

## **“Konjo-biki” painting of Kyoto Imperial Palace Seen from Techniques and Materials**

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The Kyoto Imperial Palace owns the sliding-doors, partitioning screens and folding screens on which there are paintings executed in what is referred to as “konjo-biki” style. Historical documents regarding the reconstruction of the Imperial Palace in the Kansei era (1790; hereinafter “Kansei Palace”) show that the “konjo-biki” style was applied in the paintings for Palaces which revived the architectural style of the Heian period. Considering the literal meaning of the term “konjo-biki”, it presumably means the dark blue haze seen in the paintings. However, in the historical documents, there is a description as follows; despite careful discussions about techniques and materials of the “konjo-biki” between the painter and the court, in the end, the paintings were executed in an abbreviated style. The description suggests that not only azurite but also indigo may possibly have been used, and there may have been overlaying of the coloring materials such as azurite and indigo. Therefore, scientific research was conducted to clarify the technique and materials of “konjo-biki” painting, targeting the surviving paintings on room partitions of the Kansei Palace from the fire that destroyed the Kansei Palace, and that the “konjo-biki” style of the paintings on the present Palace that was reconstructed in the Ansei era (1855; the present palace, hereinafter “Ansei Palace”)

The results of microscopic observation, visible reflectance spectroscopic analysis, X-ray fluorescence (XRF) spectrometry, and High performance liquid chromatography (HPLC) showed that there is a difference in “konjo-biki” painting between the Kansei Palace and the Ansei Palace; that of the Kansei Palace mainly uses smalt, and that of the Ansei Palace mainly uses azurite and, in both cases, “konjo-biki” painting uses indigo as a liquid undercoat, not by mixing indigo into “gofun” (extender pigment). The “konjo-biki” painting originally planned for the palace reconstruction in the Kansei era presumably aimed to create a darker and deeper blue color by coating the base materials (silk or papers) with indigo, and overlaying azurite with large particles.

## Analysis in Materials Science of the Blue Colors Used for the Paintings on Room Partitions in the Seiryōden, Kyoto Imperial Palace

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In the six years following 2019, the restoration and reproduction project has been scheduled for the paintings on the fusuma sliding-door papers in the Seiryōden. In this project, the primary purpose of our research was to investigate the microstructures of the blue coloring materials used in the three paintings; (i) Kara-e paintings entitled “*Kara-e Honmon no I*” on which historical events, scenery and customs in China drawn by Tosa Mitsusada in the Kansei era, positioned under the east eaves of the main building; (ii) Yamato-e paintings (a traditional Japanese style painting used as a term the opposite of Kara-e) entitled “*Koromode no Mori*” that depicts landscape and customs in Japan created by Tosa Mitsubumi in the Ansei era, positioned in the Daiban-dokoro (a station of court ladies) under the west eaves, and, (iii) “*Cranes in clouds*” created by Tosa Mitsukiyo, positioned in the upper part of the nageshi beam across the two rooms of the main building.

The experimental methods were as bellow: stereoscopic microscopes and digital microscopes to observe surface conditions; UV-visible spectrophotometer to measure the colors; a portable X-ray fluorescence spectrometer for elemental analysis; scanning electron microscope (SEM) to observe the microstructures of the sampled pigment fragments and energy dispersive X-ray spectrometer (EDS) to analyze composition; and X-ray diffractometer (XRD) to determine crystal structure. Fourier transform infrared spectroscopy (FT-IR) (ATR method) and High performance liquid chromatography (HPLC) to analysis the dyestuffs.

The results of the analyses showed for the first time that azurite was used in “suyari-gasumi” (mists depicted horizontally in bands) in the painting “*Koromode no Mori*” drawn in the Ansei era, while azurite and smalt were used in “suyari-gasumi” in the painting “*Kara-e Honmon no I*” drawn in the Kansei era. In other words, there is a layer of azurite on the top surface and a layer of smalt underneath. Furthermore, indigo traces of back coating was detected in suyari-gasumi mists both in the painting “*Kara-e Honmon no I*” drawn in the Kansei era and in the painting “*Koromode no Mori*” drawn in the Ansei era on the sliding-door papers and in “*Cranes in clouds*” positioned in the upper part of the nageshi beams by HPLC. In addition, ferric element was detected from a blue-colored “shikishi-gata” (square-shaped paper pasted onto the upper portion of the sliding-door) by X-ray Fluorescence (XRF). It was revealed to have been painted with Prussian blue, an artificial pigment by FT-IR (ATR).

## **A Sequel to the Report on the Master Plan for Moss-covered Grounds in Katsura Imperial Villa**

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Due to rising temperatures resulting from climate change and drying caused by urbanization in surrounding areas, the environments around the gardens of Katsura Imperial Villa have greatly changed, causing the decline of ground-cover plants, especially mosses. Furthermore, the recent increase in the number of visitors and the consequent trampling of the mosses by foot traffic are included in the factors that have caused the decline. Accordingly, a decision was made to create a master plan for the recovery of the moss-covered grounds, in order to establish management methods responding to the current environments.

This paper outlines the second half part of the master plan, while the first half part was reported in the Annual Report (Number 2) of the Kyoto Office of the Imperial Household Agency.

Considering the results of tests conducted to date, based on the growth cycle of moss, we have decided the species, planting method, and growing period of the mosses to be newly planted by creating an annual management schedule for practice suited to each phase such as growth phase, decline phase in summer, recovery/growth phase, decline phase in winter, as well as the suitable planting time. In addition, we have manualized protective measures against drying and frost columns.

In accordance with this schedule, we plan to repair the currently damaged areas over four years; and, even after the repairs, to conduct long-term continuous repairs once every one to two years depending on frequency of damage. Furthermore, based on past data, we aim to plant trees to replace withered trees in order to maintain the scenery, and to reduce impacts on mosses by ensuring consequent shade. Meanwhile, we will review planting methods for groundcovers to be planted in future, in order to facilitate easier root growth and, to plant ground-cover plants less susceptible to heavy rain in areas in which raindrop erosion has been found.

Currently, repair of the damaged areas is in progress, gradually entering the stage of continuous management. Into the future, the master plan will be brought gradually closer to fruition through working on new issues and cases to be validated, largely contributing to the maintenance of scenery with the moss-covered grounds.