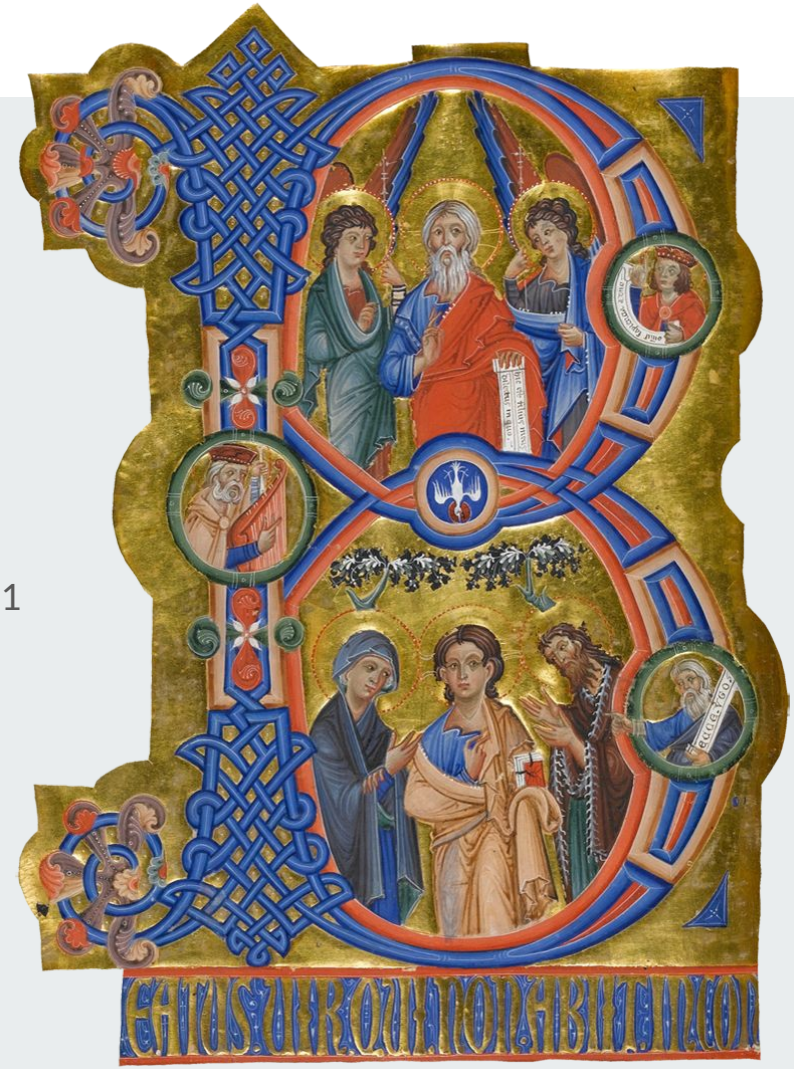
MINIARE project:

Manuscript Illumination: Non-Invasive Analysis, Research And Expertise

Keiran Rowell - USYD Theory Group Meeting - 22nd April, 2021

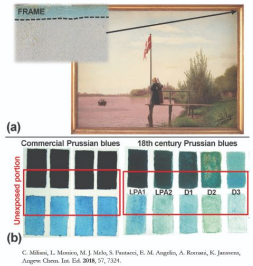
https://www.miniare.org/
(https://youtu.be/YMRvXnB7uJg)



SCIENCE FOR ART CONSERVATION

Reading Group

Fortnightly Wednesday 5-6pm (beginning 14/4/21)
G05 Dalton Building/zoom



· Are you interested to see how your science might apply to art conservation?

· Would you like to discuss science for art conservation in a friendly and supportive environment?

If yes, then our reading group is for you!

Members of the group volunteer to discuss relevant scientific literature on any topic that interests them in the field. **Undergraduate students are simply welcome to attend without any requirement to present**. We believe this is a great opportunity to network with other students and researchers with similar interests, and to practice presentation and scientific reading skills in a friendly and casual environment (with snacks!).

If you have any questions, please don't hesitate to email either
Dr. Martina Lessio (**martina.lessio@unsw.edu.au**) or
Antonia Papasergio (Chemistry UG) (**a.papasergio@student.unsw.edu.au**).
We look forward to hearing from you!

Dr Martina Lessio

Antonia Papasergio

Why manuscripts?

Largest extant record of pigments:

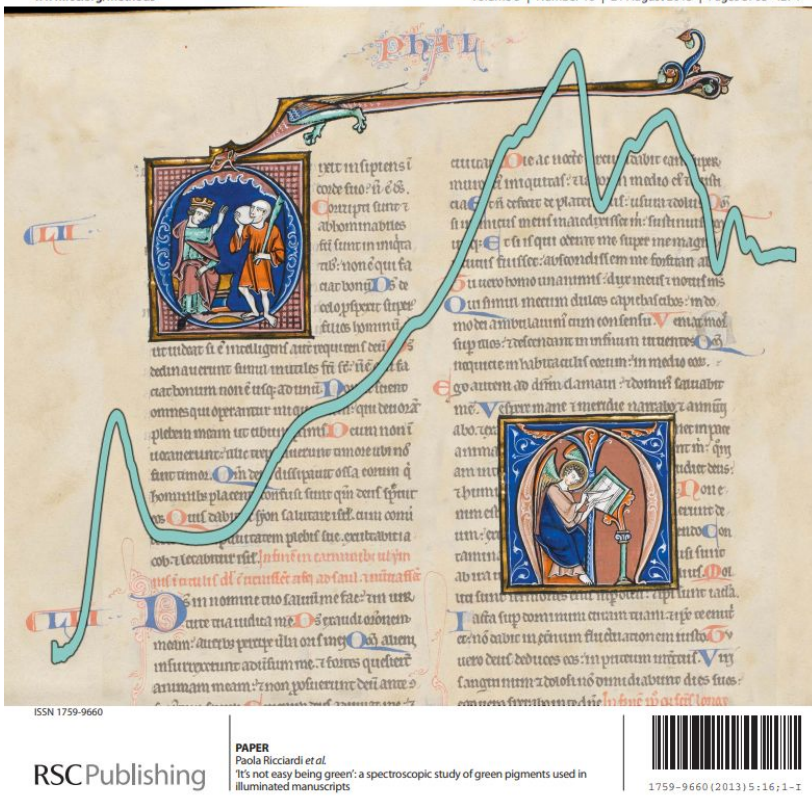
- Durable (parchment/velum) and well preserved (*cf.* frescos)
- Egyptian "Book of the Dead" (*ca.* 1350 BCE) to 19thC Ottoman
- Led by Cambridge w/ 5000+ manuscripts

Importance:

- Art history
- Chemical techniques & binders
- Global trade
- Provenance

Non-invasive techniques:

- Mostly spectroscopy
- Near-IR reflectance, X-ray fluorescence, Raman



‘It’s not easy being green’

Why green?

- Lots of types: organic, inorganic, blue & yellow mixes
- Easily fades: no modern synthetics, Cu patinas to green
- Unclear names: ‘verdigris’ is CuX_n with various anions

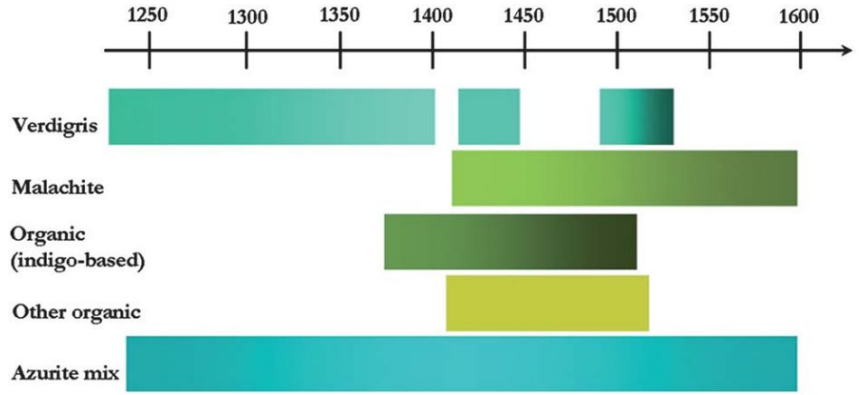


Fig. 4 Timeline summarising the green pigments and mixtures identified on the French manuscripts analysed. See text for a detailed discussion.

Malachite

$Cu_2(CO_3)(OH)_2$

Azurite

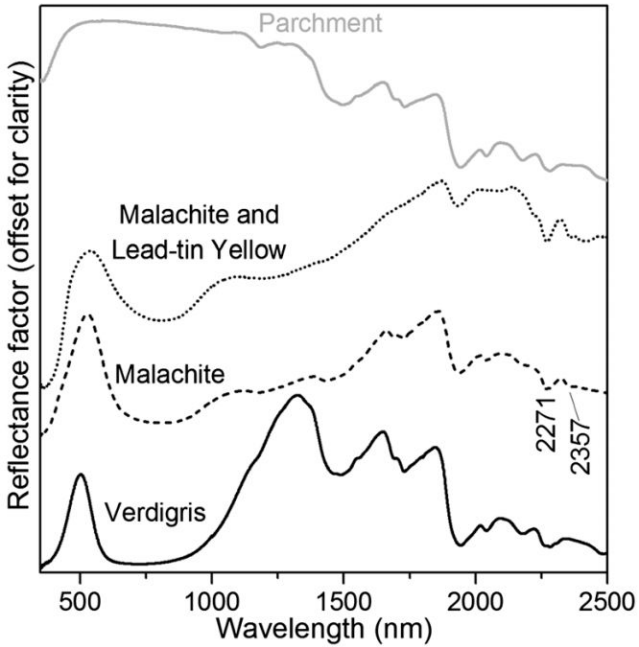
$Cu_3(CO_3)_2(OH)_2$

“Terre verte”

“A rather mongrel collection of naturally occurring pigmented earths of varying hues and mineral make-ups” - Kassia St Clair

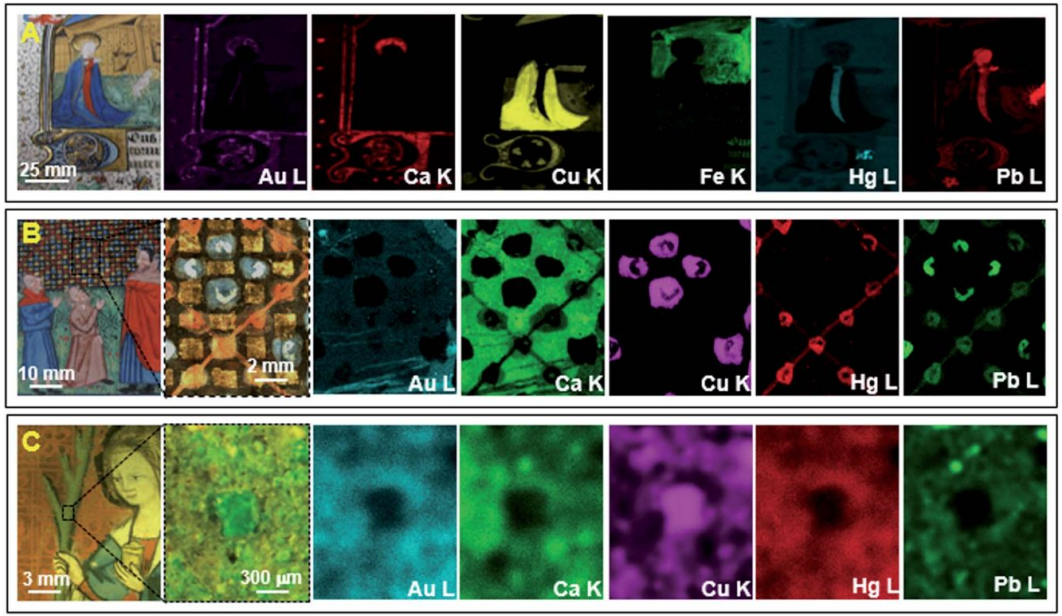
Non-invasive techniques

Fibre optic reflectance spectroscopy (FORS)



Functional group information

X-ray fluorescence (XRF)



Elemental distribution (K, L, M are core shells)

Source: Manukyan, K. V.; Guerin, B. J.; Stech, E. J.; Aprahamian, A.; Wiescher, M.; Gura, D. T.; Schultz, Z. D.. *Analytical Methods* **2016**, *8* (42), 7696–7701.

Hours of Isabella Stuart (*ca.* 1431)

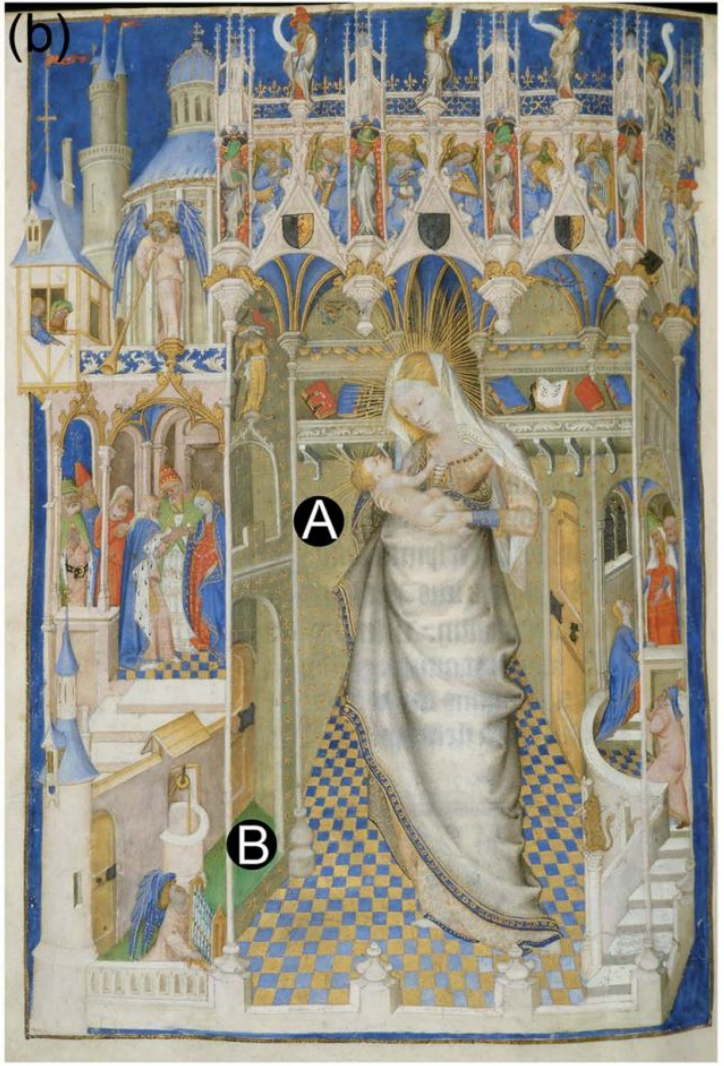
Mostly Malachite (**B, C**)

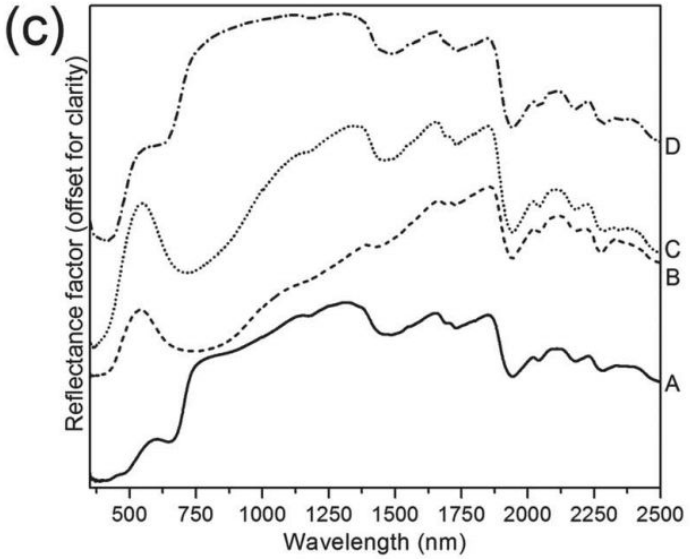
Azurite + Indigo + Yellow (**A, D**)

A, D added later by new owner

Repainted overtime:

Coat of arms; Anjou & Brittany





1. https://www.naturesrainbow.co.uk/2017/10/three-strains-of-japanese-indigo-tested-and-observations-on-indigo-extraction/

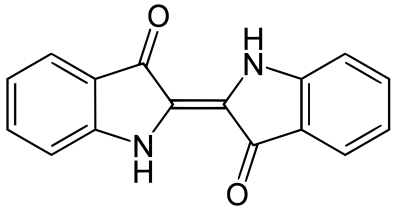
Veragut - Indigo + Orpiment

"Another green is made with orpiment and good indigo; **but it is not a good plan to use orpiment on parchment**, because by its odor it reduces white lead, red lead, and green to a sort of metallic color; **therefore I have not undertaken to explain the way to make green with it"** - De arte illuminandi (14thC)

Orpiment is highly toxic

Mineral orpiment sublimed in the presence of sulfur.

Indigofera tinctoria[1]



Synthesised by Adolf von Baeyer
In 1865, commercialised by BASF
(Badische Anilin- & Sodafabrik)

Orpiment

As_2S_3

Anselmi, C.; Ricciardi, P.; Buti, D.; Romani, A.; Moretti, P.; Rose Beers, K.; Brunetti, B. G.; Miliani, C.; Sgamellotti, A.. *Studies in Conservation*, **2015**, *60*, S185–S192.

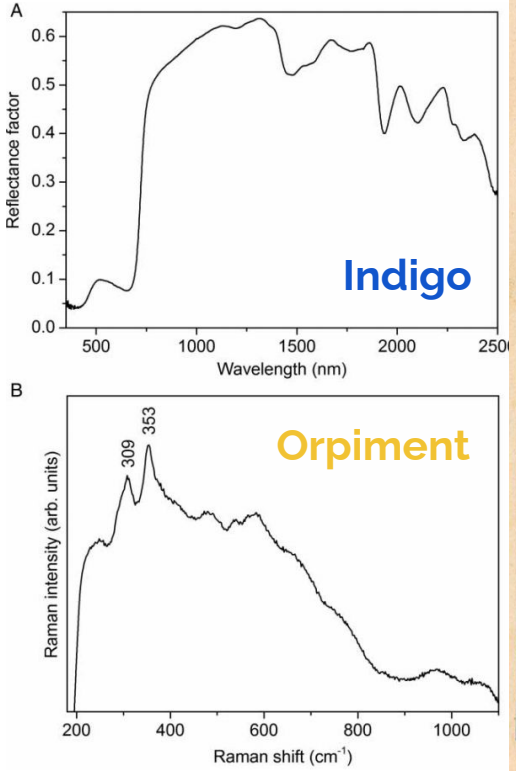
Persian manuscript (*ca.* 1562) of epic poem *Haft Peykar*

Verdigris for robes

Veragut for foliage

Malachite + **Indigo** for light green background

(Cu, no As, indigo UV-Vis)



1. Anselmi, C.; Ricciardi, P.; Buti, D.; Romani, A.; Moretti, P.; Rose Beers, K.; Brunetti, B. G.; Miliani, C.; Sgamellotti, A.. *Studies in Conservation*, **2015**, *60*, S185–S192.
2. Barkeshli, M.; Ataie G.H, *Restaurator*, **2002**, *23*, 154-164

Open questions

Why the sudden adoption of malachite in France?

- Rich malachite deposits available in Lyon
- Trade of malachite in late medieval era not full known

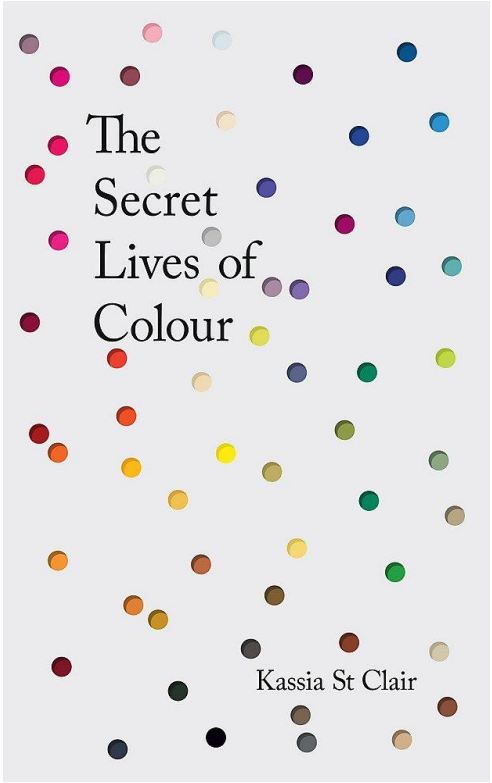
True identity of some green pigments:

- Organic glazes and colourants not resolved
- Raman identification of verdigris difficult[1]
- Saffron mixed in with verdigris[2]

Database of reference spectra:

- Variety of organic colourants and paint media
- Local supplies, international trade routes

Fun book on the vivid history of colour



https://www.chemistryworld.com/review/the-secret-lives-of-colour/2500049.article

Thank you!

Doherty, B.; Daveri, A.; Clementi, C.; Romani, A.; Bioletti, S.; Brunetti, B.; Sgamellotti, A.; Miliani, C., “The Book of Kells: A non-invasive MOLAB investigation by complementary spectroscopic techniques”, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, **2013**, *115*, 330–336.