Materials and Inks

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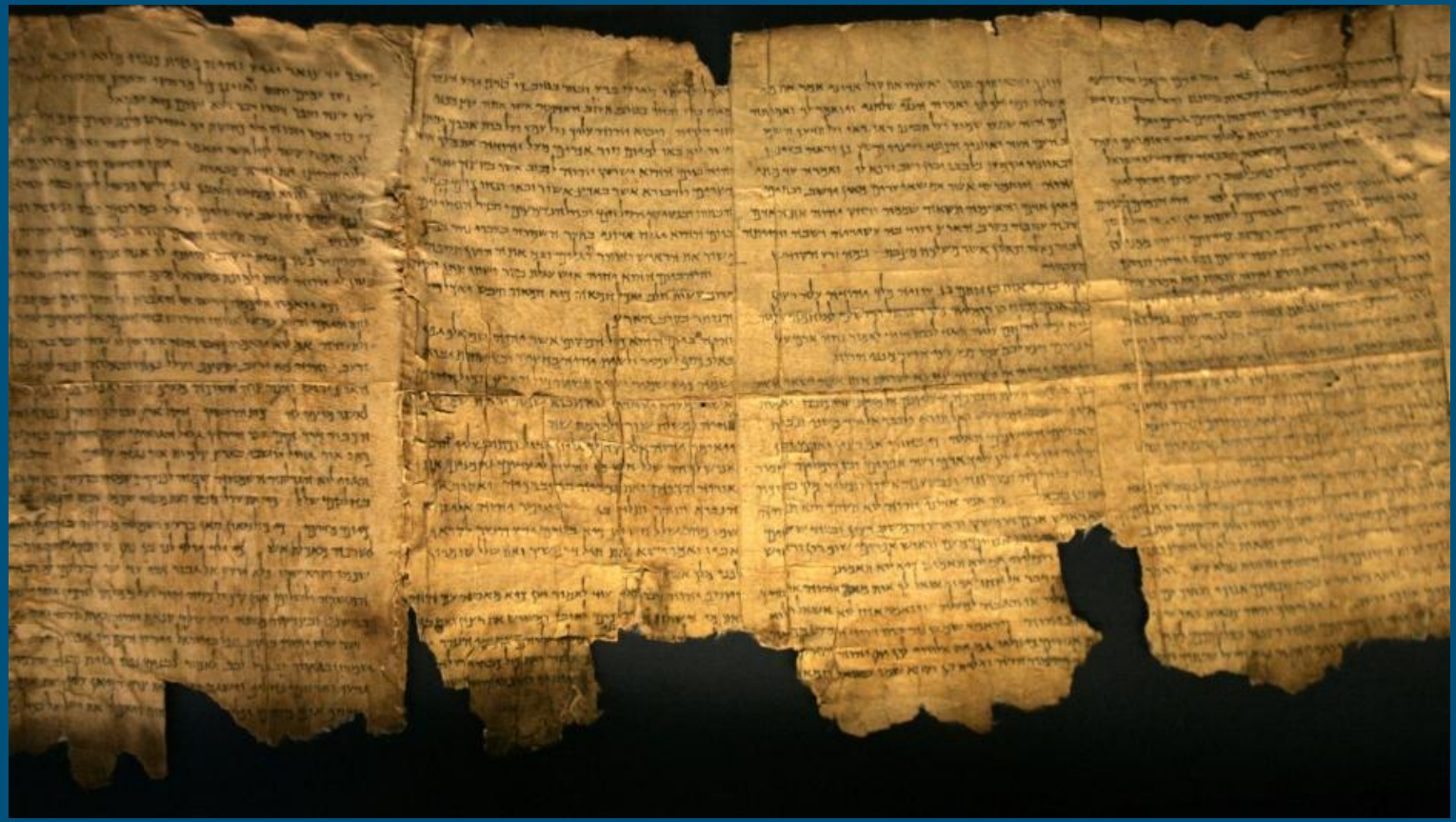
Book History

- We know many of you already understand the basics of book history, but we want to make sure we all share a common vocabulary.
- We want to think about these items as technological innovations.
- We want to think about how these different components will affect imaging of both traditional digitization and, more importantly for the sake of this workshop, multispectral imaging.

Forms

Scroll



Dead Sea Scroll, c. 400 BCE to 100 CE.

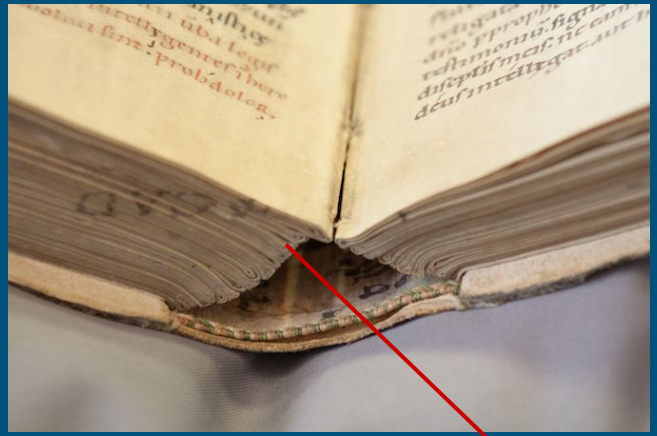
Roll

Account rolls from St George's Chapel Archive in Windsor, SGC XV.34.4, 1366–67. Image credit: https://blog.nationalarchives.gov.uk/transforming-archives-st-georges-chapel-archives-windsor/

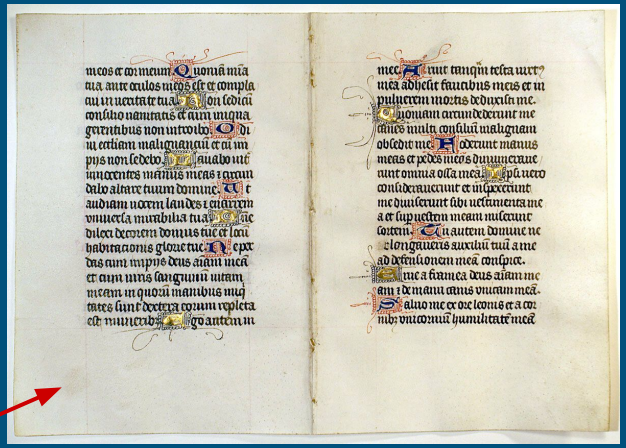
Codex

St Chad Gospels (Lichfield Cathedral, MS Lich. 01), c. 730

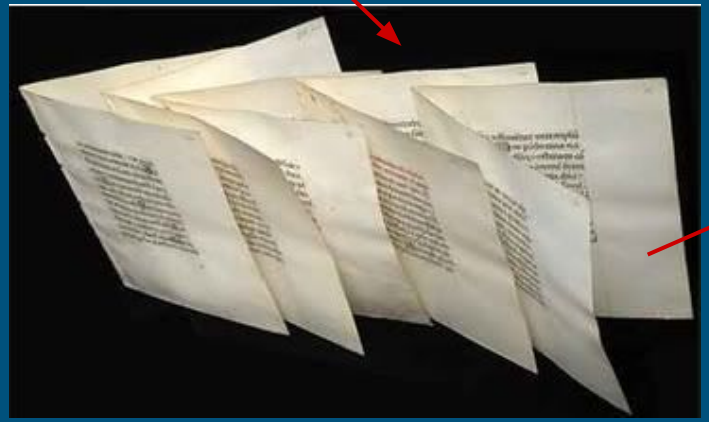
codex



bifolium = folio + folio



quire =

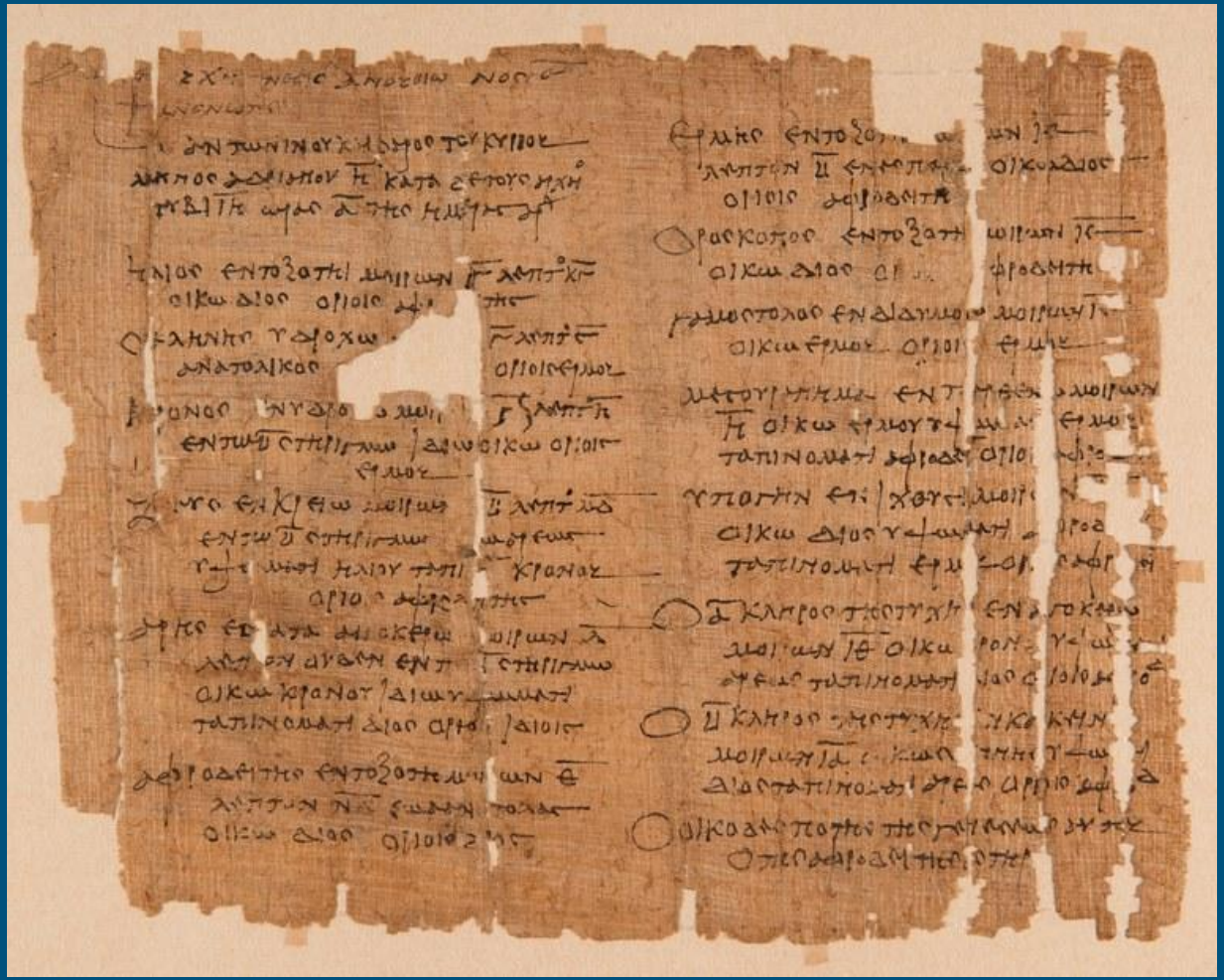


verso recto

Substrates

Clay

Papyrus



Papyrus

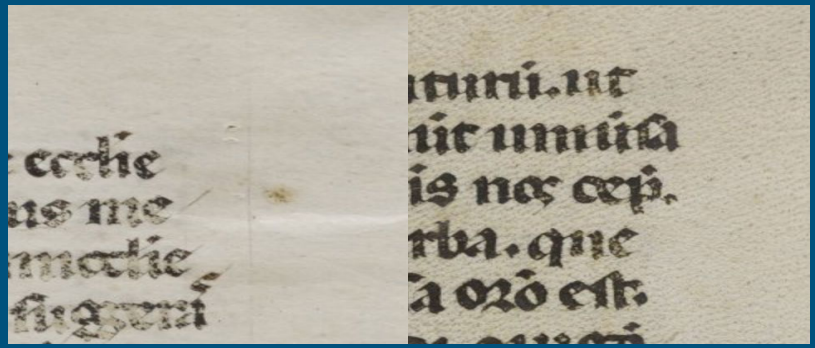
- 2550 BCE: oldest inscribed parchment found in Egypt
- All papal bulls were written on papyrus until 1022 CE
- Used in Egypt and around the Mediterranean
- Making papyrus:
  1. Peeling the reed
  2. Cutting the reed into thin strips
  3. Weaving the strips into a mat by layering strips horizontally and vertically
- Scrolls were made by gluing sheets together on their fringed edges

Parchment

Parchment

- Parchment = animal skin that has been prepared for writing or printing
  - Antiquity: leather or tanned parchment
  - Middle Ages: untanned parchment
- Animals most commonly used: goat, cow/calf, and sheep
  - DNA analysis suggests about 70% identification accuracy among experts
- More durable than papyrus or paper
- High cost of production

- Fluoresces under UV light
- Retains inks very well
- Flesh vs. Hair sides



University of Pennsylvania, MS LJS 184, fols. 4r (flesh) and 3v (hair), respectively.

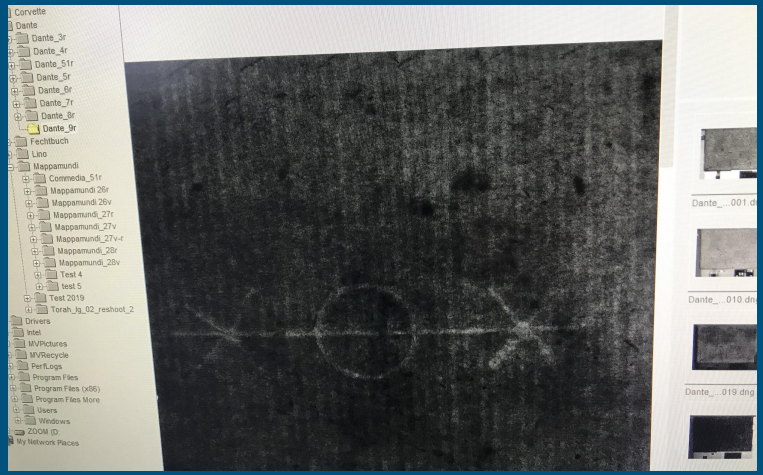
Paper

Rijksarchief te Gent K98, watermark dated to c. 1398. Image credit: http://sites.nd.edu/manuscript-studies/2017/02/10/what-lies-beneath-the-reliability-of-watermarks-as-a-method-for-telling-time/

Paper

- China, c.150 BCE → Middle East, 751 CE → Europe, 1144 CE
- European paper mills use
  - Linen cloth/rags
  - Wiremolds and watermark designs
  - Gelatin as sizing agent
- Watermarks allow for high precision dating and provenance
- Cheaper but less durable than parchment

- Does not retain ink as well as parchment
- Transmissive light source reveals watermark



Watermark and chain/laid lines revealed clearly in transmissive band on a page of Dante's *Inferno* (Dresden, SLUB MS Ob.25).

Inks and Pigments

Inks and Pigments

- Ink = colored liquid made from dye solutions (e.g., tannins) or pigment dispersions (e.g., sepia, bistre)
- Pigment = dry coloring material mixed with a binding agent (e.g., gum arabic, egg tempera) to form an opaque paint
- Identification is possible using XRF, Raman and IR spectroscopy, and observation under UV, visible, and IR light

University of Rochester, D.460 1300–005

Soluble Inks

- Commonly used materials derived from plants or insects
- Brown plant inks, traditionally made from the bark of the blackthorn/sloe tree and wine, was commonly used in monasteries in the early Middle Ages
- “Theophilus Ink”
  - Recipe from Theophilus Presbyter’s *De diversis artibus* [*On Various Arts*] (c.1120) recommends adding small amounts of vitriol to the traditional bark-wine ink
  - Transitional between plant-based and iron-gall inks

Carbon or Dispersion Inks

- Made by mixing soot with a binding agent (e.g., gum arabic, egg tempera/yolk, animal glue)
  - Four recipes survive from medieval Europe, all using egg yolk as the binder
- Various additives can be detected (e.g., copper sulfate) because pure soot was difficult to produce in Antiquity
- Carbon inks were expensive to produce, and cheaper inks were necessary as documentary cultures increased

Iron Gall Ink

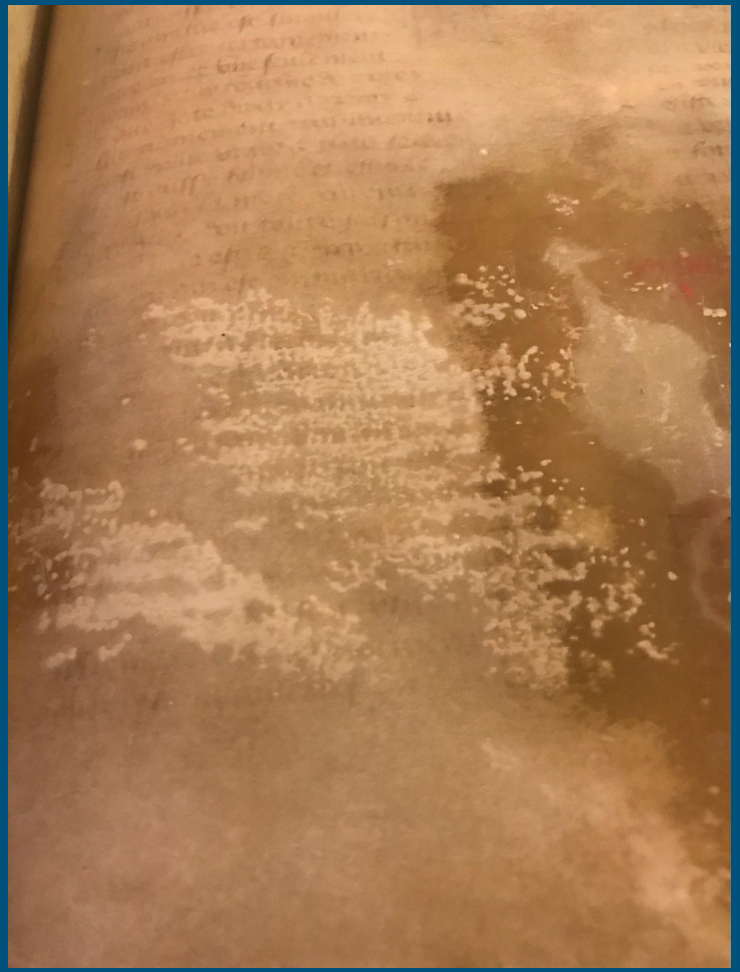
Image credit: https://sarahpeverley.com/2014/01/29/iron-gall-ink-a-medieval-recipe/

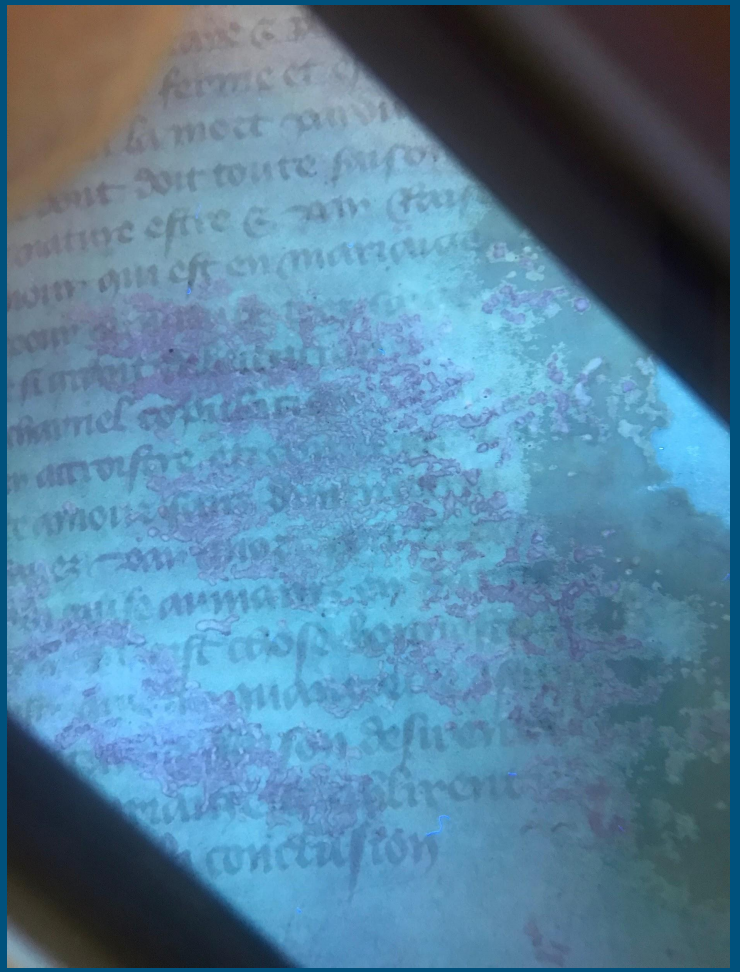
Iron-Gall Inks

- Most common ink used in medieval Europe
- Made by distilling oak galls in an aqueous medium (e.g., wine, vinegar) and combining the distillate with vitriol (iron (II) sulfate) and gum arabic
- Combines properties of soluble and dispersion inks

Relevant properties for MSI:

- Soluble – penetrates surface of substrate
- Corrosive – causes parchment to thin over time
- Blocks fluorescence of parchment under UV light
- “Disappears” under IR light

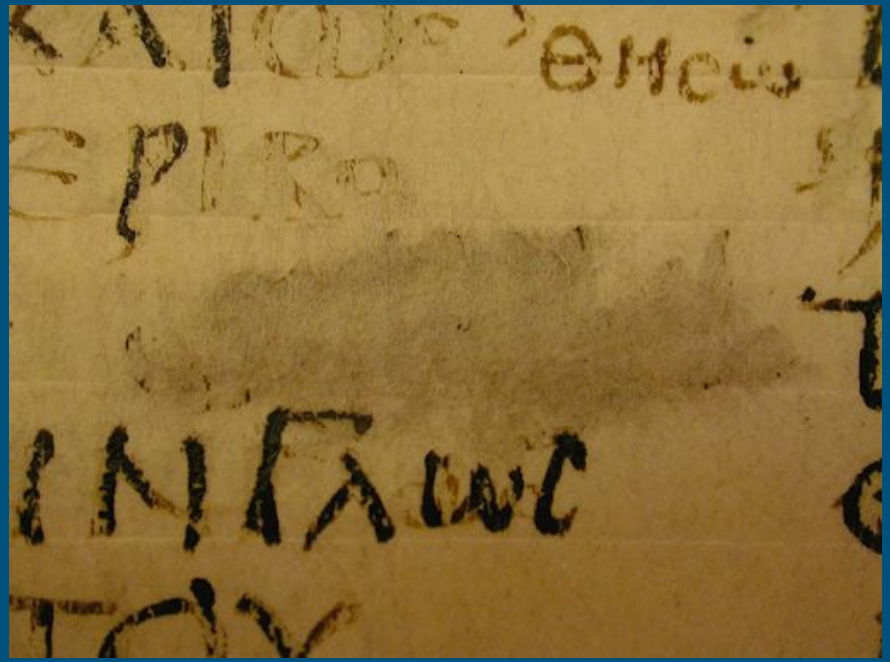




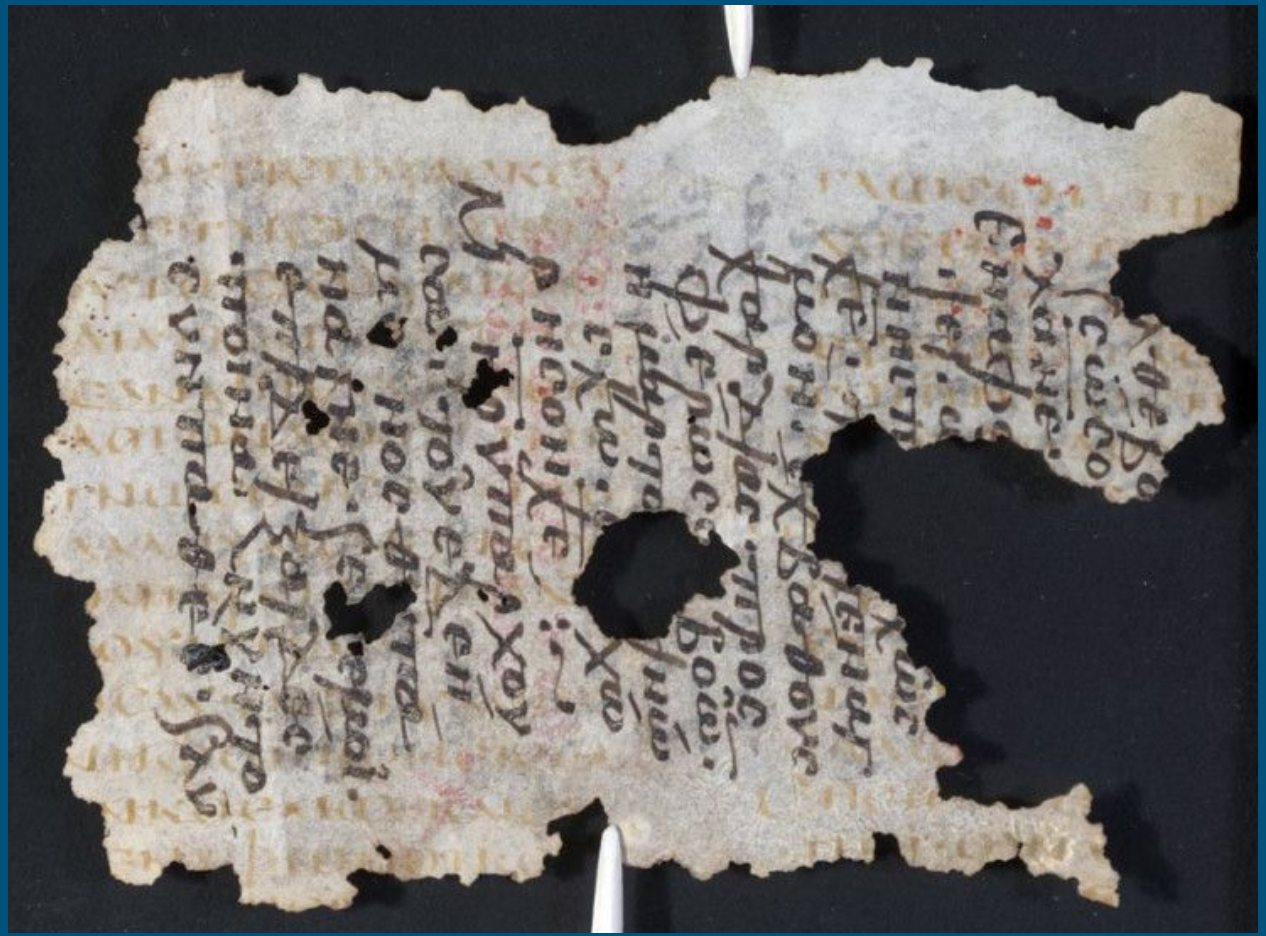
fol. 109r of *Les Eschéz d'Amours* (SLUB MS Oc. 66) under visible light (left) and under handheld UV light (right).

Frequent Types of Damage

Erasures and Corrections

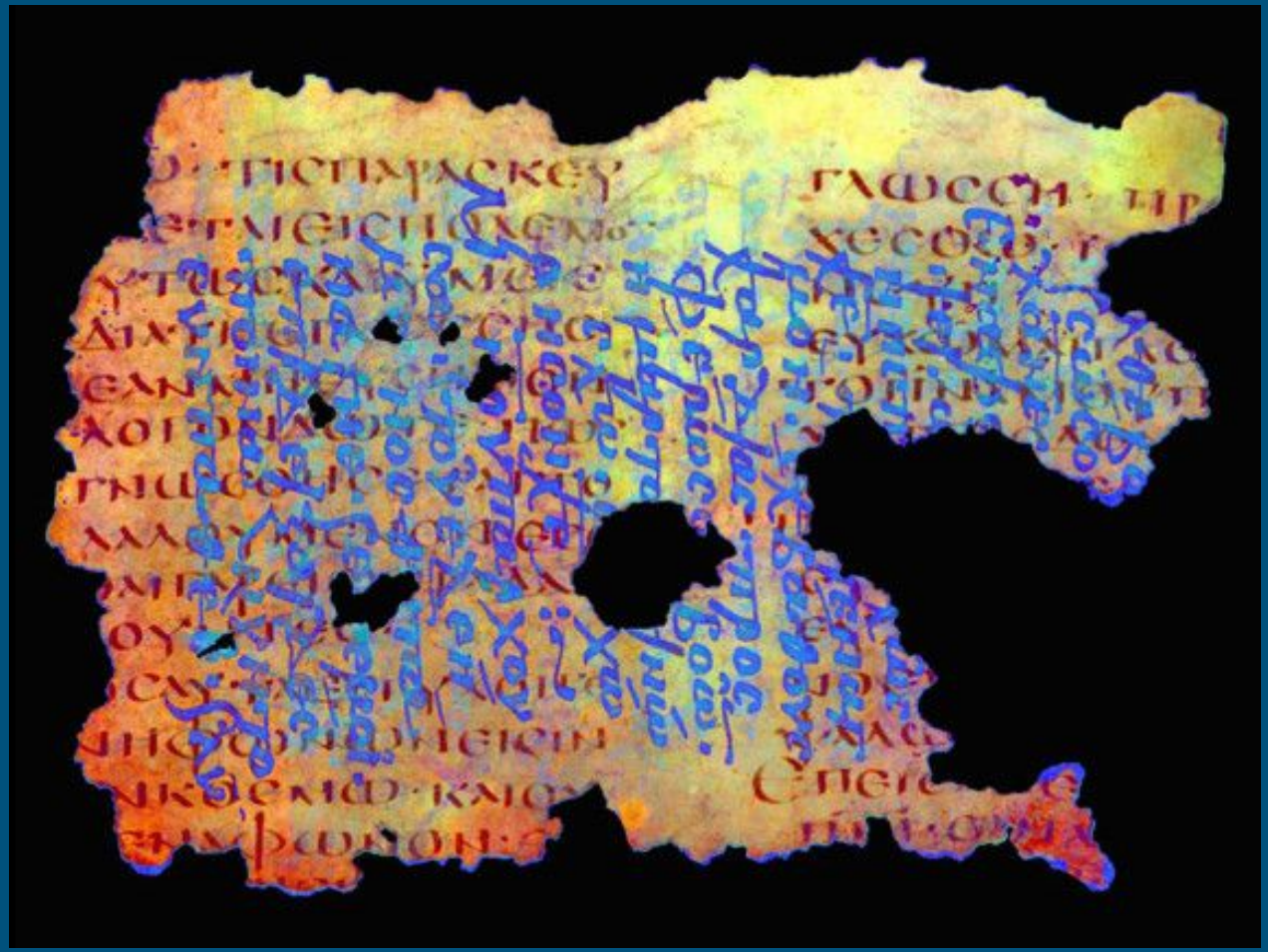


Palimpsest



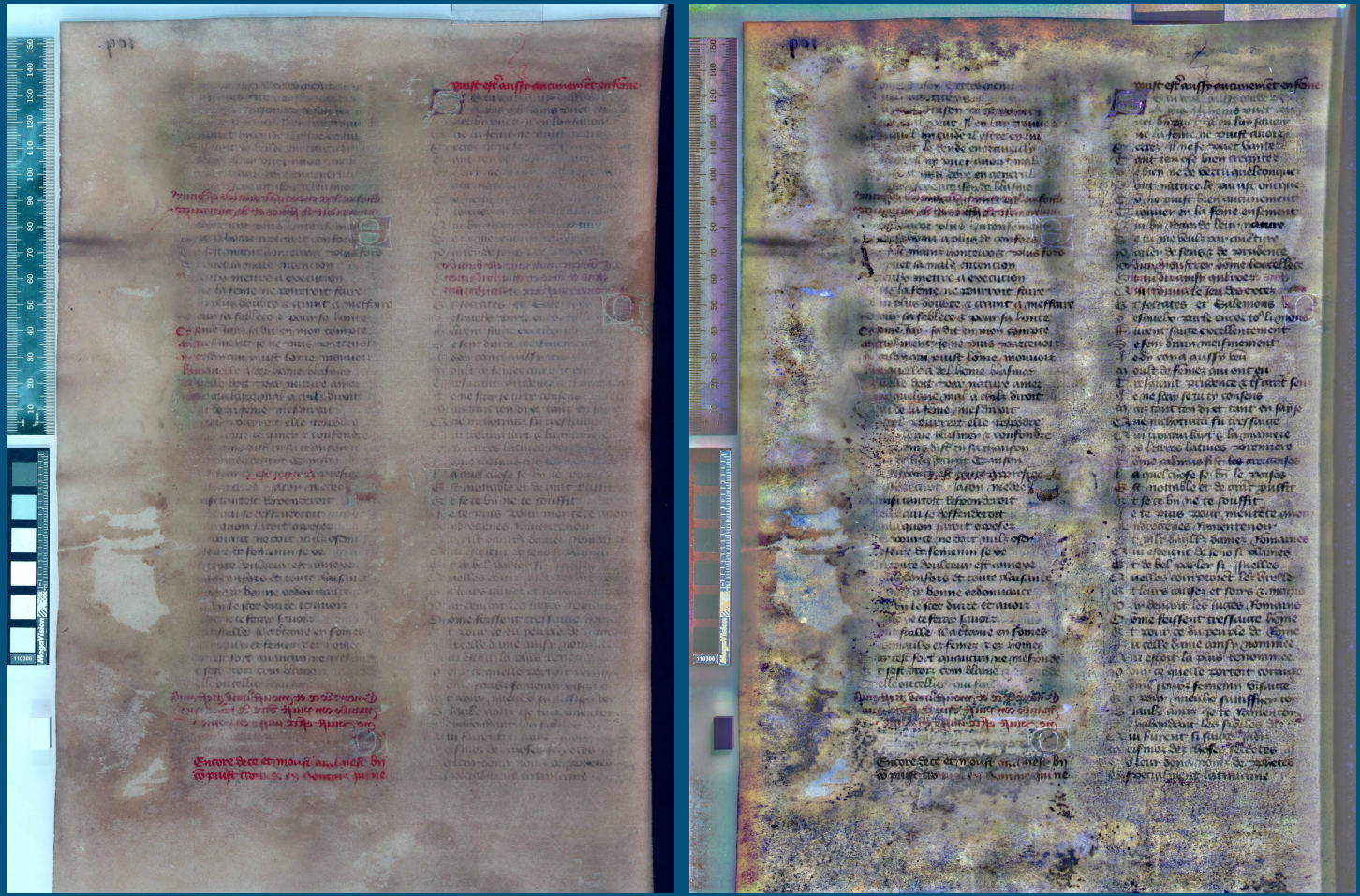
Palimpsested copy of 1 Corinthians under visible light.
Image credit: Sinai Palimpsests Project.

Palimpsest



Palimpsested copy of 1 Corinthians after multispectral image processing.
Image credit: Sinai Palimpsests Project.

Water



Les Eschéz d'Amours (Dresden, SLUB MS Oc. 66), fol. 109v, before and after image processing

Fire

Chartres Media Library, L’Apostrophe – Médiathèque de Chartres, MSS Fragments

Workshop

Many thanks to Dr. Anna Siebach-Larsen and UR's Department of Rare Books, Special Collections, and Preservation for supplying these wonderful objects!

- Pairs (if you are a science person, try to find a humanist, conservator, librarian, etc.)
- Work directly with one of the manuscripts to answer the following questions:

- Identify the **form** of the object.
- Identify the **substrate(s)**.
- Try to identify the type of **ink** used.
- Is it a palimpsest?
- What considerations would you have for imaging it?
  - What would you be trying to capture?
  - What would you be hoping to highlight with imaging?