Radiocarbon dating of ancient Japanese calligraphy sheets and the discovery of 45 letters of a lost manuscript

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Summary. The *Miidera-gire* is an ancient paper sheet with different, elegant calligraphy on both sides. One side contains a part of a Buddhist scripture from around the ninth to the twelfth century and written in cursive hand, while the other side contains a part of *Monzen* (an anthology of Chinese literary works). The paleographical style of this *Monzen* seems to be older than that of the Buddhist scripture and is similar to some Chinese manuscripts written in the Tang Dynasty (AD 618–907). However, amid these elegant calligraphic writings, there exist many copies and counterfeits that were written several centuries later. We, therefore, measured the radiocarbon age of the *Miidera-gire* by using accelerator mass spectrometry. The calibrated radiocarbon age indicated 666–776 [cal AD] (2σ error), thus leading to the conclusion that the *Monzen* was first written on the obverse side, and long afterwards, the Buddhist scripture was written on the reverse side. Since only a few incomplete books of *Monzen* were written before the ninth century, this calligraphy is one of the oldest of the existing *Monzen* manuscripts.

1. Introduction

When using classic literature as a resource in historical, literary, and linguistical research, an accurate text is required. Before books began to be printed with wood blocks in the Edo period (from the early seventeenth century) in Japan, literary works were generally circulated as handwritten manuscripts. However, copying by hand resulted in unintentional errors and intentional manipulations. Therefore, original texts have the highest academic value, and the value of old manuscripts with few mistakes and manipulations is higher than that of new manuscripts. However, the original texts and the old manuscripts written in the Nara (AD 710–794), Heian (AD 794–1192), and Kamakura (AD 1192–1333) periods hardly exist as complete books.

Since the end of the sixteenth century, when the tea ceremony became very popular, old manuscripts were taken apart page by page and mounted on hanging scrolls in tea

houses to be appreciated for their antique calligraphy. The pages or fragments containing elegant calligraphy are called *kohitsugire*. In the Edo period (AD 1603–1867), the emergence of *kohitsugire* collectors, who compiled the albums of *kohitsugire* (called *kohitsu-tekagami*), accelerated the subdivision of old manuscripts. Thus, the ancient manuscripts written before the fourteenth century remain in the form of many *kohitsugire* sheets.

Kohitsugire is a page or part of a lost ancient manuscript containing few mistakes and manipulations. Although *kohitsugire* potentially has high academic value, many copies and counterfeits written several centuries later but attributed to famous calligraphists are in circulation. The age or the identity of the calligraphist should be clarified before the *kohitsugire* is accepted as a reliable historic research material. In the case of ancient books or documents containing many calligraphical lines, the age and the writer can generally be determined through calligraphical, paleographical, and bibliographical considerations. However, it is difficult to conclusively deduce such information for some cases, for example, when *kohitsugire* pages have only a few calligraphical lines. Previous studies of radiocarbon dating on ancient documents and sutras of a known age [1–3] indicated that the calibrated radiocarbon age corresponds to the historical period in which the document or sutra was written. Therefore, although it has statistical errors and is a destructive analysis, radiocarbon dating will be a useful method for obtaining information about a *kohitsugire* whose age and writer are unknown [4, 5].

2. Purpose

Kohitsugire was originally a page of a manuscript; other pages that have an identical form and handwriting are occasionally discovered. Such *kohitsugire* sheets are called *tsure*. If several *tsure* are collected, a part of any of the lost ancient manuscripts can be recompiled. When a number of *tsure* are known, they are given a generic name. *Miidera-gire* is one such generic name. *Miidera-gire* is a famous *kohitsugire* ascribed to Enchin (AD 814–891), a Buddhist monk of the Tendai sect and the patriarch of the Jimon branch of Tendai who revived the *Miidera* temple in AD 859. The *Miidera-*

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Fig. 1. The Buddhist scripture side of the *Miidera-gire* (Sample No. 1). The calligraphy is attributed to Enchin and is characterized by its cursive hand. The calligraphical age is the Heian period (AD 794–1192).

gire is a paper fragment of a Buddhist scripture written in cursive hand. Although it is not confirmed whether the Buddhist scripture contains the genuine handwriting of Enchin and is regarded as the work by other calligraphists, it is commonly accepted that it was written in the Heian period [6]. Although the *Miidera-gire* generally refers to *kohitsugire* sheets of the Buddhist scripture, we discovered a *Miidera-gire* (Sample No. 1, 27.3 cm × 8.2 cm) with two kinds of calligraphy on it. It has the Buddhist scripture written in cursive hand on one side (Fig. 1) and a part of *Monzen* written in block script on the other (Fig. 2).

Monzen is an anthology of Chinese literary works from the Eastern Zhou Dynasty (BC 770–BC 256) to the Liang Dynasty (AD 502–557). It was originally compiled in China by Crown Prince Zhaoming (AD 501–531) and was considered the model of poetry composition. *Monzen* was also sent to Japan in the Nara period and was considered to be obligatory reading for the nobles. Although *Monzen* is an essential resource not only for studying ancient Chinese literature but also understanding the culture of ancient Japanese nobles, currently, only few old manuscripts of *Monzen* exist. Only a few incomplete manuscripts written in the Heian and Kamakura periods are known.

The calligraphy of *Monzen* on the *Miidera-gire* (shown above) seems to be older than that of the Buddhist scripture on the reverse side. If this assumption is correct, then this *kohitsugire* is one of the oldest existing *Monzen* texts. Therefore, to determine the period in which the *Monzen* side

Fig. 2. *Monzen* side of the *Miidera-gire* (Sample No. 1). The calligraphy is characterized by its block script and strokes peculiar to the Chinese manuscripts in the Tang Dynasty (AD 618–907).

was written, we investigated the calligraphy and measured its radiocarbon age.

3. Calligraphy investigation

First, for determining the period in which the paper was written, we will discuss the relative ages of calligraphies on both sides of the *Miidera-gire*. The surface of the *Monzen* side seems to have been beaten with a wooden hammer for a smooth finish. However, the side containing the Buddhist scripture has a very uneven surface, which is unsuitable for writing. Extended preservation of Japanese handmade paper reduces the absorbency of the Indian ink; therefore, thin ink is used for old paper sheets. The natural calligraphy of this *Monzen* seems to have been written on a fresh sheet of paper; in contrast, the watery calligraphy ink of the Buddhist scripture suggests that it was written on an old paper sheet. The condition of the paper's surface and the Indian ink indicate that *Monzen* was originally written on one side whereas the Buddhist scripture was written later on the reverse side.

The calligraphy of the *Monzen* is characterized by many remarkable strokes of the writing brush. The first and second characters written on the *Monzen* side have been enlarged in Fig. 3. A vertical line of a Chinese character is drawn in block script, usually in two steps: First, the brush moves in a short stroke, from the top left to the bottom right, as shown in Fig. 3-(a), and then, it moves vertically. Therefore, the vertical line starts at an obtuse angle. The calligraphy, how-

Fig. 3. The first and second characters in the *Monzen* side. Strokes are peculiar to the Chinese manuscripts in the Tang Dynasty.

ever, includes many noteworthy vertical lines, as shown in Fig. 3-(b). They are at right or acute angles and are written in three steps: First, the brush moves in a short stroke, from the bottom left to the top right; then, it moves from the top left to the bottom right, and finally, it moves vertically. We can also find remarkable strokes in the horizontal lines. Although the end of a horizontal line is usually rounded, as shown in Fig. 3-(c), the calligraphy has horizontal lines with ends moving upward (Fig. 3-(d)). Such a style characterized by vertical lines at right or acute angles and horizontal lines “moving upward” is peculiar to the Chinese manuscripts written in the Tang Dynasty (AD 618–907), for example, *Ohbotsu-shu*, *Kegonkyo*, and *Sesetsusingo*.

After examining the condition of the paper and calligraphy style, this study concludes that the *Monzen* side was copied from a manuscript written in the Tang Dynasty in the Nara or early Heian periods, and later, the Buddhist scripture was written on the reverse side in the Heian period.

4. Radiocarbon dating

4.1 Samples

The *kohitsugire* samples subjected to radiocarbon dating are listed in Table 1. To compare the results, in addition to the *Miidera-gire* (No. 1), we also measured the following three *kohitsugire* written in the Nara period: *Uokai-kyo* (No. 2), *Tempyo-kyo* (No. 3), and *Todaiji-nigatsudo-yakegyo* (No. 4). The fragment of the *Daihannya* sutra attributed to Asano no Uokai (*Uokai-kyo*, No. 2, 25.1 cm × 4.2 cm) is a well-known *kohitsugire* for many *tsure*. The original sutras were hand-copied in approximately AD 770 at *Todaijihoushaisaikyōjo* by a number of special transcribers. The fragment of the *Daihannya* sutra Vol.426 (*Tempyo-kyo*, No. 3, 25.7 cm × 9.9 cm) is also a *kohitsugire* of the sutras copied by the

Table 1. *Kohitsugire* calligraphies for radiocarbon dating.

Sample No.	Name of <i>kohitsugire</i>	Written age
1	<i>Miidera-gire</i>	
2	<i>Uokai-kyo</i>	around AD 770
3	<i>Tempyo-kyo</i>	eighth century
4	<i>Todaiji-nigatsudo-yakegyo</i>	around AD 744

specialists in the eighth century. *Todaiji-nigatsudo-yakegyo* (No. 4, 22.8 cm × 9.6 cm) are *kohitsugire* also famous for silver letters and ruled lines, dark blue paper sheets, and scorches at the top or bottom. They are fragments of *Kegon* sutra scrolls attributed to Emperor *Shomu* (AD 701–756). The *Kegon* sutra scrolls were recited during the imperial ritual held in the *Todaiji* temple in AD 744.

4.2 Methods

Japanese paper samples were cut from the margins of *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 6–55 mg 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 on a hot plate (each step was repeated several times for 2–3 h at 60 °C –70 °C). After re-treating the samples with 1.2 M HCl solution and rinsing them with distilled water (60 °C –70 °C), they were dried in a vacuum desiccator. Then, the samples were combusted using CuO (850 °C, 3 h) 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 two accelerator mass spectrometry (AMS) systems. Sample Nos. 1–4 were measured by CAMS-500 (NEC, U.S.A.) at Paleo Labo Co., Ltd., Japan. Sample Nos. 2 and 3, which yielded enough sample mass for additional measurements, were also measured by a Tandetron accelerator mass spectrometer (HVEE, the Netherlands) at Nagoya University, Japan. Each sample was measured four times at the Tandetron.

4.3 Results

Tables 2 and 3 list the radiocarbon ages of the *kohitsugire* calligraphies with 1σ and 2σ errors. Table 2 indicates the results measured by CAMS-500, and Table 3 lists those measured by Tandetron. The radiocarbon ages were calibrated to calendar years by using the IntCal04 calibration curve [7]. In the columns for the calibrated radiocarbon age, the numbers within parentheses are the calibrated values of the mean radiocarbon age and the numbers outside them are the error ranges. Although because of a flat calibration curve, the

Table 2. Results of radiocarbon dating by CAMS-500.

Sample No.	Radiocarbon age [BP]	Calibrated radiocarbon age [cal AD]
1	1281 ± 23 (1σ) ± 45 (2σ)	678 (690) 724, 739 (751, 762) 771 666 (690, 751, 762) 776
2	1281 ± 22 (1σ) ± 43 (2σ)	678 (690) 723, 740 (751, 762) 770 667 (690, 751, 762) 776
3	1283 ± 23 (1σ) ± 45 (2σ)	676 (689) 722, 740 (752, 761) 770 666 (689, 752, 761) 776
4	1272 ± 22 (1σ) ± 43 (2σ)	684 (709, 747, 766) 772 670 (709, 747, 766) 777

Table 3. Results of radiocarbon dating by Tandetron. Only 1σ errors are listed for every repeated result.

Sample No.	Radiocarbon age [BP]	Calibrated radiocarbon age [cal AD]
2-(1)	1190 $\pm$ 60 (1σ)	
-(2)	1224 $\pm$ 43 (1σ)	
-(3)	1274 $\pm$ 45 (1σ)	
-(4)	1276 $\pm$ 49 (1σ)	
-(av.)	1241 $\pm$ 25 (1σ) $\pm$ 50 (2σ)	711 () 746, 766 (774) 779, 794 () 800 683 (774) 876
3-(1)	1276 $\pm$ 46 (1σ)	
-(2)	1287 $\pm$ 38 (1σ)	
-(3)	1342 $\pm$ 44 (1σ)	
-(4)	1363 $\pm$ 66 (1σ)	
-(av.)	1317 $\pm$ 25 (1σ) $\pm$ 49 (2σ)	663 (673) 687 655 (673) 719, 742 () 769

error ranges of the calibrated radiocarbon age expand to approximately one century from *ca.* 670 to *ca.* 780 cal AD, the radiocarbon age of the *Miidera-gire* corresponded to the other three *kohitsugire* written in the Nara period. Radiocarbon ages measured by the two AMS systems indirectly indicate that the systematic error on the age of the *Miidera-gire* is negligible.

5. Discussion

On the basis of the investigation of calligraphy and radiocarbon dating, we make the following conclusions about the history of the *Miidera-gire*:

1. The *Monzen* manuscript was written in block script on the smooth sides of fresh paper sheets in the Nara period or perhaps even earlier.

2. The Buddhist scripture, attributed to Enchin, was written in cursive hand with watery Indian ink on the reverse side during the Heian period.

3. Beginning with the end of the sixteenth century, the manuscript was subdivided into fragments as a *kohitsugire*.

Because only a few incomplete books written in the Heian and Kamakura periods remain, this *Miidera-gire* dating back to before the Nara period is the oldest example of *Monzen* among the existing manuscripts. The old manuscripts are more valuable resources, because literals, missing and extra letters, and malicious falsifications increase with repeated copying. The source book of most of the existent *Monzen* manuscripts can be traced back to a manuscript called *Kokoku-bon*. It was published in the Kakei period (AD 1796–1820) by Kokokuka (AD 1758–1817) by comparing some different *Monzen* manuscripts. The *Monzen* text of the *Miidera-gire* fragment is much older

than that of *Kokoku-bon* and has 45 letters that are not found in the manuscripts belonging to the *Kokoku-bon* genealogy. Therefore, although it is a fragment, this *kohitsugire* is valuable for understanding the original *Monzen* text. In this study, 45 letters of a lost *Monzen* manuscript were discovered by radiocarbon dating of *kohitsugire*.

Some *tsure* of the *Miidera-gire* are known in *kohitsutekagami* (album). However, the *Monzen* side of the most of the *tsure* was pasted to make the Buddhist scriptures on the reverse side visible. On investigating approximately 40 *kohitsutekagami*, we found exceptional 2 *tsure* in which the *Monzen* sides can be read directly. Furthermore, we found 4 *tsure* in which *Monzen* can be seen through the Buddhist scripture side. If these *tsure* are peeled and a large number of private collections are gathered, their calligraphical investigation and radiocarbon dating will lead to the compilations of the lost manuscripts of *Monzen*. As indicated in this study, we believe that radiocarbon dating demonstrates the potential value of *kohitsugire* as resources for the historical, literary, and linguistic research.

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