

INDIRECT RADIOCARBON DATING OF THE SHIBUNRITSU SUTRA BROUGHT BY THE PRIEST GANJIN

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Because radiocarbon dating is a destructive form of analysis, it cannot be applied to national treasures or important cultural properties. However, indirect radiocarbon dating offers another possibility. In Shosoin, 16 scrolls of the Shibunritsu sutras are kept. A theory that these scrolls were brought to Japan by the priest Ganjin in AD 753 was based on bibliographical evaluation of documents kept in Shosoin. However, the possibility that they were copied for future preservation cannot be ruled out. Radiocarbon dating cannot be used to date the Shibunritsu in Shosoin. Some parts of valuable ancient manuscripts, sutras, and calligraphy were cut and removed for future preservation; these fragments are called kohitsugire. Therefore, we focused our analysis on a kohitsugire of the Shibunritsu sutras. The texture, size of characters, spaces between the lines, and calligraphical features were compared with those in the Shibunritsu in Shosoin, indicating the same format. Microscopic observation of the kohitsugire and Shibunritsu shows that both sutras are made from kozo fiber and have a similar surface treatment called uchigami. In addition, clear, square crystals called cubic crystals were detected as an impurity in both sutras. The bibliographical study and the microscopic observation show that the kohitsugire is a fragment of the same series of Shibunritsu kept in Shosoin. Therefore, we measured radiocarbon ages of the kohitsugire using AMS. The result is 1323 ± 21 years before present (BP) and it corresponds to 656–694, 700–708, 747–765 calendar years AD (cal AD). This result indicates that the kohitsugire was written before Ganjin visited Japan. It also shows that the 16 scrolls of Shibunritsu held in Shosoin were not copies for future preservation and supports the theory that they were brought to Japan by Ganjin in AD 753.

I. INTRODUCTION

Six main sects on Buddhist learning introduced to Japan from China flourished in the Nara era (AD 710–794). One of these was the Ritsu-shu sect conveyed by the high priest named Ganjin, who visited Japan in response to an imperial request in AD 753, bringing with him many scriptures, Buddhist images, Buddhist altar fittings, and medicines. The most important gift was 60 scrolls of sutras called the Shibunritsu. It means first introduce religious precepts to the Japanese Buddhist world.

At present, 16 scrolls of Shibunritsu sutras are kept in Shosoin. A bibliographical study on documents kept in Shosoin generated a theory that the 16 scrolls are Shibunritsu sutras brought to Japan by Ganjin in AD 753¹. This theory was supported by bibliographical resources, although the possibility that they were copied to preserve them cannot be ruled out. Therefore, it is necessary to determine the paper's age using natural scientific methods.

II. BACKGROUND AND PURPOSE

To show that Japanese paper is suitable for radiocarbon dating, we measured radiocarbon ages of ancient Japanese documents, sutras, and books whose ages were determined by paleographical and bibliographical factors. Their radiocarbon ages agreed with paleographical ages. Therefore, radiocarbon dating is a useful method to determine the age when the

documents were written. However, radiocarbon dating is a destructive method and cannot be applied to national treasures or important cultural properties. Thus, it is difficult to date the Shibunritu sutras directly.

Ancient Japanese manuscripts predating the fourteenth century are rare because their pages were cut and separated for display as hanging scrolls. The pages of lost manuscripts are called kohitsugire. Most of the 60 scrolls of Shibunritsu sutras brought by Ganjin have also likely been made into kohitsugire. At present, only 16 scrolls are stored in Shosoin, while most of the others remain as kohitsugire fragments.

Although it is difficult to directly date the Shibunritu sutras kept in Shosoin, radiocarbon dating a fragment of kohitsugire is acceptable because the scroll was previously cut. Therefore, we focused our dating efforts on a kohitsugire from a written portion of Vol. 27 of the Shibunritu sutras. This example has many similarities to the 16 scrolls of Shibunritu sutras kept in Shosoin. The purpose of this study is to determine the age when these Shibunritu sutras were written and to clarify that they are truly a part of the 60 scrolls of Shibunritsu sutras brought to Japan by Ganjin in AD 753.

III. EXPERIMENTAL STUDIES

We compared the bibliographical features of the kohitsugire and scrolls kept in Shosoin. The styles of both calligraphies are quite similar to those of sutras written in the Tang Dynasty. For example, the kohitsugire and the scrolls have ruled lines and the width and height of those lines are also almost the same. The average size and space of letters is also mostly equal in both.

The result of microscopic observation of the Shibunritsu sutra Vol. 18 kept in Shosoin was reported in 2010.² We observed the kohitsugire paper with a digital microscope (VHX-1000, KEYENCE). The kohitsugire and Vol. 18 of the Shibunritsu sutras were written on paper sheets of similar qualities. The thickness and density of line marks correspond in both papers. They are also made on uniform quality uchigami paper and square clear particles called cubic crystals are found. In addition to the bibliographical study, microscopic observation indicates that the kohitsugire is a part of the same series of Shibunritsu sutras in Shosoin.

We measured the radiocarbon age of the kohitsugire by AMS. Japanese paper samples were cut from the margins of the kohitsugire. The samples were soaked in distilled water to peel the surface sheet of the calligraphy from the mounts forming a lining. The 11 mg samples of surface sheets were first washed in distilled water with an ultrasonic cleaner and then treated with 1.2 M HCl and 1.2 M NaOH solutions. The samples were then combusted using CuO to form CO₂, and the purified CO₂ was reduced to graphite by H₂ in the presence of Fe catalyst (650°C, 6 h). The radiocarbon ages were then measured by CAMS-500 (NEC, USA) at Paleo Labo Co., Ltd., Japan. The result is 1323 ± 21 years before present (BP). The radiocarbon age was converted to calendar years using the IntCal13 calibration curve. The calibrated radiocarbon ages were 656–694, 700–708, and 747–765 cal AD.

IV. DISCUSSION

Two nondestructive analyses, bibliographical study and microscopic observation, indicated that the kohitsugire was originally a part of the same series of 16 scrolls kept in Shosoin. In addition, radiocarbon dating of kohitsugire samples was conducted, indicating dates of 656–694, 700–708, and 747–765 calendar years AD. These dates correspond to the period when Ganjin visited Japan in AD 753 or earlier. Therefore, the 16 scrolls of Shibunritsu sutras in Shosoin are not copies, but were written in the latter half of the seventh to the first half of the eighth centuries. A combination of bibliographical evaluation, microscopic observation, and radiocarbon dating of kohitsugire reveals the written age of these ancient documents, demonstrating that this approach can be used to date other similarly valuable materials such as sutras, paintings, and books that cannot be damaged by destructive analytical methods. Such information is invaluable for historical, bibliographical, paleographical, and literary studies worldwide.

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