

Analysis of morphology and elements on the paper specimens of the Stein collection of the British Library

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Paper specimens of the documents and Buddhist's sutras of the Stein collection of the British Library were examined by Scanning Electron Microscopy (SEM) and X-ray Fluorescent analysis. Small fragments within 5mmx5mm of the Stein series #6000 and #2000 stored in the conservation studio for the scientific investigation were examined under the special permission of the Chinese Collections of the British Library.

SEM observation revealed that most of all specimens (of total 10) of the series #6000 were heavily coated and in some cases no fibre was seen in the as-received condition. While in those of the series #2000 fine fibres can be clearly seen even under the as-received condition, although fine crystals or powder used for sizing and/or filler were seen on the surface. Heavy "make-up" found in the paper specimens of the series #6000 implies that the origin of this series of the paper specimens would be different from those of the series #2000. Six of ten examples of the series #6000 are the Buddhist's sutra "Lotus Sutra", and three of them were found to be mulberry paper and others were hemp paper. Only three of ten samples of the series #2000 were found to be mulberry paper, and others were hemp paper. According to the special references of the British Library for the present ten samples, the paper of S2106 (Wei mo i chi), one of three mulberry paper samples was dated 6 April, A.D.500. If this is true, the paper of S2106 is one of the quite early examples of the old Chinese mulberry paper.

In the X-ray fluorescent analysis, the ratios of three elements, calcium, potassium and iron, each to each, which are the main metallic elements remaining on /in the paper were measured. The analysis of the series #6000 showed that K/Ca and Fe/K ratios seem to be classified to the same group, respectively, for eight samples, irrespective of paper material i.e. hemp or mulberry, except two hemp paper specimens. This means that the paper making techniques, for example sizing, of those eight samples seems to be similar irrespective of difference in paper material, hemp or mulberry. The analysis of the series #2000 paper samples showed that at least two of three mulberry paper specimens could be classified to the same group. This result suggests that the paper of those specimens was made by similar paper making technique. The possibility of similar classification of hemp paper specimens of the series#2000 samples was also shown. It is suggested that, in the present investigation, the physical analysis of the paper specimen using SEM observation and X-ray fluorescent analysis is useful and promising method to know and reveal the techniques and the origin of old Chinese paper.