the fragilization of the surface layer of the statue is due to the growth of microorganisms, the microorganisms should be eliminated. And then, the surface layer should be consolidated. However, microorganisms would grow again on the surface quite soon after such treatment, if any measure was not taken to prevent growing of microorganisms. In this case, diminishing of the water content in the surface layer is the most effective for that purpose, because microorganisms, especially mosses, algae and lichens, can not live without enough water. Thus basic idea for conservation measure is considered as follows:

Firstly, the surface of the statue is to be cleaned by eliminating the microorganisms. Then, the surface layer is to be consolidated by impregnation with hydrophobic consolidant, so that the surface layer is consolidated and made water repellent to prevent recurrence of the growth of microorganisms. Consolidant should have high durability and good penetrability into stucco layer. So, an hydrophobic silicone resin is considered most suitable in this case.

5. Preliminary Test *in situ*

50cm square area, which was terribly discolored and made

fragile by growth of microorganisms, on the surface of the statue was chosen for the test. The area was cleaned and then the half of the area (50cm × 25cm) was treated by impregnation with an hydrophobic silicone resin*, while the other half area was untreated. Six months after the treatment, microorganisms were growing on the untreated area, while no change was found on the treated area. One year after the treatment, the untreated area was completely returned to the state before cleaning, while the treated area had not changed at all, keeping the state just after the cleaning.

On basis of this test result, it was decided to carry out the practical conservation treatment.

6. Practical Conservation Treatment

6.1 Cleaning and Partial Restoration

The cleaning process was done in the dry season because the microorganisms were in the state of suspended animation and was eliminated quite easily.

Dry deposit of mosses, algae and lichens was carefully removed by mechanical means with small scrapers, scalpels, soft brushes and synthetic fiber abrasives. Neither chemical nor water was used in the cleaning process. The cleaning process was accomplished by nine conservators and eight workers within 37 days.

The deteriorated plaster was removed and restored by using traditional lime plaster consisting of slaked lime, sand and paper fibers. These materials were well mixed and thoroughly pounded until it reached the desired consistency. This process yields stronger and less porous lime plaster. It also improves the plasticity and workability of the plaster. The portland cement which had been partially used in the previous restoration was also removed and replaced by this mixture.

6.2 Impregnation with Silicone Resin

About 300kg of the silicone resin solution (SS-101) was transported to the site from Japan. The silicone resin solution was applied to the statue in the order from the higher part to the lower part by pouring and/or brushing.

The solution penetrated well into the deteriorated part which had suffered from tremendous growth of microorganisms, while it penetrated a little into the sound part which had not suffered from growth of microorganisms. So, the amount of impregnated (applied) solution varied from 2 - 3 kg/m² down to 500 g/m² depending on the deterioration degree and the average amount was about 1 kg/m².

After the conservation treatment, its color changed from greenish black to slightly grayish white. And, it should be noted that the face of the Buddha changed to be merciful with the change of the color.[Photo.2]

* Solution of oligomer of methyl-triethoxysilane in organic solvent; SS-101, Colcote Co. Ltd.,

6.3 Monitoring

The condition of the statue has been and will be periodically checked after the conservation treatment. In order to monitor the effect of the treatment with silicone resin, the same treatment was done to a part of another smaller Buddha statue which is located just outside the main hall of Wat Sri Chum. In this case, the amount of impregnated (applied) silicone resin solution was less than 500 g/m² so as to make the condition of the monitoring part severer than the giant statue.

7. Condition of the Statue after the Conservation Treatment

As of December, 2000, the surface of the statue was becoming gray in colour somewhat. This colour change is considered to be due to an accumulation of dust and an adhesion of microorganisms on the dust. According to the periodical measurement of water content of the surface layer of the statue, the surface layer has been becoming dry in disregard of season since the conservation treatment was applied to the statue. which means that the microorganisms can not live on the surface of the statue but only on the accumulated dust on the statue. Therefore, the change of the surface of the statue in gray cooler is considered not to proceed so much. Anyway, however, it is necessary to investigate the condition carefully.

8. Shelter

It is obvious that covering the statue by a shelter is very effective to protect it from rainwater. However, rebuilding of the roof on the main hall should not be taken into account, because its original shape and material are unknown.

So, a shelter which is invisible from outside the main hall was considered. In this case, the material and characteristics of the shelter are important. Transparent materials such as glass, acrylic resin, polyester resin, etc., can keep inside of the main hall light in daytime. However, the temperature inside the hall rises by hothouse phenomenon. which is uncomfortable for prayers and tourists, and causes propagation of little animals and insects. And it is necessary to clean the shelter periodically, otherwise it becomes dirty and ugly easily.

Therefore, side-open type thatch roof is considered as the appropriate shelter. The merits of thatch roof are as follows:

- It is completely made of local materials and by local technique, which means its cost is low and its maintenance is easy.

- It looks quite natural unlike modern materials such as glass and plastics.
- It does not affect so much the condition inside the main hall, because it is side-open type roof and the roof material (thatch) is not airtight.

9. Experiment on the effect of thatch roof by using model structures

Four pillars, which were made of bricks and covered with lime mortar, and each of which was enclosed brick wall, were built at the North-east corner of the site of Wat Sri Chum. And two of them were covered by thatch roof.

Two of the pillars, one of which is covered by the roof and the other one is not covered, were impregnated with a solution of hydrophobic silane which is the same solution used for the treatment of the giant Buddha, so as to investigate the effect of the treatment with the silane solution.

Precise investigation on the condition of the pillars shall be made, so that the effect of the shelter can be evaluated.

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Photo.2
Giant Buddha After Conservation Work



Photo.1
Giant Buddha Before Conservation Work