

**Experiment title:**

Determining the nanostructural integrity of the Domesday Book

Experiment number:

EC- 110

Beamline:

ID18F

Date of experiment:

from: 29-NOV-2006 to: 03-DEC-2006

Date of report:

27/02/07

Shifts:

12

Local contact(s):

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Report:

The Domesday Book was a land survey commissioned by William the Conqueror in 1086 and is a valuable part of English history and heritage. Information collected on the land and resources available at this time and was recorded onto parchment and compiled into two volumes: 'Great Domesday' and 'Little Domesday'. The writing itself provides a wealth of knowledge on Medieval England but the parchment it is written on can also supply us with vitally important information. Degradation of these important documents is a serious factor placing them at risk therefore there is a need to preserve them.

The National Archives has entrusted us with nine samples taken from 'Little Domesday' and 'Great Domesday'. Domesday samples were sourced as scrapings from the surface of the parchment and were sub-millimeter in size and approximately 50 micron in thickness.

Experiments were carried out on these samples at the high brilliance synchrotron source at the European Synchrotron Radiation Facility, France on beamline ID18F. The beam size was $2\mu\text{m} \times 6\mu\text{m}$ and the wavelength of the X-rays was 0.08627nm. The extremely small beam size allowed scans to be completed on all nine Domesday samples and a control parchment sample (dated 1792) gifted by the National Archives of Scotland. Over 100 images were collected during each scan of the ten samples. The non-destructive technique of X-ray scattering provided a means of assessing the deterioration of the samples and providing information about the structure of collagen and its hierarchical arrangements.

All nine samples were found to produce collagen axial diffraction with the collagen in some samples more intact than others. Figure 1 (a) shows a typical X-ray diffraction pattern for one of the samples. Presences of minerals were also found in certain samples. Figure 2 (b) shows a typical X-ray diffraction image for one of the samples containing the presence of minerals. Further analysis of the mineral peaks is currently being conducted.

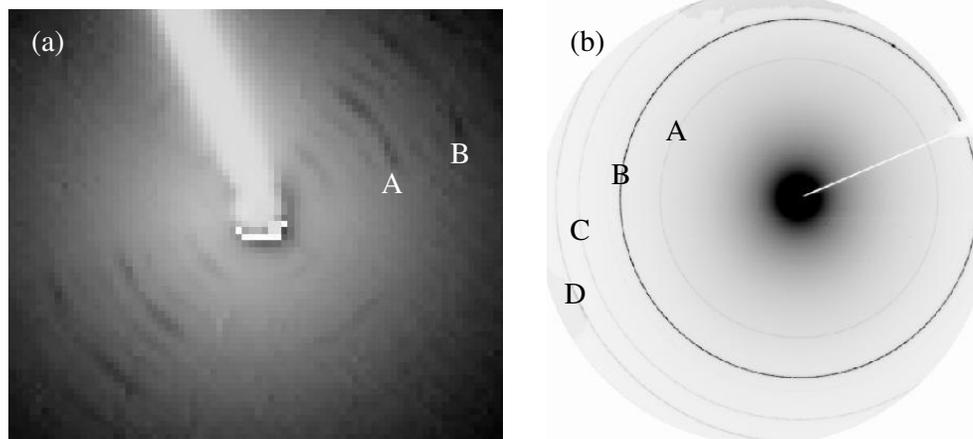


Figure 1: (a) Two dimensional X-ray diffraction pattern showing the presence of meridional diffraction. The 6th and 9th orders of collagen axial diffraction is highlighted as A and B respectively on the figure. (b) Two dimensional X-ray diffraction pattern showing the presence of minerals within the parchment. The peaks A, B, C and D in the image correspond to 2.9 Angstroms, 3.65 Angstroms, 3.9 Angstroms and 4.44 Angstroms respectively.

Analysis of these historically significant samples on beamline ID18F has given a clearer picture of the condition of the Domesday Book and allowed greater understanding of the degradation mechanisms in parchment.

Further biochemical analysis is currently being completed on the samples including microthermal analysis and amino acid analysis. This work is being conducted by the School of Conservation, Copenhagen, Denmark. Once all analysis on the condition of the Domesday Book is concluded the work will be announced to the public.

Publications

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Kennedy, CJ Vest, MCooper, M Wess, TJ. Laser cleaning of parchment: structural, thermal and biochemical studies into the effect of wavelength and fluence. *APPLIED SURFACE SCIENCE*. 2004 227 151-163

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