Biological weathering on the first gallery wall of Angkor Wat temple, Cambodia

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The Angkor complex is mainly constructed in the 9~13th century by Khmer dynasty and was designated as a world cultural heritage by UNESCO in 1992. The Angkor complex represents the entire range of Khmer art and is also famous for large trees growing on the temple wall (Ta Prohm) and various lichens on the stone surfaces. Angkor Wat temple, constructed of sandstone and laterite, is one of the most popular temples in the complex. The French School of Asian Studies (Ecole française d'Extrême-Orient, EFEO) had performed conservation work in early 20th century. However, it was in poor condition after the Cambodian civil war. During the period of 1986 to 1993, Archaeological Survey of India (ASI) contributed to the Angkor Wat's conservation including reconstruction of the building itself, replacement of blocks, and removal of vegetation. After completion of the cleaning procedures (nearly 200,000 m^2) by ASI, the original color, gray to yellowish brown, of the Angkor Wat sandstone was restored. However, after two years, cyanobacteria have colonized large portions of the surface of Angkor Wat temple. We categorized surface of the first gallery wall into four types: 1) area covered by cyanobacteria; 2) un-covered area; 3) exfoliated area; and 4) re-covered area after peeling off. We measure the hardness of the first gallery wall by Schmidt rock hammer. Average rebound value of exfoliated area is 3.7 times higher than cyanobacteria covered area. In Un-covered area, it is 3.6 times higher than cyanobacteria covered area. Cyanobacteria are not protecting the wall surface but are accelerating its weathering by reducing surface hardness. However, it is hard to remove clearly and will be easily covered again.

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