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Radiocarbon dating of ancient Japanese document and calligraphy

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1. Introduction

The purpose of this study is show that radiocarbon dating is a useful method to determine written age of ancient Japanese document and calligraphy. Therefore, we measured radiocarbon ages of ancient documents, sutras and books of known age by accelerator mass spectrometry (AMS).

Kohitsugire are ancient paper sheets or fragments containing elegant calligraphy. They were originally pages of ancient manuscripts. The old manuscripts written before the 14th century hardly remain as complete books; therefore, kohitsugire potentially has high academic value. However, among kohitsugire attributed to famous calligraphists, many copies and counterfeits written several centuries later are in circulation. Therefore, in this study, we measured radiocarbon ages of kohitsugire by AMS. In the first, we measured ancient documents, sutras and books of known age for check of the method. Then, we applied to kohitsugire calligraphies of unknown age to determine their historical ages and academic value.

2. Experimental

Paper samples were cut from the margins of ancient document or kohitsugire. A kohitsugire is commonly mounted on other paper sheets that form a lining. The samples were soaked in distilled water to peel the surface sheet of the calligraphy from the mounts. The surface sheets were first washed in distilled water with an ultrasonic cleaner and then treated with 1.2N HCl and 1.2N NaOH solutions (60-70^{o}C). After re-treating with 1.2N HCl and rinsing with distilled water, they were combusted using CuO (850^{o}C, 3h) to form CO_2. The CO_2 was reduced to graphite by H_2 (650^{o}C, cat-Fe, 6h). The radiocarbon ages were measured by AMS.

3. Results and discussion: the known-age documents

The results of the known-age documents, sutras and books were plotted on the calibration curve. The obtained radiocarbon ages of the documents correspond to the paleographical ages. Although ancient Japanese paper can be considered as a wooden sample, it was made from short-lived branches of trees. In addition, old paper is not used for calligraphy because it repels India ink and is unsuitable for elegant handwriting. The result indicates that ancient Japanese paper is suitable for radiocarbon dating.

4. Results and discussion: kohitsugire calligraphies

We applied to kohitsugire of unknown age to clarify their historical ages and academic value. An example is kohitsugire attributed to Nakatomi no Kamatari (614-669). However, radiocarbon dating indicated that it was written in the 14th century and is not his genuine handwriting.

Ganjin(688-763) is a priest of China. He brought Japan many Buddhist sutra, Buddha statues, medicine and spice in 753. Especially an important thing is the Shibunritsu sutra of 60 volumes which described commandments and organizational operation of temple. At present, the Shibunritsu sutra of 16 volumes that are said for Ganjin to have brought are stored in Shosoin. Radiocarbon dating is destructive analysis. It, therefore, cannot be applied to Sutra stored in Shosoin directly. Kohitsugire is a fragment of ancient calligraphy. They were cut from an ancient book or roll of sutras. We obtained a kohitsugire considered to have been cut from Shibunritsu stored in Shosoin. Microscope observation and bibliographical consideration clarified that the kohitsugire is rightly fragment of the Shibunritsu stored in Shosoin. Radiocarbon dating of the kohitsugire indicated that it was written before the Ganjin visit to Japan. This result shows that possibility that the kohitsugire and Shibunritsu of Shosoin were brought by Ganjin is very high. This study using microscope observation, bibliographical consideration and radiocarbon dating indicated that indirectly radiocarbon dating can be applied for samples to which destructive analysis could not be originally applied.

Keywords: Histrical age, Ancient Japanese document, Ancient Japanese calligraphy, Radiocarbon Dating