Conservation of The Sukhothai Monuments

by Chiraporn Aranyanak

Most of the ancient monuments in Thailand are in a deteriorated state. Two of the most important factors contributing to this are the environment and climatic conditions. Since Thailand is located in the tropics, high humidity which accelerates the biological activities of various objects is ever present. In addition, moisture also hastens the deterioration processes either physical, chemical or biological.

A survey of the condition of the Sukhothai monuments has indicated that all monuments were mostly damaged by various types of microorganisms and higher vegetation i.e. fungi, bacteria, lichen, algae, ferns, selaginella, grass and other dicots. Their growths not only obscure carving and details of the structure but also affect the stability and durability of the monuments.

Fungi and bacteria, when present on porous building materials, transform the inner constitution of the materials and also utilize organic matters in some for their nutrients. They not only weaken the materials on which they grow but also produce stains from the metabolic reactions. Some microorganisms produce organic acids of numerous types, for instance, citric acid, oxalic acid, gluxonic acid, etc. which are very harmful to building materials.

Fungi and bacteria may be found in greater or lesser numbers in the soil, water and air over a large part of the earth's surface. Their spores are present in the atmosphere all the time, but generally remain dormant. They become active and start developing as soon as conditions of humidity and temperature favourable to their growth occur. It has been found that the number of microorganisms (cells per gram) is greatest in the rainy season.

Algae are closely related to bacteria and fungi. They possess chlorophyll and are thus able to synthesize their own food. Most of the algae found on the Sukhotai monuments are bluegreen algae. The rest are green algae, diatom, netrium and others. Some algae can convert nitrogen from the atmosphere into nitrogen compounds similar to bacteria. Their dead tissues are the sources of carbon, nitrogen and other growth factors of organisms including higher plants.

Mosses, lichen, hapaticeae, liver-

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Details of some parts of the Sukhothai Monuments.

worth, ferns, grasses and other dicots have also been found in every monument. The growth of these plants in building materials severely damage the foundations and walls. Seeds are often deposited in the joints surface through the droppings of birds and bats; their roots penetrate towards the interior and grow slowly inside, separating and detaching structural elements of the wall.

Control of microorganisms

Since biological growth of microorganisms is always associated with moisture retention, the damp-proof course together with mechanical and chemical methods are efficient means of preventing the development of vegetation in the monuments. Mechanical control involves the use of tools such as hoes, spudders, scythes, mowers, etc. for physically lifting or cutting the plants from the surface. However, weeds should be controlled before emergence or when they are small. Biological control can also be done for certain plant species when grown prevent the spread of some weeds.

Many chemicals of varied properties which affect biological growths are available. However, care must be taken to select those which are non-toxic to both man and animals and do not act upon the building materials. At times, these chemicals must be rotated or mixed in order to broaden the spectrum of weeds and microorganisms that they eliminate.

It has been observed that the number of microorganisms and weeds is greatly reduced after the application of biocides. It becomes doubly effective when the monuments or the surface of the building materials have been cleaned prior to the application of the chemicals and when this is done in late summer when the plants and microorganisms have very little stored food.

The type and concentration of the chemicals used depend upon the species of microorganisms and weeds, the properties of the building materials and the location of the monuments.