

ANALYTICAL INVESTIGATION OF FURNITURE LACQUERS

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Examples of mid-18th century French furniture



Red lacquer commode 72DA46

Black commode 65DA4

18th century French lacquered furniture



- The J. Paul Getty Museum's collections include several important examples of mid-18th century French furniture that incorporate high quality Asian lacquers
- French cabinetmakers varnished and decorated the original Asian panels using western method and materials that imitated the appearance of the Asian lacquers.

18th century French lacquered furniture



- The objects contain various concentrations of complex mixtures of organic and inorganic materials, including the impressive long list of components found in Asian lacquers.
- Visual inspection presents difficulties in distinguishing the work of skilled European imitators from original Asian lacquers

Materials used in Asian lacquers

- urushiol (& other tree saps), camphor, shellac
- tung oil, linseed oil, perilla oil
- Indian redwood, indigo, persimmon juice
- animal glue, pig's blood
- flour, hemp, paddy husks, rice starch, sawdust, cow dung
- charcoal, ivory black, lampblack, minerals



Materials used in European lacquers

- amber, camphor, colophony, copaiva balsam, copal, fir resin, benzoin, elemi, larch resin, mastic, terebinth, sandarac, shellac, spruce resin
- linseed, walnut
- cochineal, dragon's blood, gamboge
- animal glue, gum animi, gum tragacanth

18th century French lacquered furniture

- GCI developed analytical protocol using FTIR and pyrolysis GC-MS in identifying both Asian and European lacquers on mid-18th century French furniture.
- FTIR utilizes the Bruker Hyperion microscope to conduct stratigraphic analysis while employing an in-house generated infrared spectral library for identification for various components.
- Pyrolysis GC-MS protocol uses TMAH derivatization prior to analysis to identify and differentiate the components of both European and Asian lacquers in a single run.
- Procedure minimizes sample size while enhancing the detection limits and sensitivity.



Asian Lacquers



- Several types of phenolic based Asian lacquer films have been found on various French furniture:
- Japanese/Chinese lacquers *Rhus vernicifera* based on urushiol: C15 unsaturated side chain
- Vietnamese/Taiwanese lacquers *Rhus succedanea* based on laccol: C17 unsaturated side chain
- Burmese/Thailand lacquer *Melanorrhoea usitata* based on thitsiol: C17 unsaturated side chain with some terminating in phenyl group

Glossary of select urushi terms

- Ki urushi – Raw urushi straight from the urushi tree.
- Suki urushi – Translucent urushi made by removing water from Ki urushi.
- Kuro urushi – Black urushi made through the addition of iron hydroxide or carbon black (Suki urushi).
- Bengara urushi – Red urushi made by the addition of red iron oxide.
- Shu urushi – Made by adding vermilion or cadmium red.

Bruker Hyperion microscope



FTIR experimental procedure

- Analysis was carried out on both polished cross sections and free samples.
- In the case of free samples, representative particles placed on a diamond window and flattened using a metal roller. Analysis was performed on the resultant translucent sample.
- The ATR objective from the Bruker Hyperion 3000 was used in stratigraphic surface analysis of multi-layered samples.

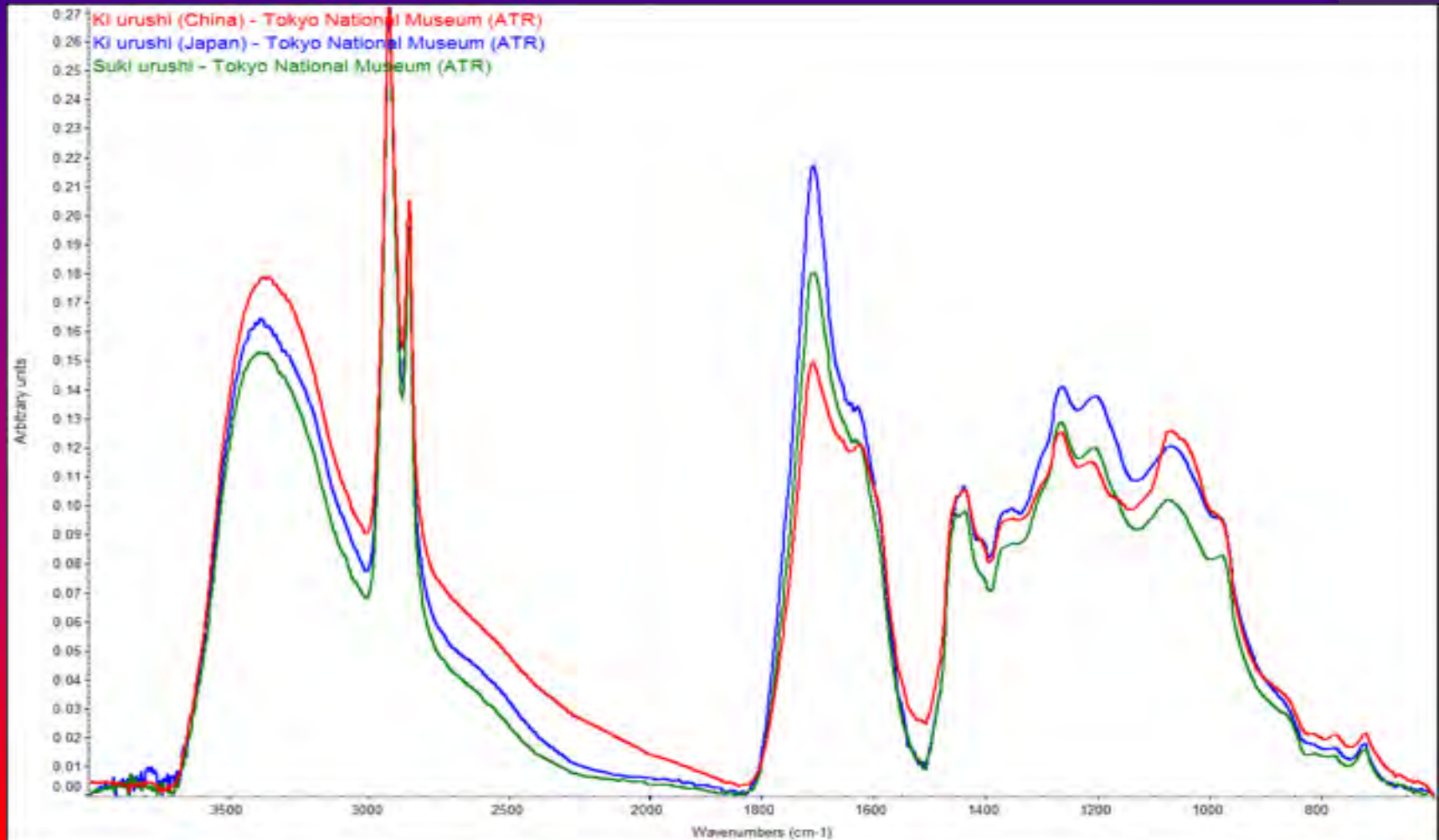
FTIR advantages

- Requires very small sample size
- Preparation time is minimal with use of free samples with later recovery for further analysis
- The reflectance ATR objectives (80 μm facet) can be employed for stratigraphic analysis of thin layers
- The technique can detect both Asian and European components: i.e. urushi and cellulose nitrate

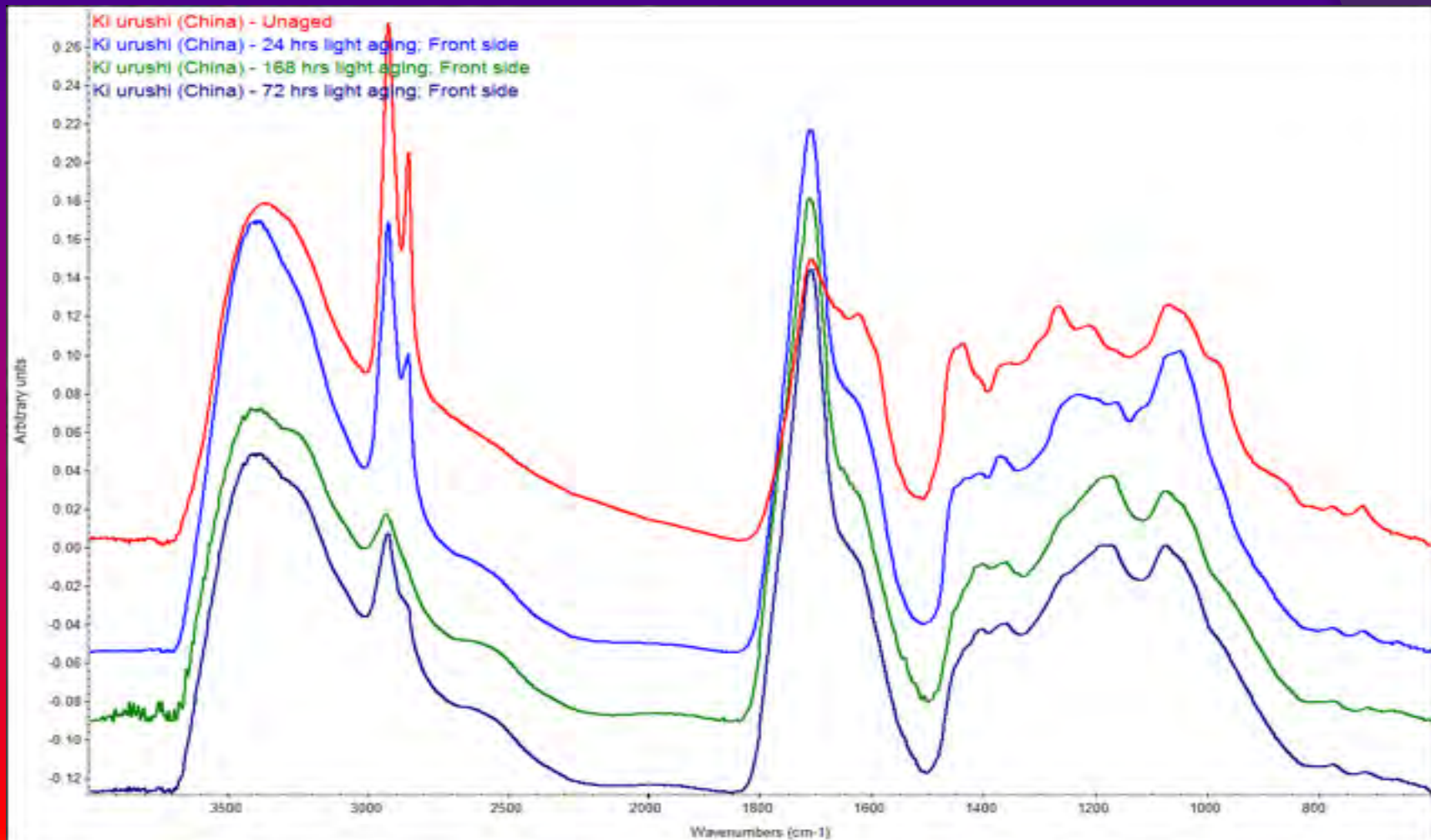
FTIR disadvantages

- Higher concentrations required for proper characterization.
- Difficult to distinguish various types of lacquers, particularly after aging.
- Contamination from other natural resinous material such as shellac.

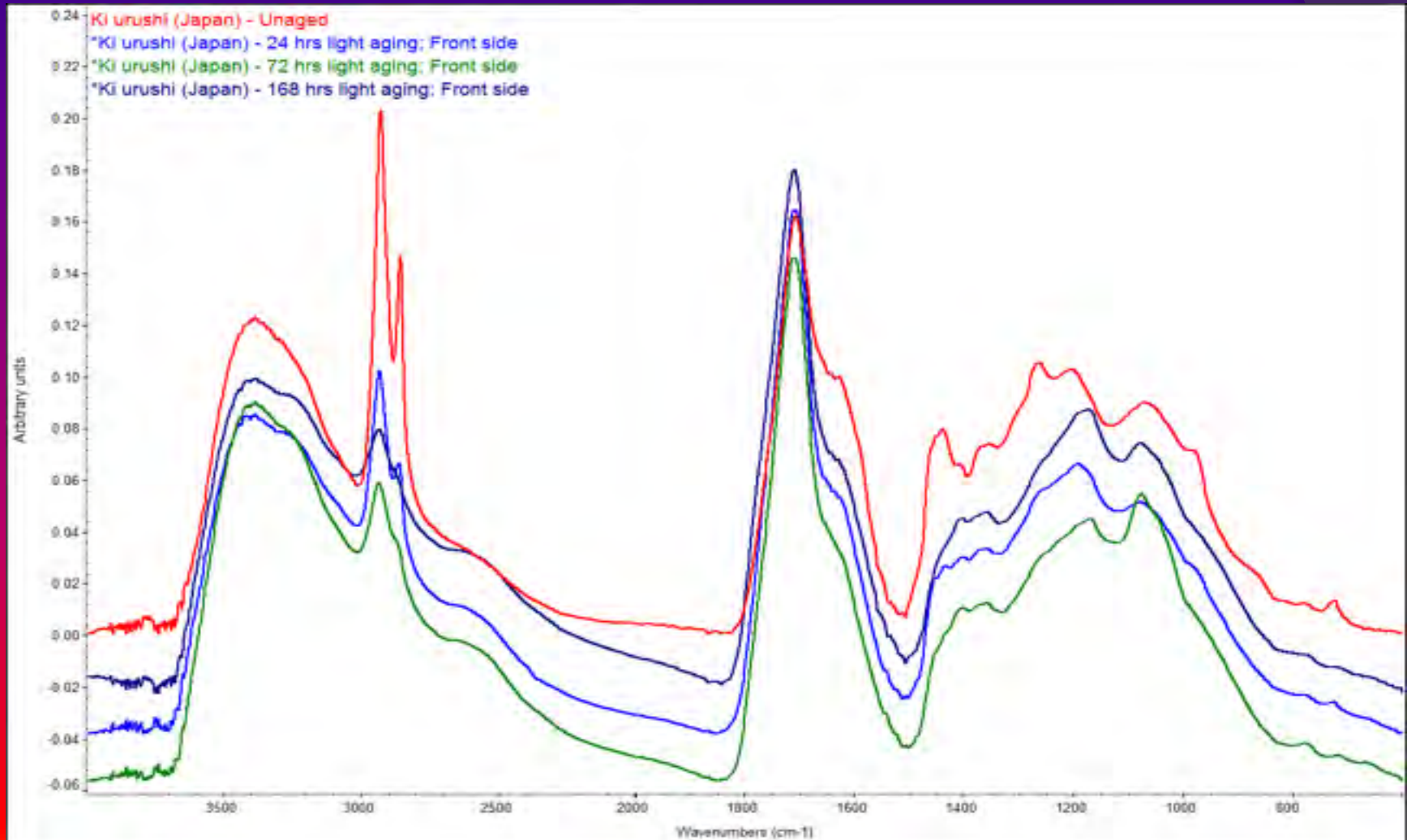
FTIR spectra of unaged urushi films



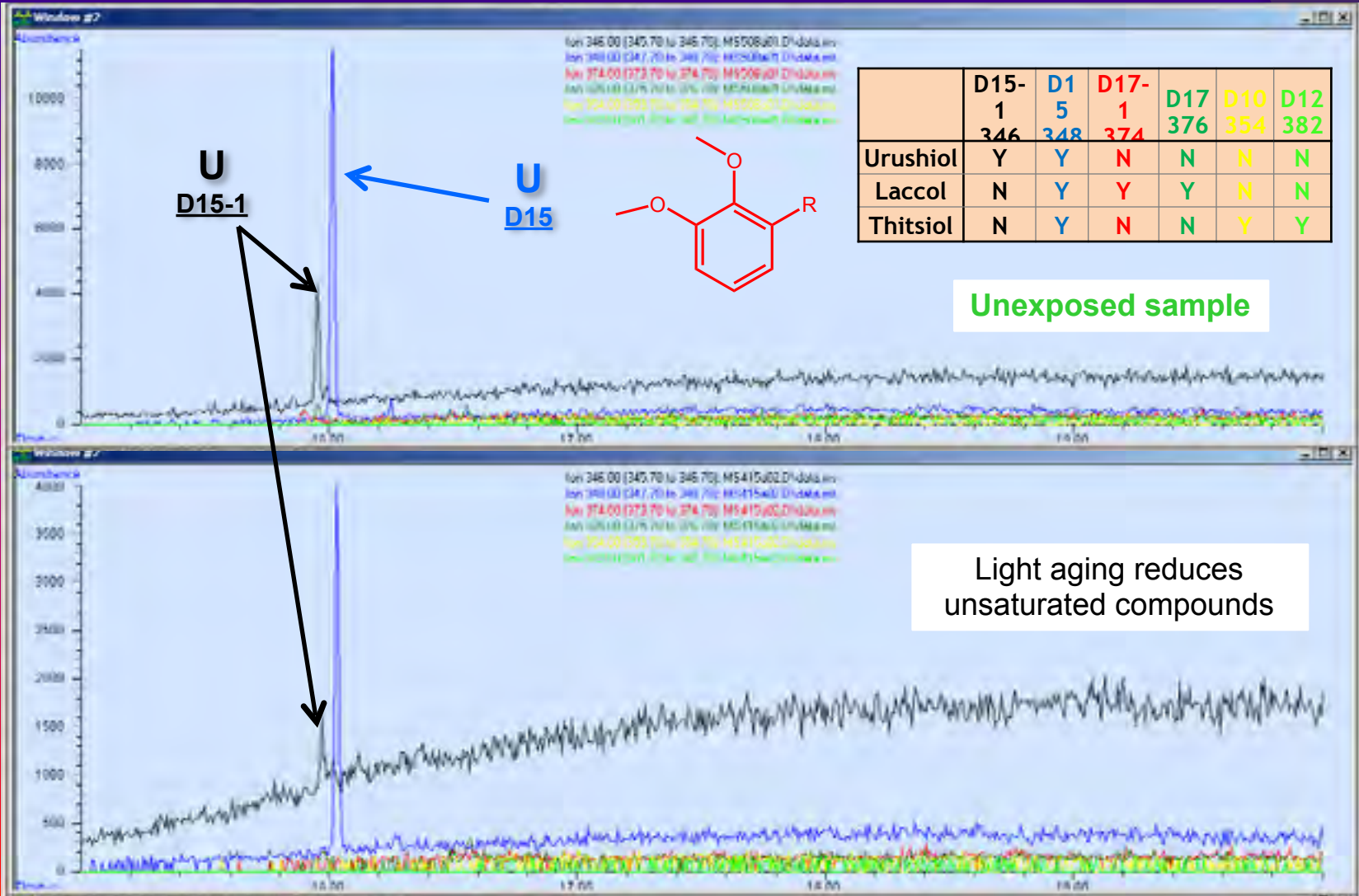
FTIR spectra of light aged urushi films



FTIR spectra of light aged urushi films



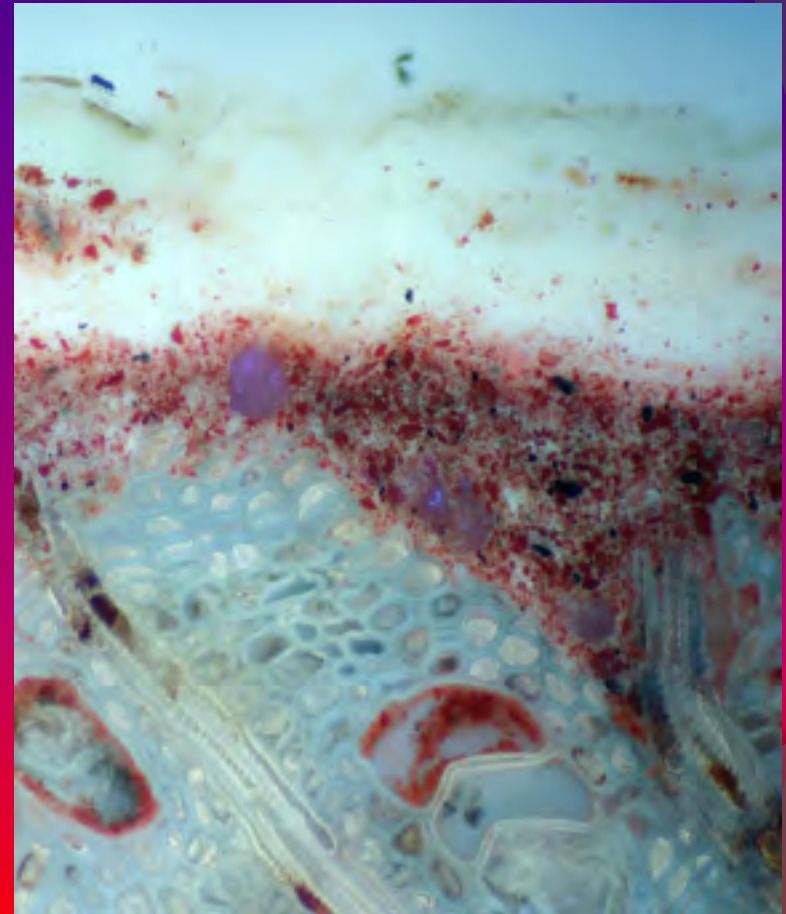
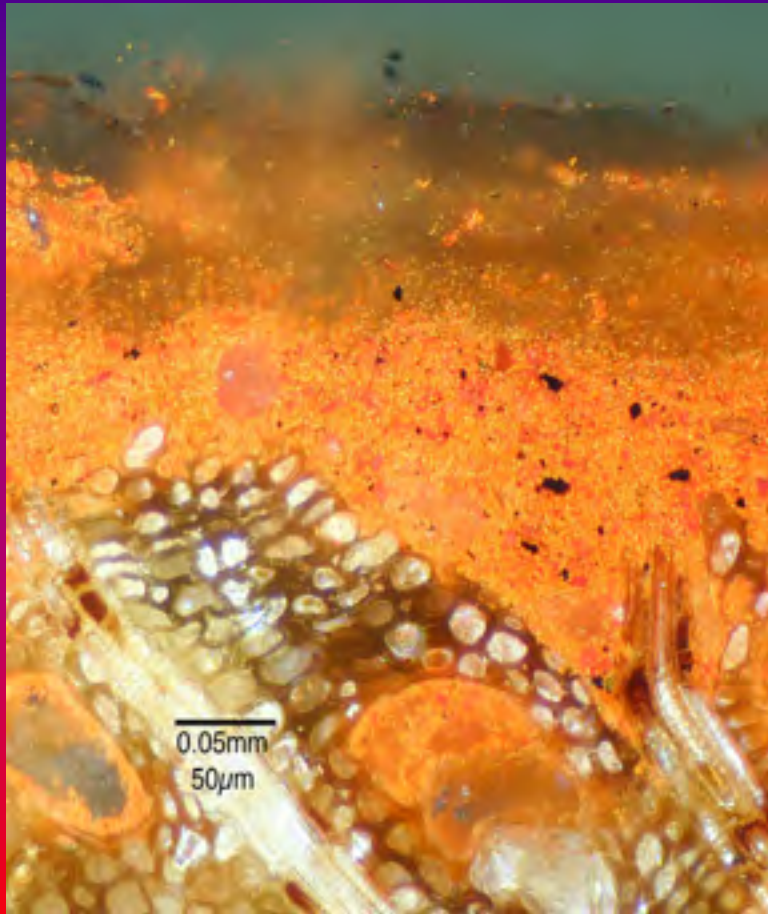
Effects of Light Exposure on Urushiol



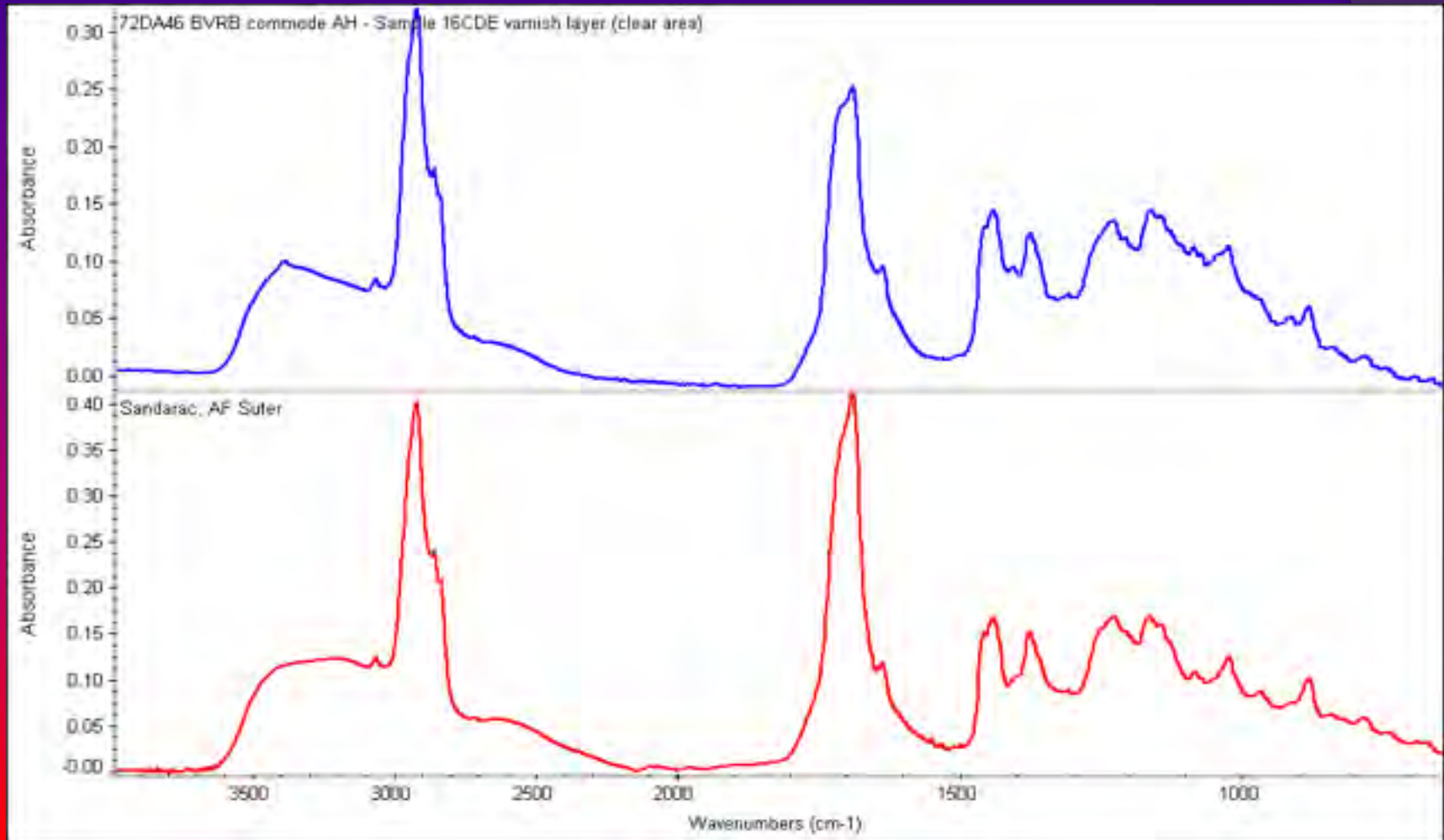
Red commode 72DA46



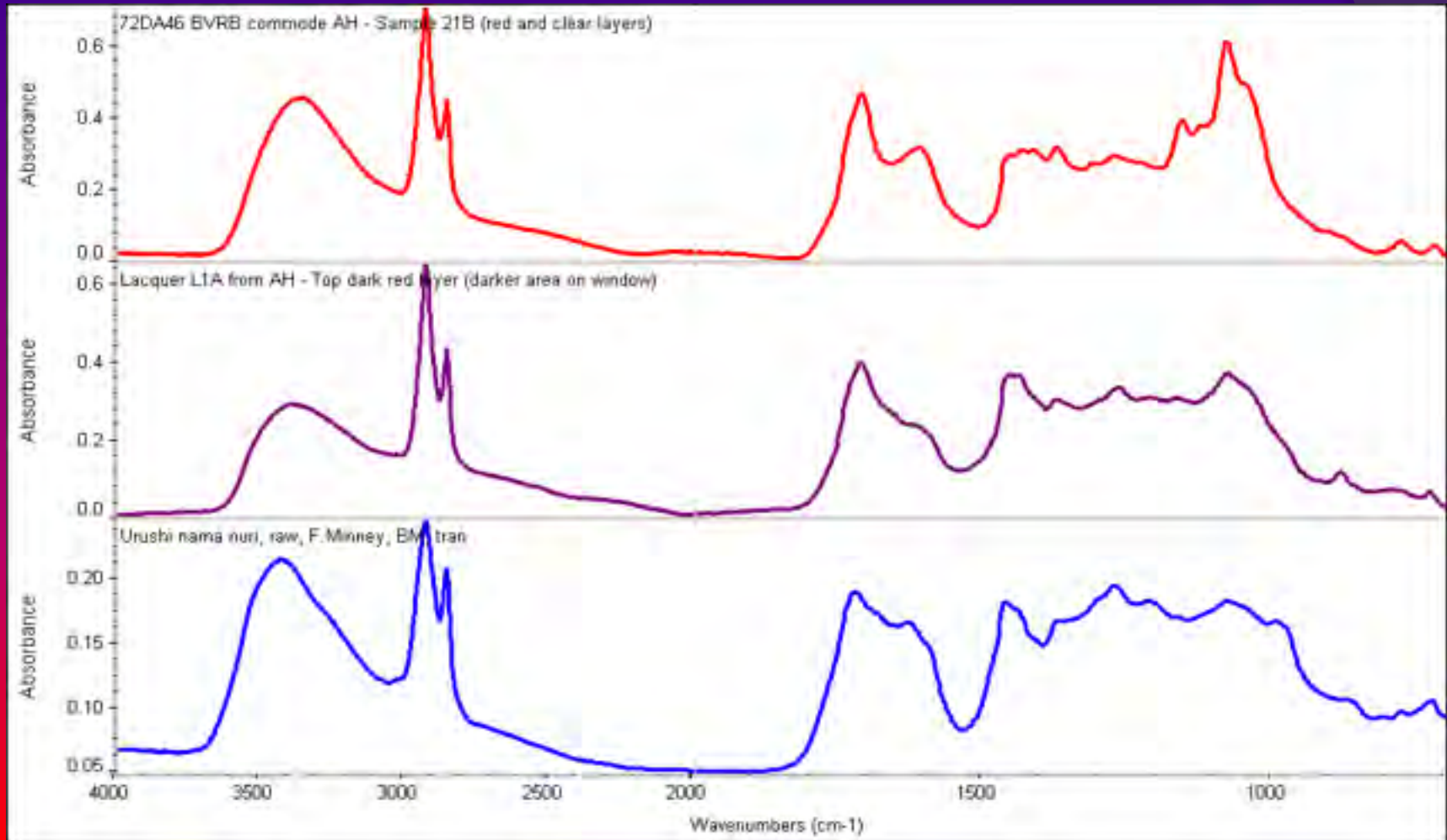
Red commode 72DA4



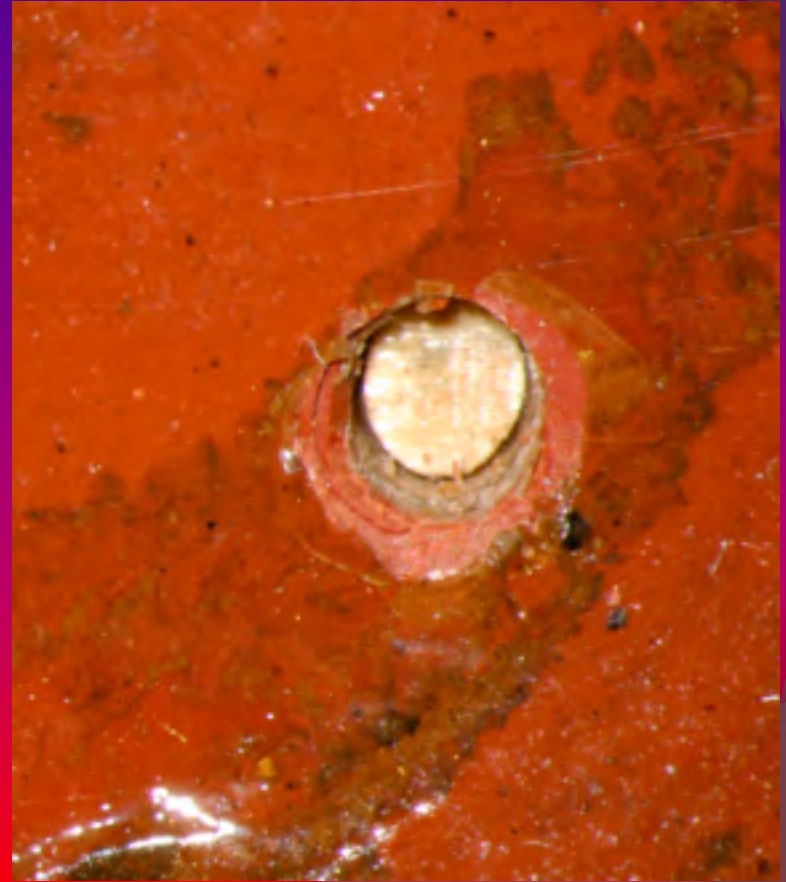
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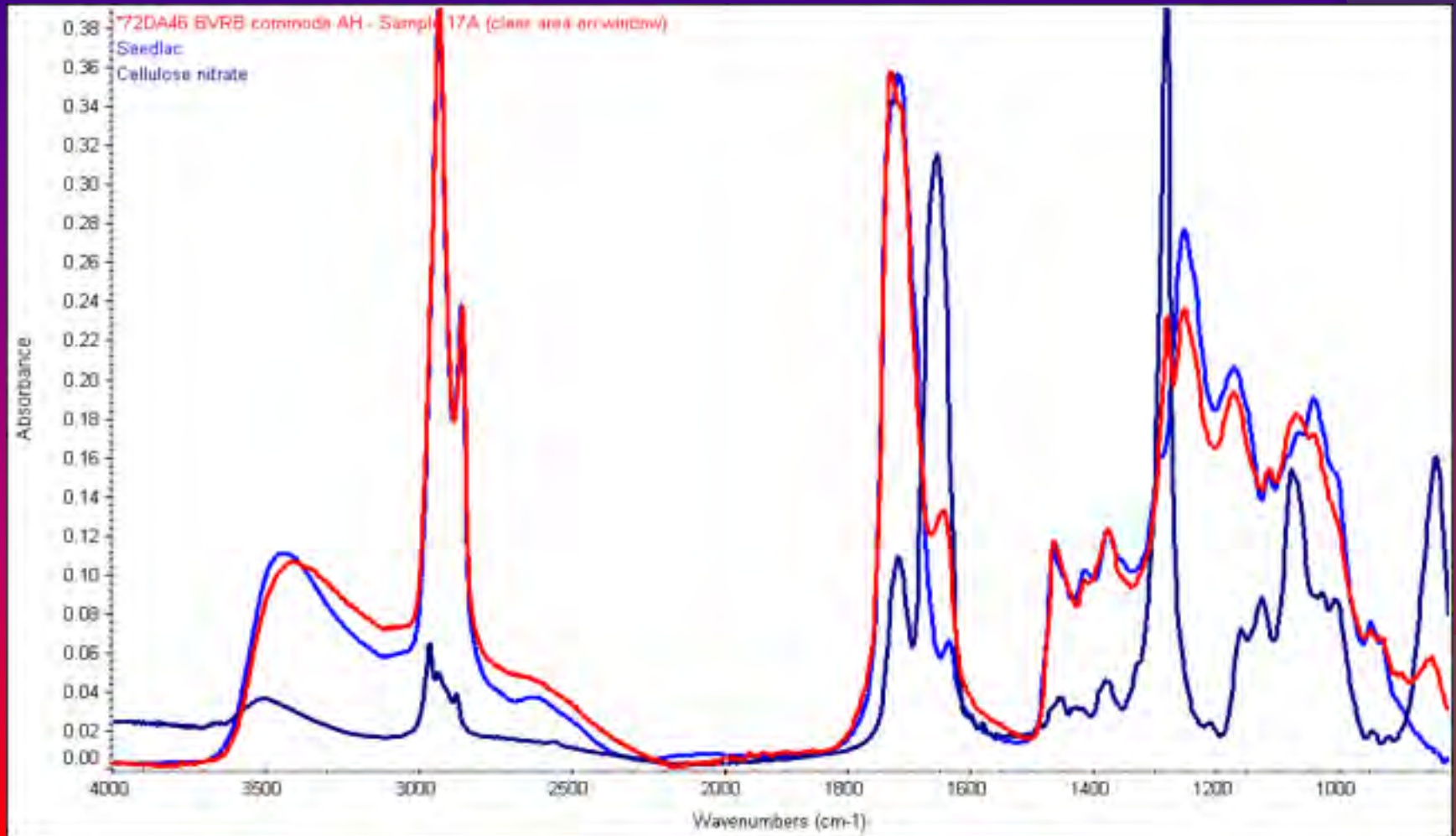
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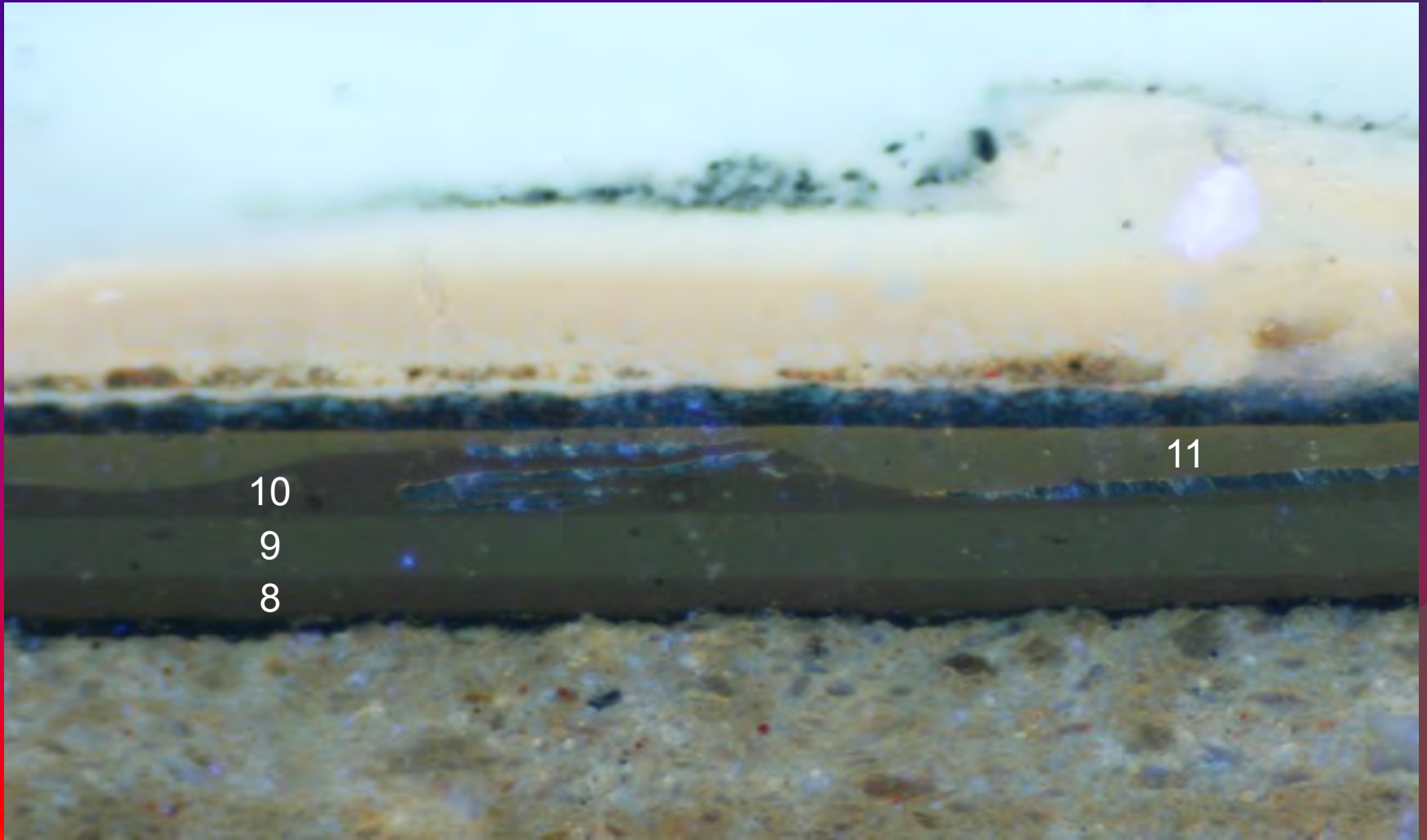
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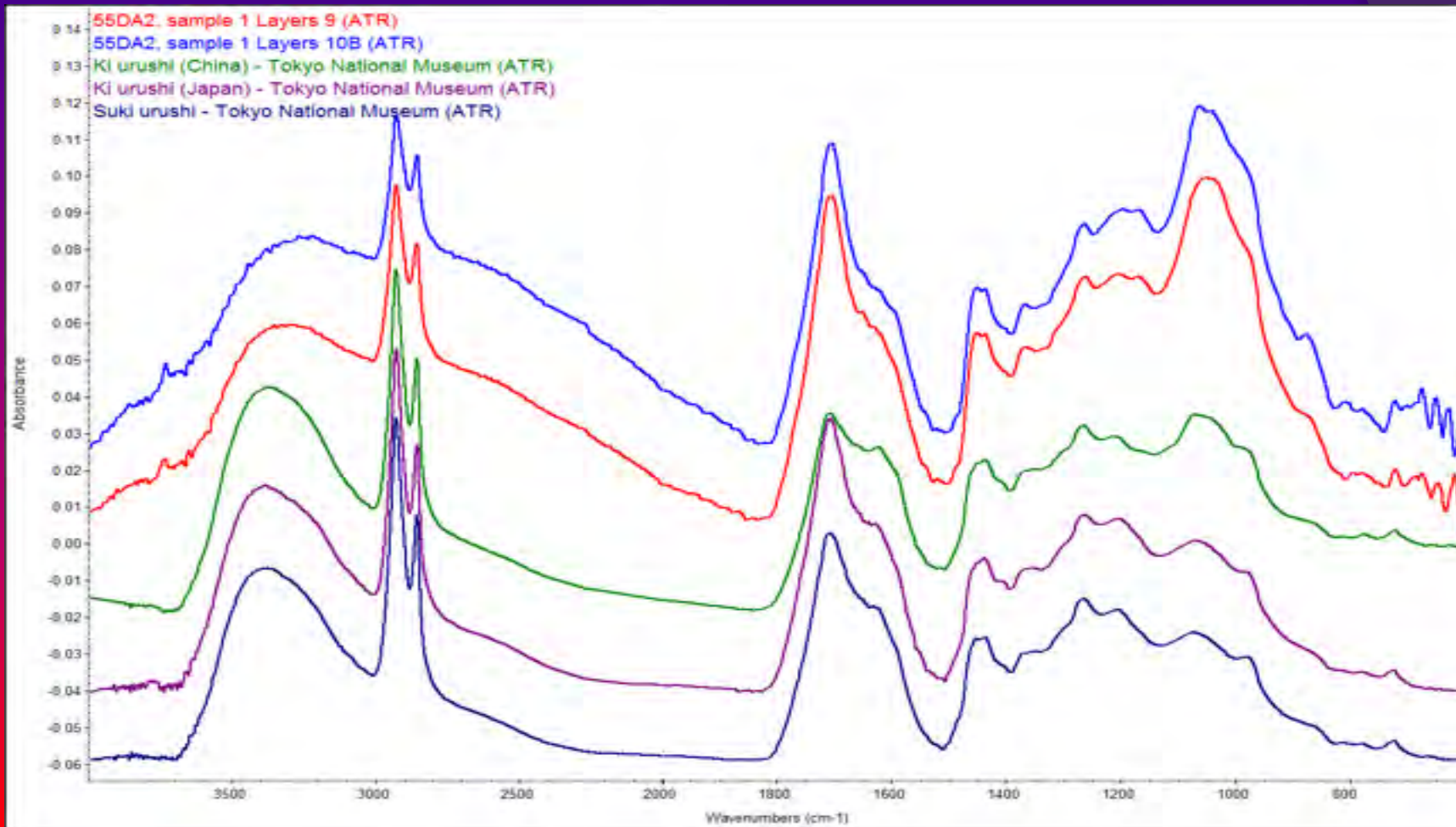
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Joseph commode 55DA2



Joseph commode 55DA2

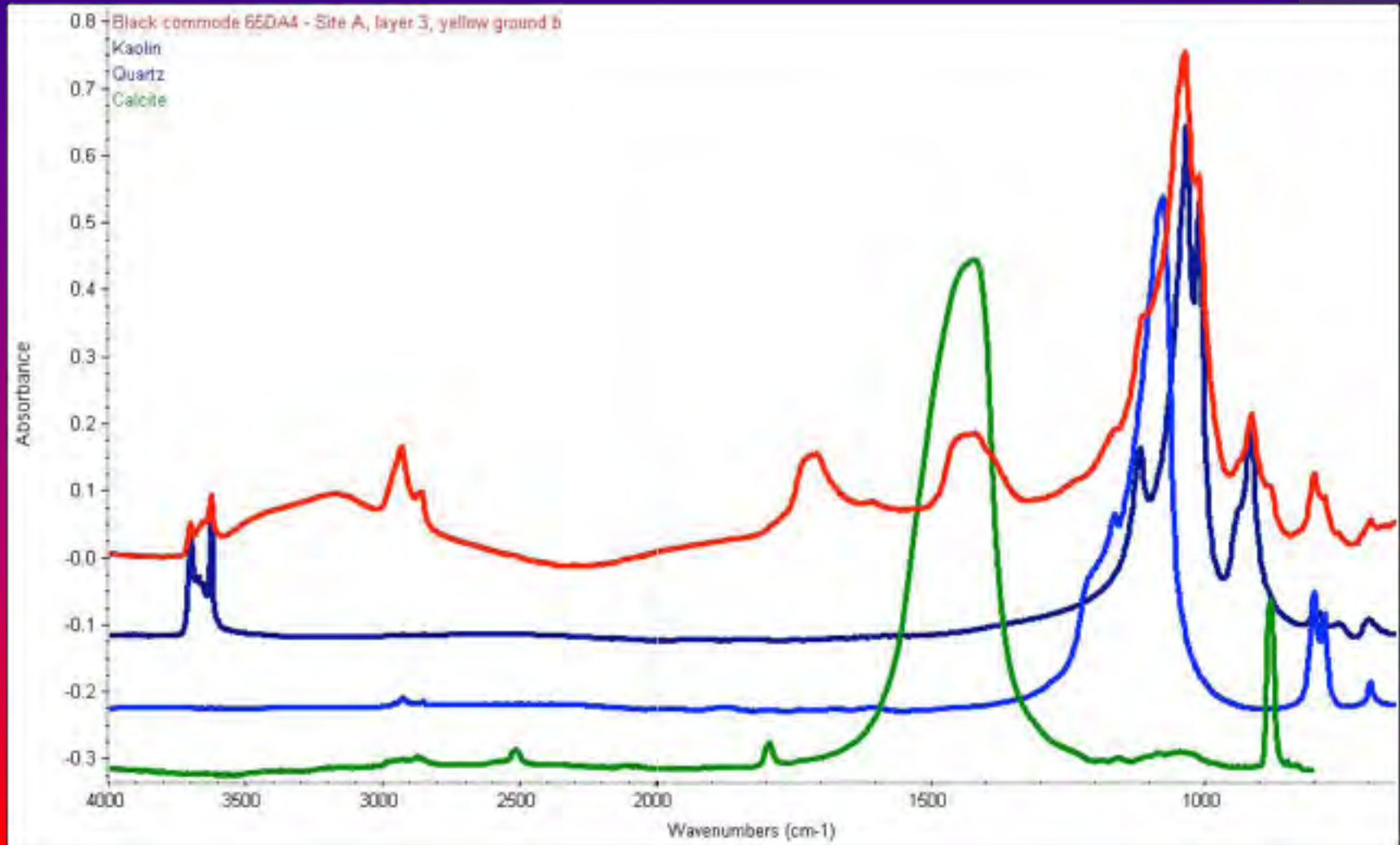


Joseph commode 65DA4

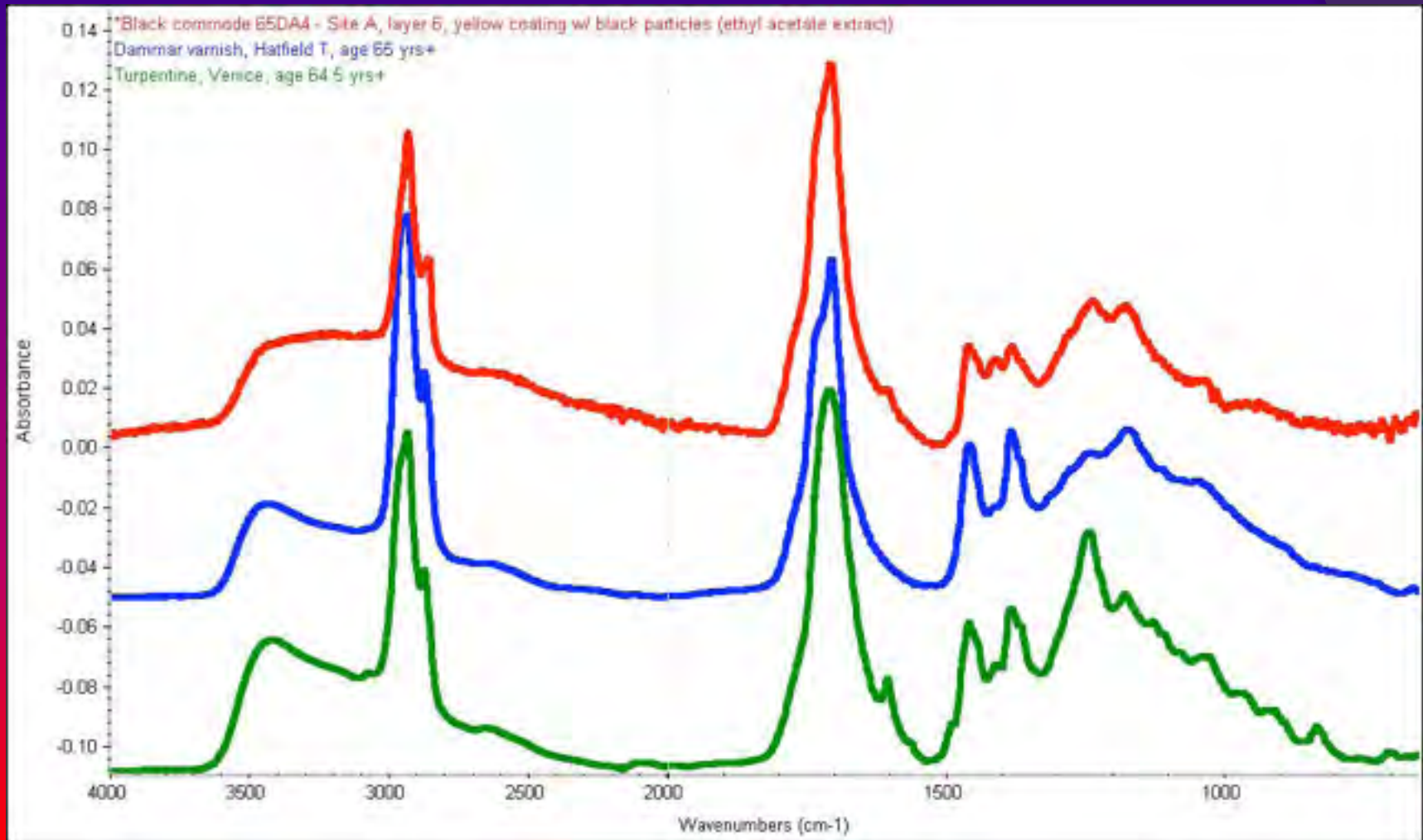


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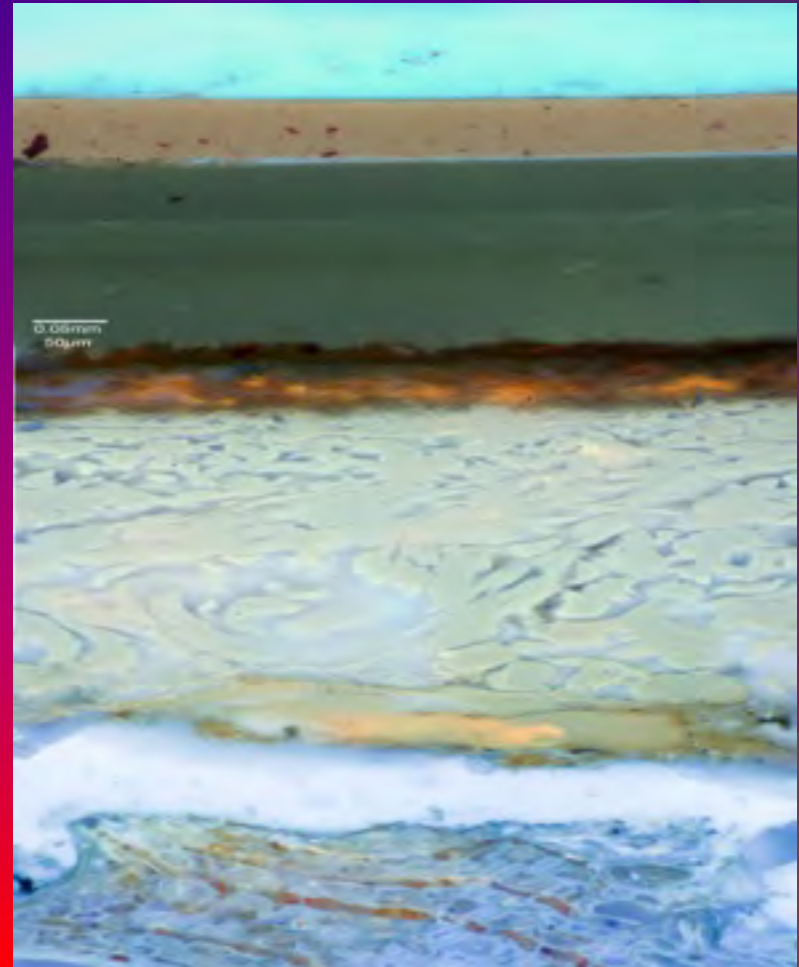
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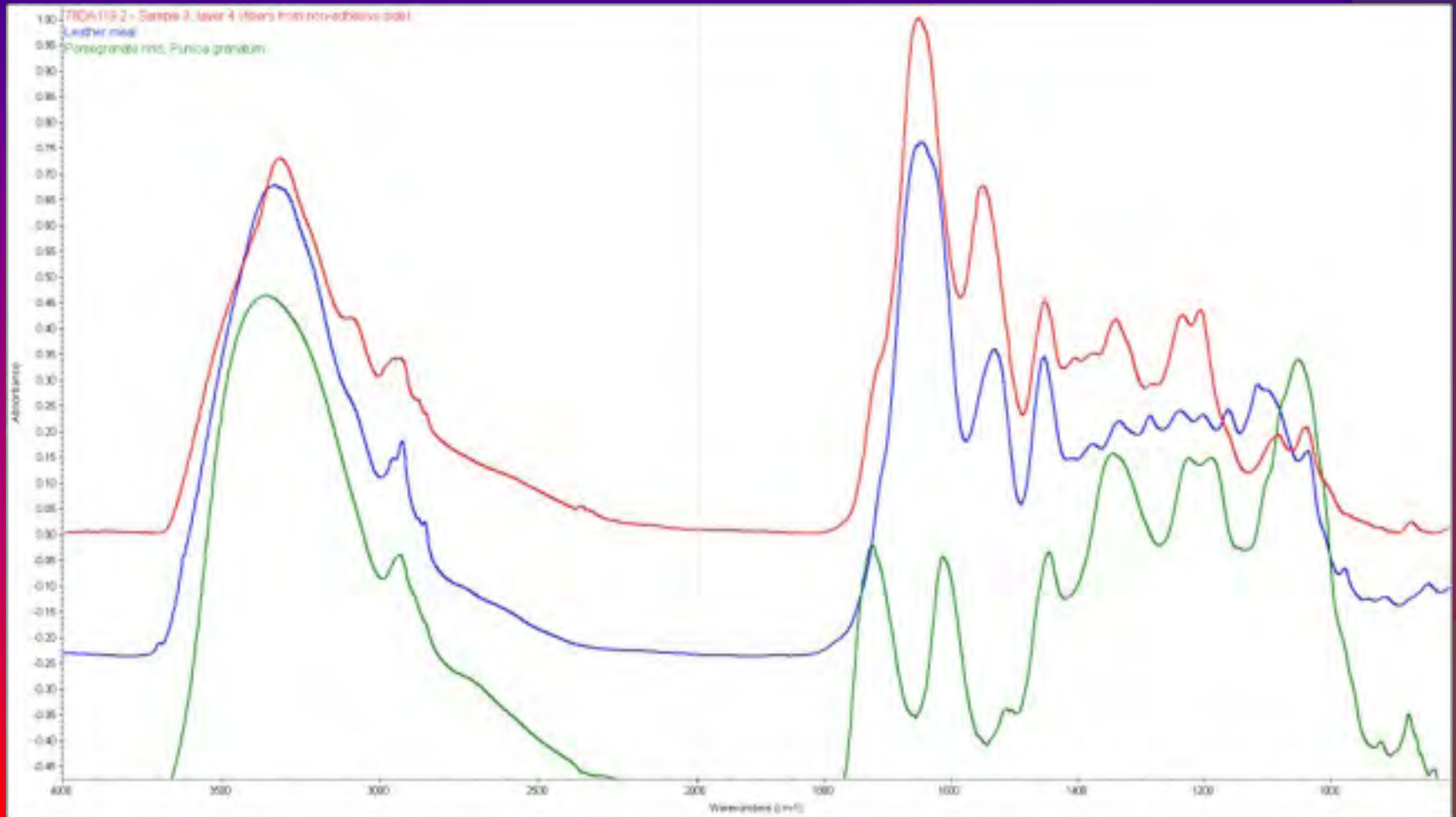
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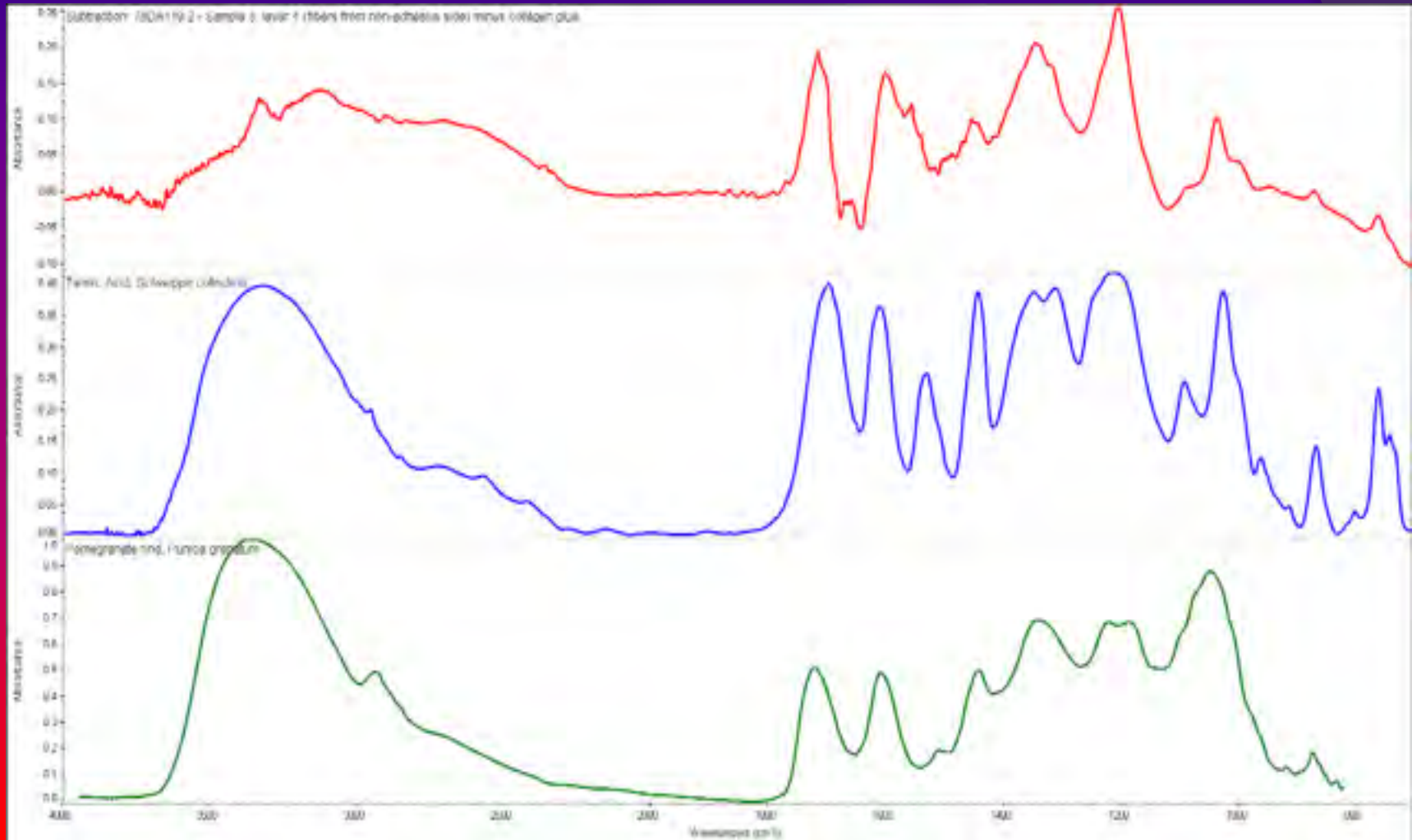
Commode 78DA119



Commode 78DA119



Commode 78DA119



Conclusions

- Identification of lacquers from European and Asian origins found on decorative panels is now possible.
- The protocol leads to better understanding and documentation of resins used by different workshops in mid-18th century.
- Information gathered from the analysis will help lead to the improved attribution of unknown objects.