



ENGLISH
HERITAGE

Inherent risk:

Darwin Daguerreotypes and their travelling cases

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Daguerreotypes

- Invention announced in 1839 by Daguerre
- Uses silver plated (~0.01 mm thick) copper sheet (~0.4 mm thick), polished to mirror finish
- Silver metal is sensitized with fumes from iodine crystals
- Exposed in camera
- Developed over heated mercury (image forming particles in highlights are nanoparticles of silver-mercury amalgam, giving extremely high resolution)
- Fixed in hot saturated salt (sodium chloride) solution
- Improvements used sodium thiosulfate to fix image and remove light sensitive compounds, or gilding (with gold chloride and sodium thiosulfate) – ungilded particles very sensitive to abrasion
- Light sensitivity improved by using iodine and bromine or chlorine



Down House Daguerreotypes



- 6 Daguerreotype portraits of Darwin children
- Includes only known image of Darwin with another person (his son William)
- Taken at Claudet's studio in 1842 (Claudet was Daguerre's student, improved method using chlorine instead of bromine)

Original travelling case

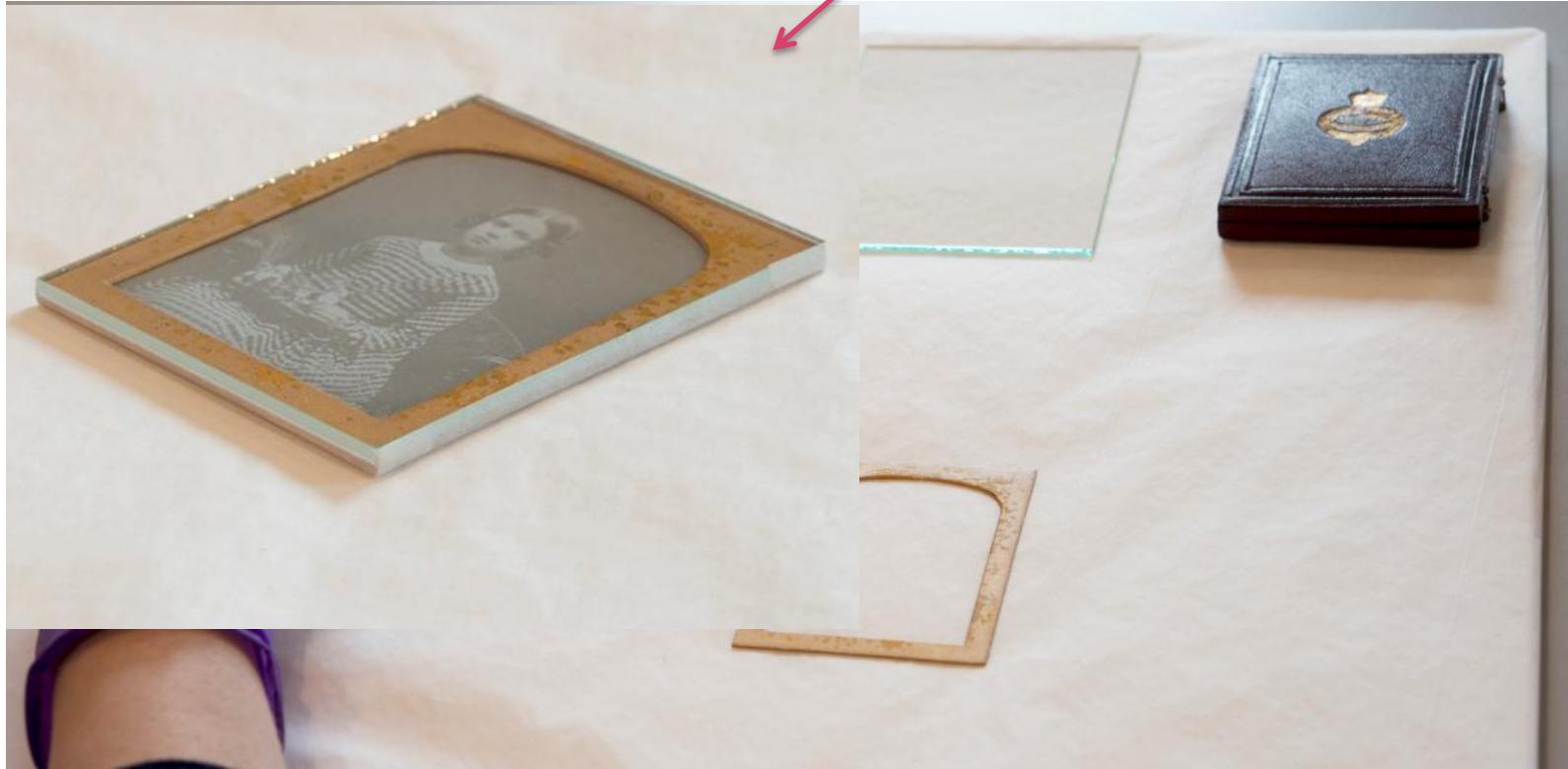


Provided protection from light, abrasion and pollutants

- Wooden case
 - Source of acetate and formate
- Leather covered
 - Source of sulfides
- Paper lining (behind Daguerreotype)
- Wool velvet ribbon internal edge (and inside front cover)
 - Source of sulfides

Daguerreotype packet

Daguerreotype packet



er
tape sometimes covered with
decorative brass preserver)

Current Daguerreotype display



Daguerreotype image damage



- Wool & leather potential sources of reduced sulfide gases
- Daguerreotype plates commonly have double ring of tarnish
- Is the travelling case the cause of the silver tarnish?

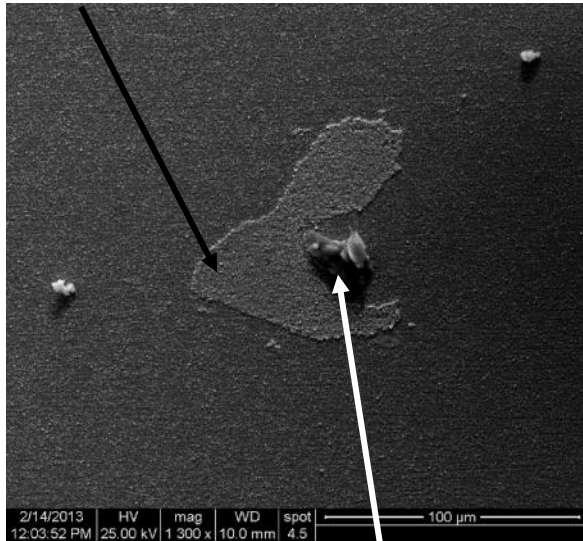
Cover glass damage



- Glass composition determined to be unstable
- Wood in travelling case possible source of formic acid
- Is the travelling case increasing glass corrosion?

Daguerreotype damage from cover glass

Silver sulfide



Sodium formate

- Corrosion products can fall from glass
- Surrounded by localised tarnish on Daguerreotype plate
- IPI note this can lead to areas of copper corrosion on Daguerreotype surface

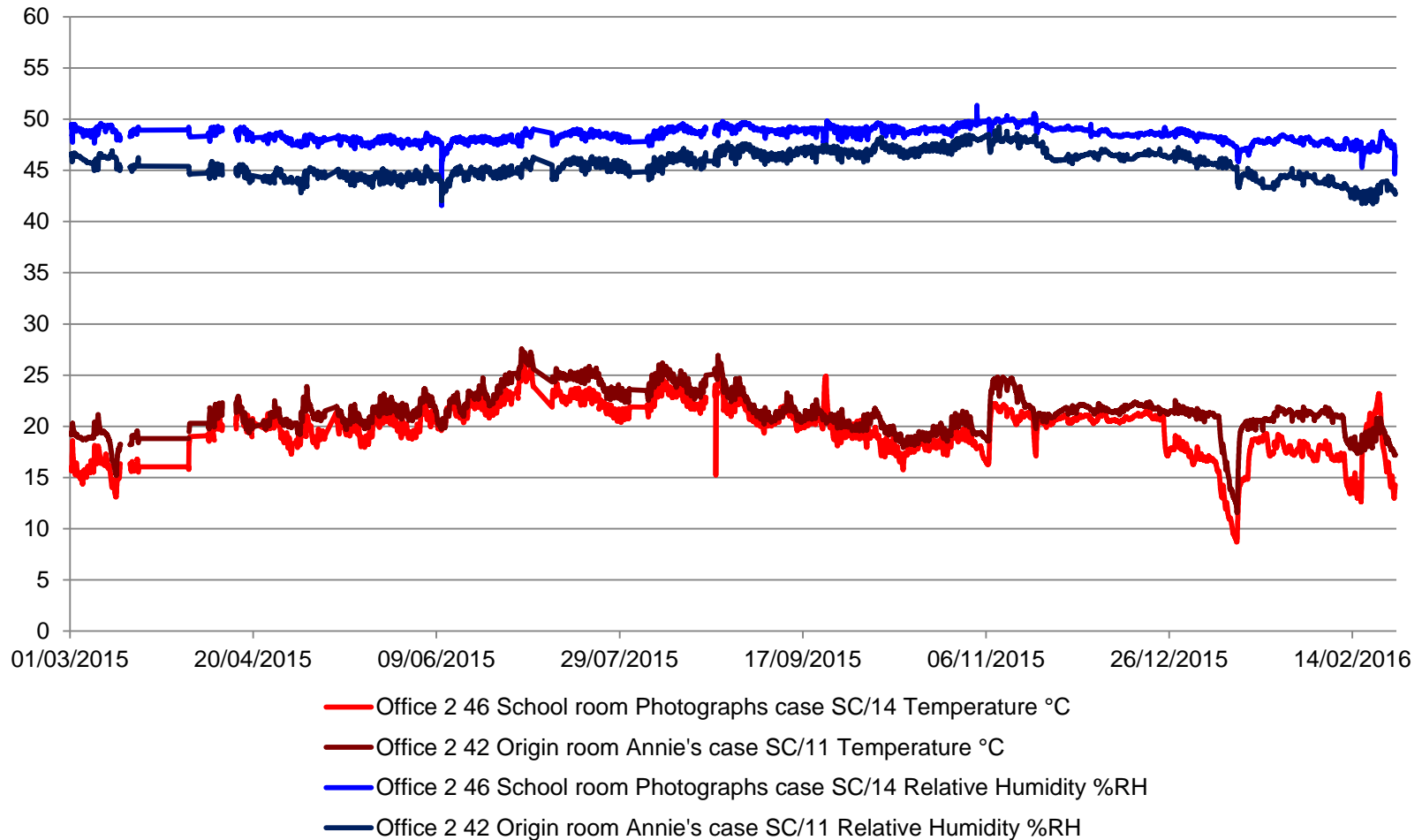


RH control for cover glass

- Current passive control maintains stable environment
- Limited active control possibilities
- Determine if glass corrosion can be controlled by maintaining low RH in showcases
- What RH level?



Current Daguerreotype environment



RH control for cover glass

55% RH



28% to 41% RH (ongoing)

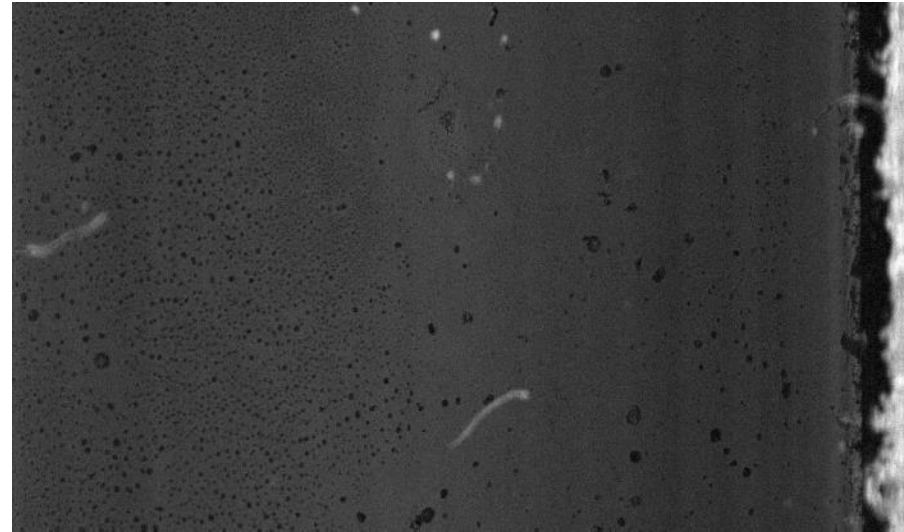


OCT comparison

USB microscope



OCT



Identified even the replacement cover glass (from post 1997) has some glass deterioration

RH control display implications

- Impact on other collections
- Redisplay and reinterpretation of cases
- Adaptation of cases & galleries (power supply)
- Cost & maintenance of control equipment



Condensation in Daguerreotype packets

- Test Daguerreotypes bought from eBay
- Surface wetness sensors applied to glass
- Added T and RH sensors
- Insert silver coupon



Silver coupons - colorimetry

- Planned to look at colour change compared to room and stored reference
- 1cm² coupons placed inside eBay test Daguerreotypes
- But no visible change in ~6 months for test Daguerreotypes



Travelling case assessment

- Use eBay travelling case to assess possible pollution risk
- Placed inside Escal bag with AirCorr (Ag 500nm) to provide continuous monitoring
- Bag sealed with oxygen clip



AirCorr results

Measurement summary

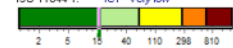
Start time: 27/01/2016 09:55:43
Measurement frequency: 30 minute(s)
Stop time: 25/02/2016 15:12:22
Measurement duration: 30 day(s)
Number of data point(s): 1451

Air corrosivity

Ag 500 nm (Silver, thickness 500 nm)
Corrosion depth: 1.3 nm
Corrosion rate: 15.8 nm/year
Corrosion buildup: 1.6 nm/30 days [3]

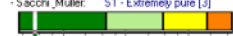
Corrosion classification:

· ISO 11844-1: ICI - Very low



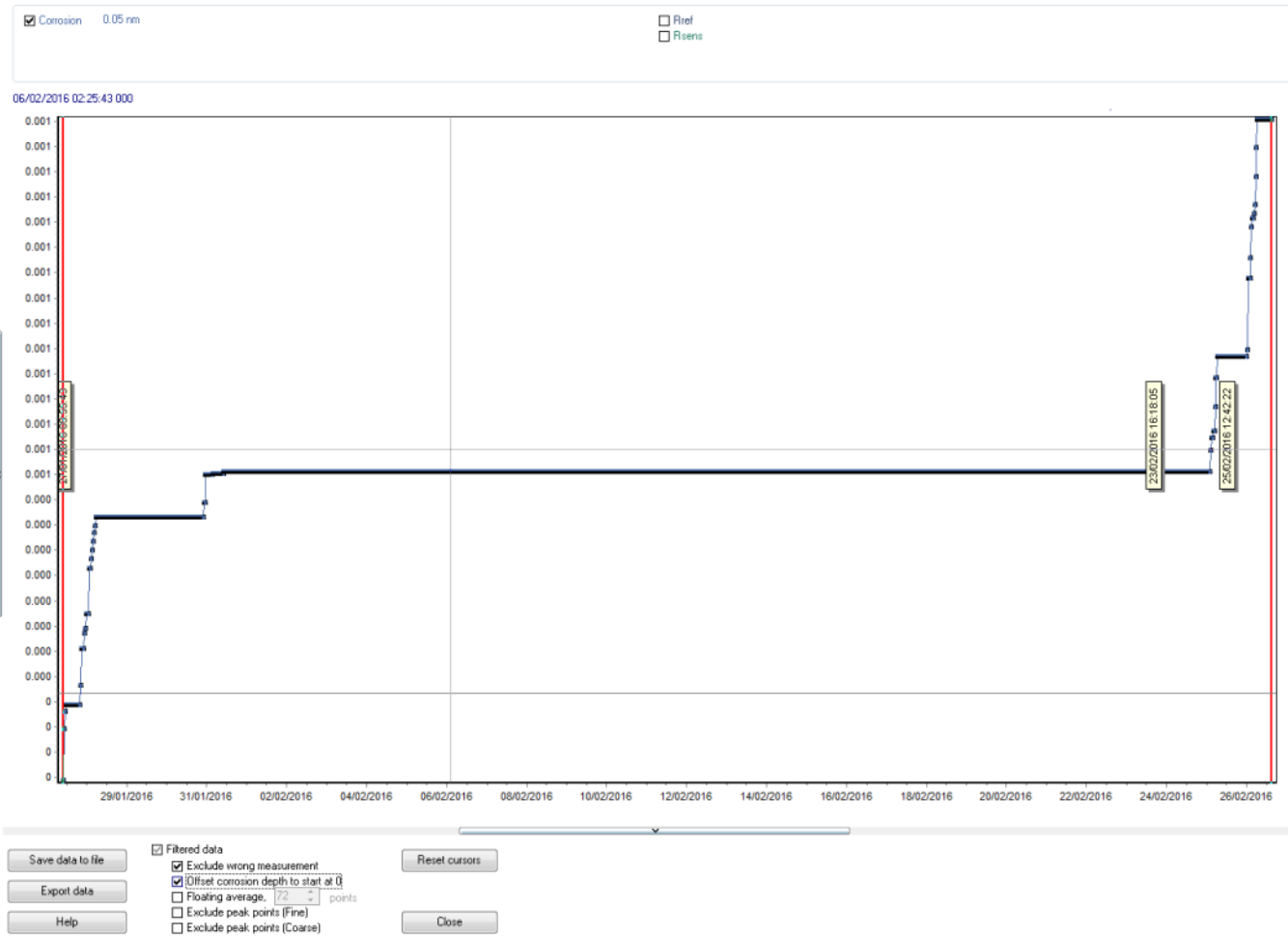
A horizontal bar with a color gradient from green to red, divided into segments. The values 2, 5, 15, 40, 110, 298, and 810 are marked along the bar.

· Sacchi_Muller: S1 - Extremely pure [3]



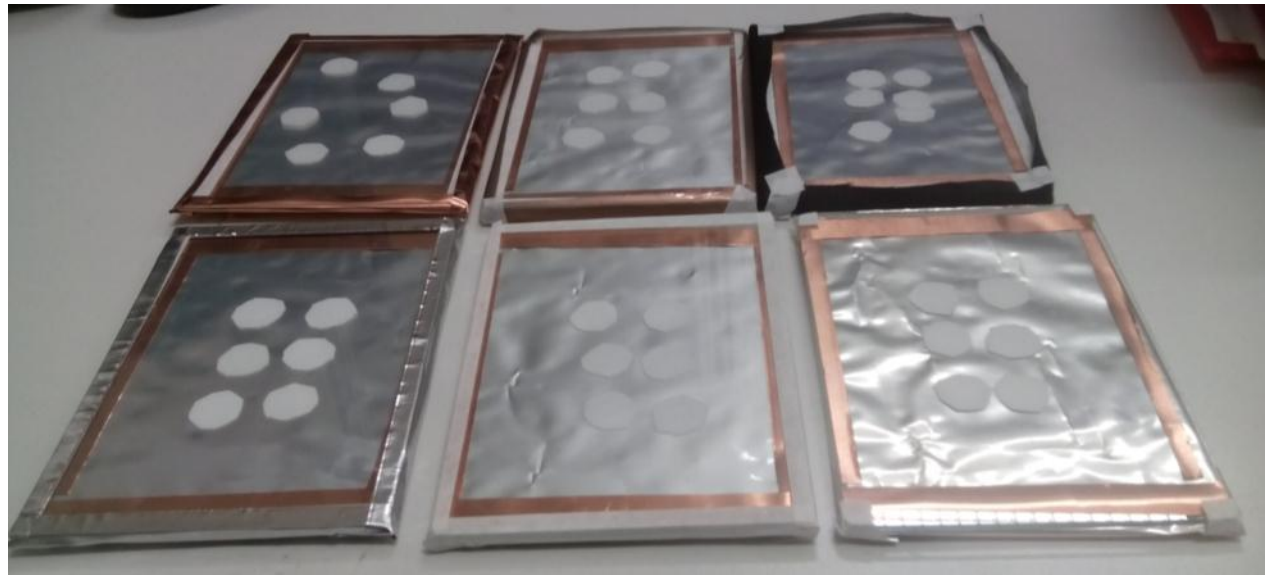
A horizontal bar with a color gradient from green to red, divided into segments. The values 2, 5, and 15 are marked along the bar.

[3] Warning: The buildup was estimated from the corrosion depth. Therefore, it is only indicative.



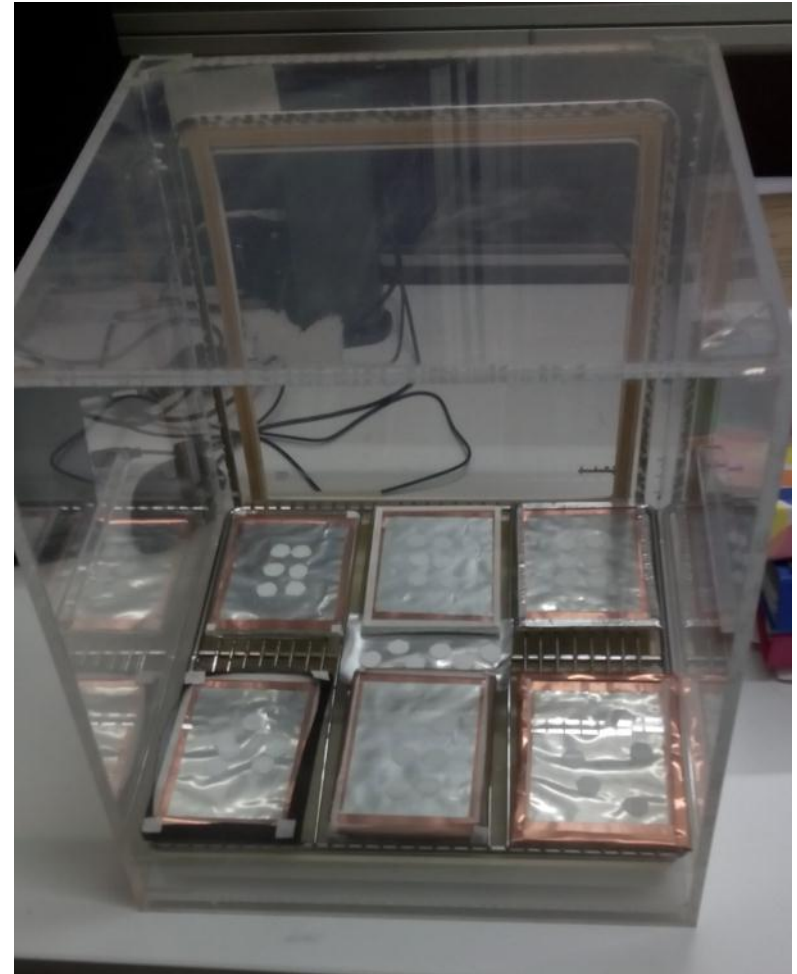
Daguerreotype packet test control methods

- No seal
- P90 tape
- Aluminium tape
- Copper foil
- Corrosion intercept
- Charcoal cloth



In progress

- More sensitive method to monitor inside Daguerreotype packet required
- Diffusion tube samplers placed inside identical test frames
- Place frames inside pollution chamber (formate solution)
- Use ion chromatography to determine level of ingress for each compared to no seal and background level



Further work

- Investigate the use of quartz crystal microbalances
- Coat crystals in same thickness silver as Daguerreotypes
- Previous research shown tarnish rate is similar to Daguerreotypes
- Place inside test frames
- Expose to high sulfide levels (e.g. Apsley House or wool carpet within enclosure)



Conclusions

- Travelling cases are integral part of the original object, preliminary AirCorr results indicates require further study to determine the risk from materials
- RH control of showcases to limit glass corrosion may be possible but passive control options are limited so might require removal of other related display materials
- Improved sealing of Daguerreotype packets could limit pollution ingress (possible use of brass preserver) but increased condensation risk required further study



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Step into England's story