

Conservation of the Codex Sinaiticus

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Multi-spectral imaging for the Codex Sinaiticus

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Advantages of multi-spectral imaging

- Enhancing difficult-to-read text:
 - Faded ink
 - Ink loss
 - Erasures
 - Substitutions

- Going beyond the visible spectrum:
 - Ultra-violet: revealing traces of faded or erased writing
 - Infra-red: revealing under-writing and substitutions

- Plotting reflectance spectra:
 - Identification of materials

Multi-spectral imaging systems

Art gallery systems – eg National Gallery’s VASARI system

- Intended for high-resolution imaging of large easel paintings
 - Resolution > 10 pixels/mm
 - 7 broad spectral bands
 - Collects a series of images, combined digitally to form a mosaic
 - Large paintings → very large files → storage issues
 - “Home built” – requires expert knowledge to design and operate

Multi-spectral imaging systems

The FORTH Photonics MuSIS system

- Designed for easel paintings, wall paintings, manuscripts
 - 1600 x 1200 pixel sensor
 - 32 spectral bands between 400 and 1000nm
 - Mosaics possible
 - Comparatively small image size
 - “Off the shelf”: Windows-based – comparatively easy to operate

The MuSIS system

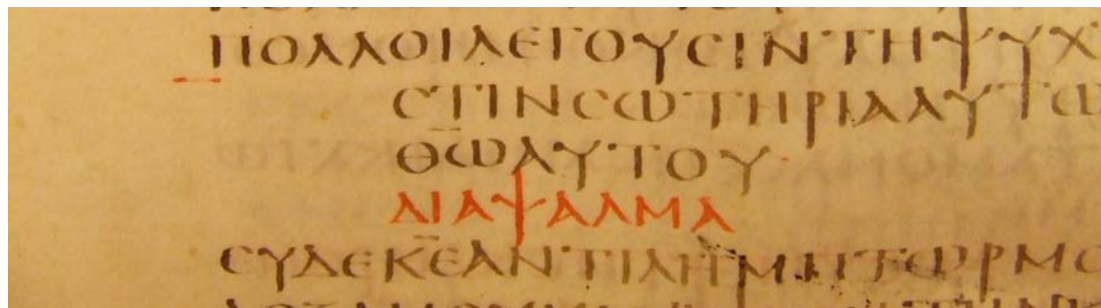


The MuSIS system



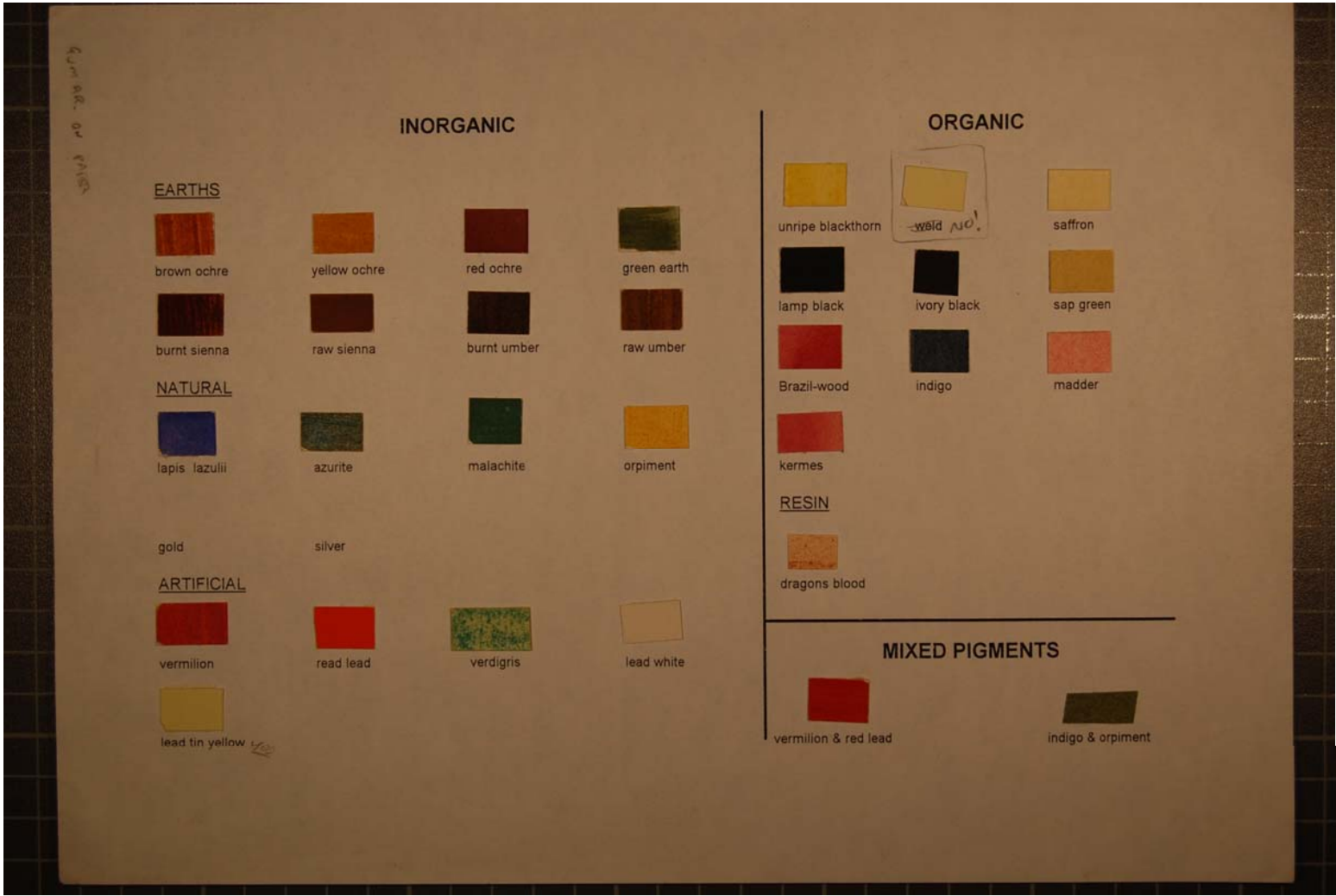
Measuring reflectance spectra

Detail of folio 88:

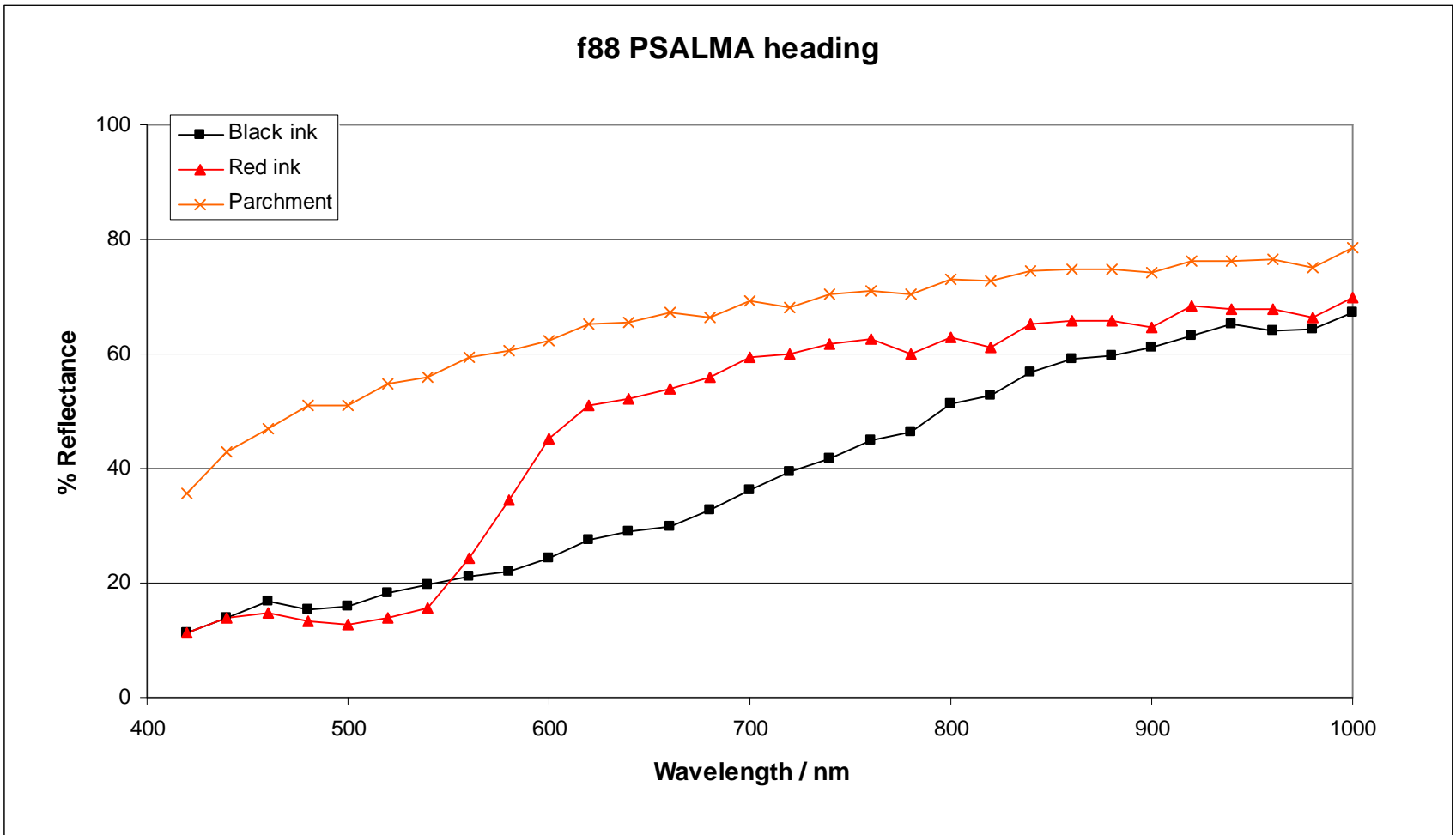


- Record spectra at 10 points on parchment, black ink, red ink
- Export to Excel, average to reduce variation (SD ~ 2%)
- Calibrate against standard black and white specimens
- Compare with standard pigment spectra

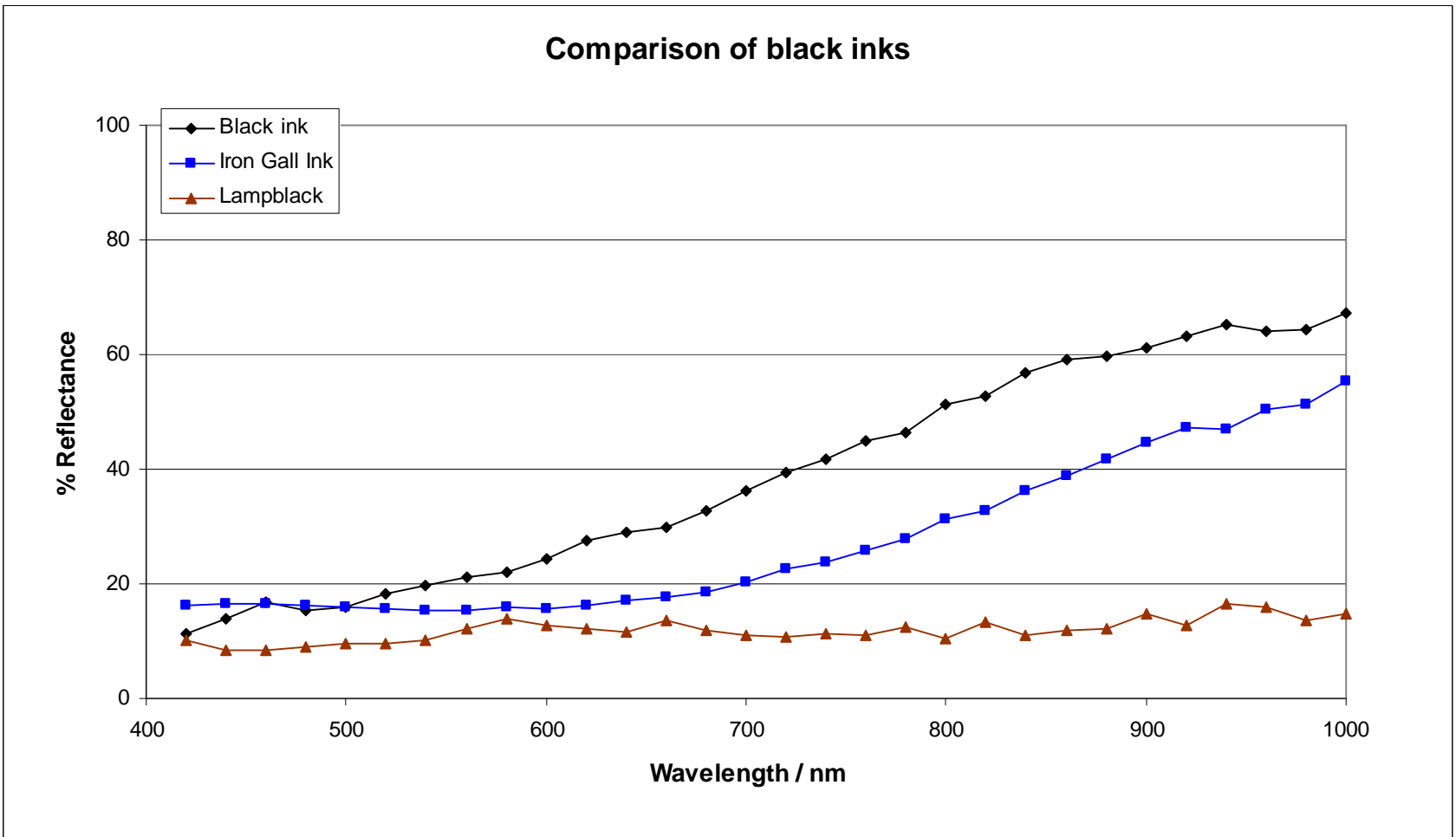
Standard pigment samples



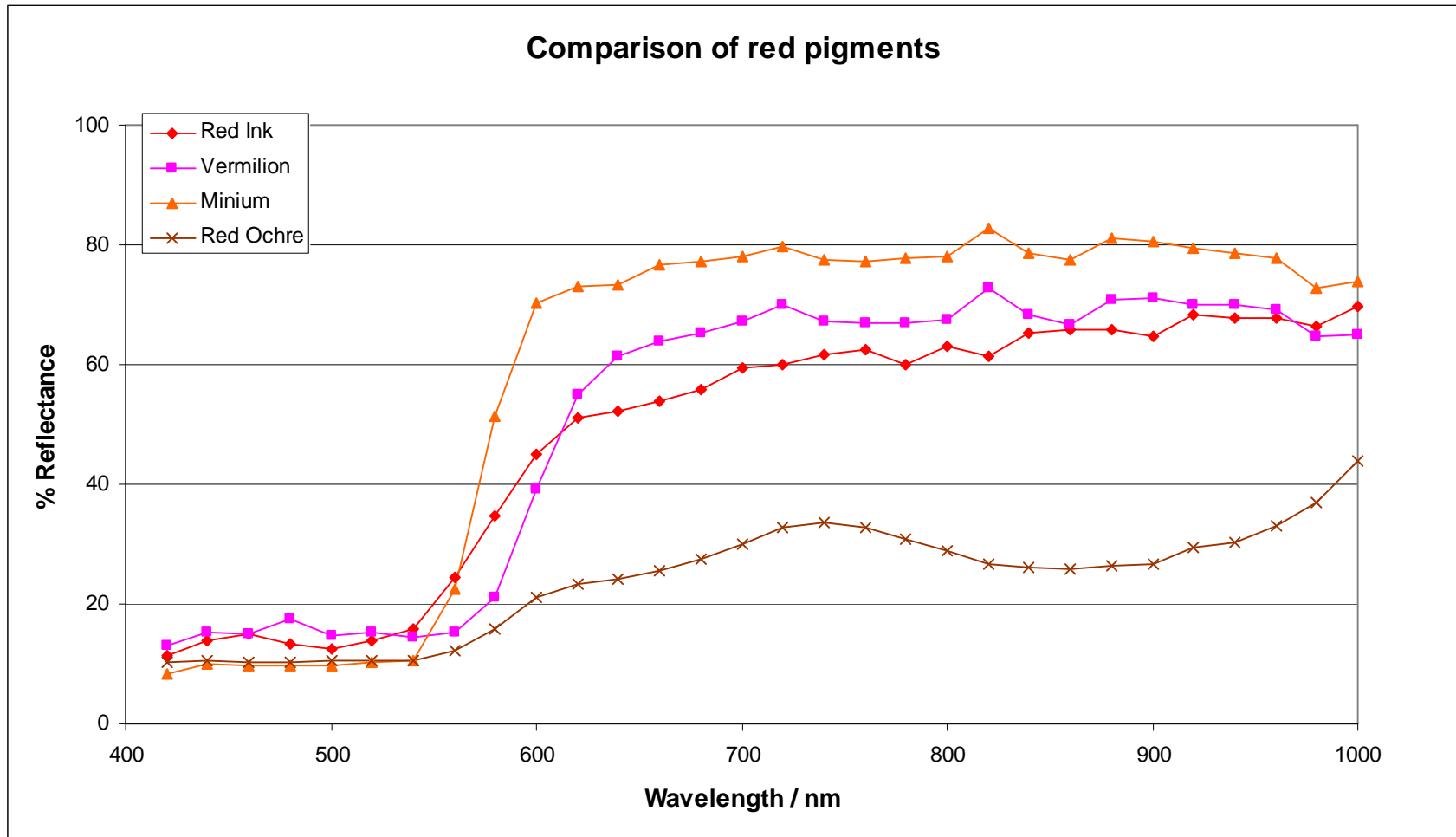
Spectra of manuscript



Spectra of black inks



Spectra of red pigments



Conclusions

- Black ink is definitely not carbon; is probably iron gall ink
- Red ink is definitely not red ochre; is probably vermilion (HgS) but minium (Pb_3O_4) cannot be ruled out
- Compare with Vercelli Gospels (Latin, end of 4th century)
 - Analysed by X-ray fluorescence and Raman spectroscopy
 - Original text is iron gall and vermilion
 - Later notes are carbon and minium