

ALPHA-R

In situ and in lab applications



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Bruker Italia Srl
lunedì 25 luglio 2011



Summary

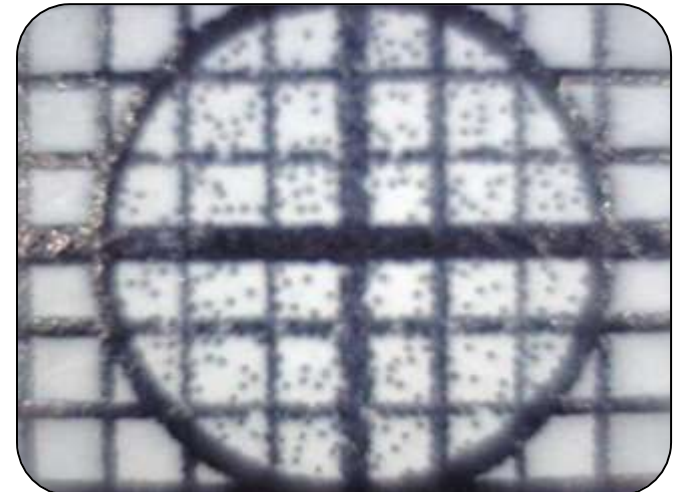
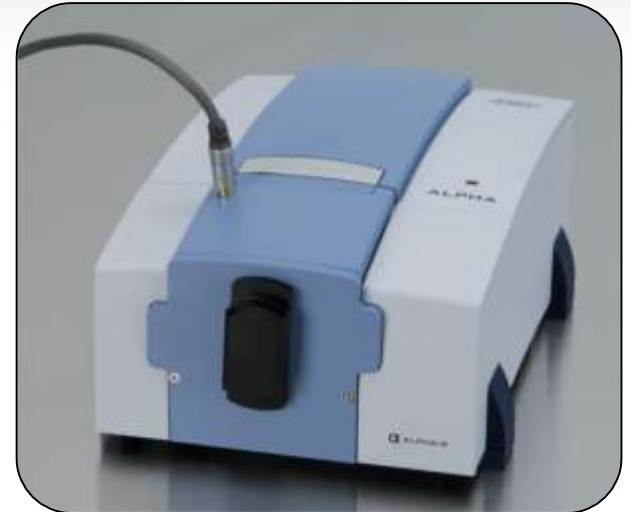


- Introduction: ALPHA-R, External Reflection technique, options
- Applications: Gems and stones
- Applications: Sculptures
- Applications: paintings and mural paintings – in lab and in situ analysis
- Applications: inks, ancient papers, parchments and manuscripts
- Applications: tapestries
- Applications: woods
- Demanding applications
- Acknowledgment
- Publications
- Bibliography

The External Reflection Technique



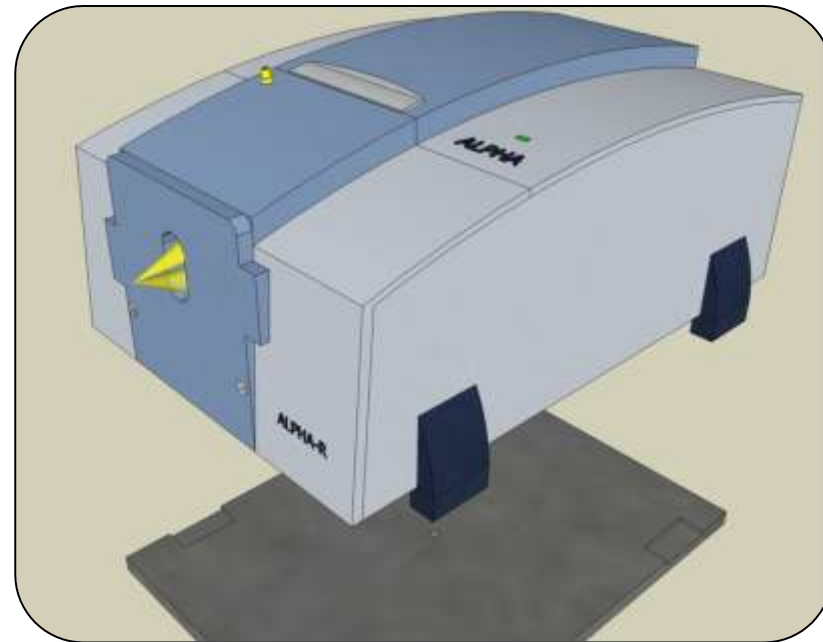
- Specular Collection optics
- Collecting light reflected by the sample. Depending from the sample surface,
 - Specular Component
 - Diffuse Component
- Working Distance: about 15 mm
- Focus dimension: about 6 mm (diameter)
- Integrated Camera, Field of view 6 x 8 mm



The External Reflection Technique



- Mixing of the reflectance components and presence of strong absorber(s) (Calcium Carbonate, Calcium Sulfate, Silica...) usually produce a spectrum difficult to manage
- Hard to use just Kramers-Kroenig or Kubelka-Munch Algorithm in the full spectral range
- Useful to use reference spectra
- Useful to use "NIR" spectral range



Why to use the ALPHA-R?



- Really non destructive e non invasive analysis: sample is not heated up during the acquisition or the illumination with infrared light
- Measure what you look for with the high resolution integrated camera
- No interference with fluorescence
- Possible to obtain a spectrum almost from everything (wood, paper, pigments, paintings, stones, gems, tissues, plastics and polymers...)
- Possible to use wi-fi connection with notebook and battery for spectrometer

Portability Option: transport bag



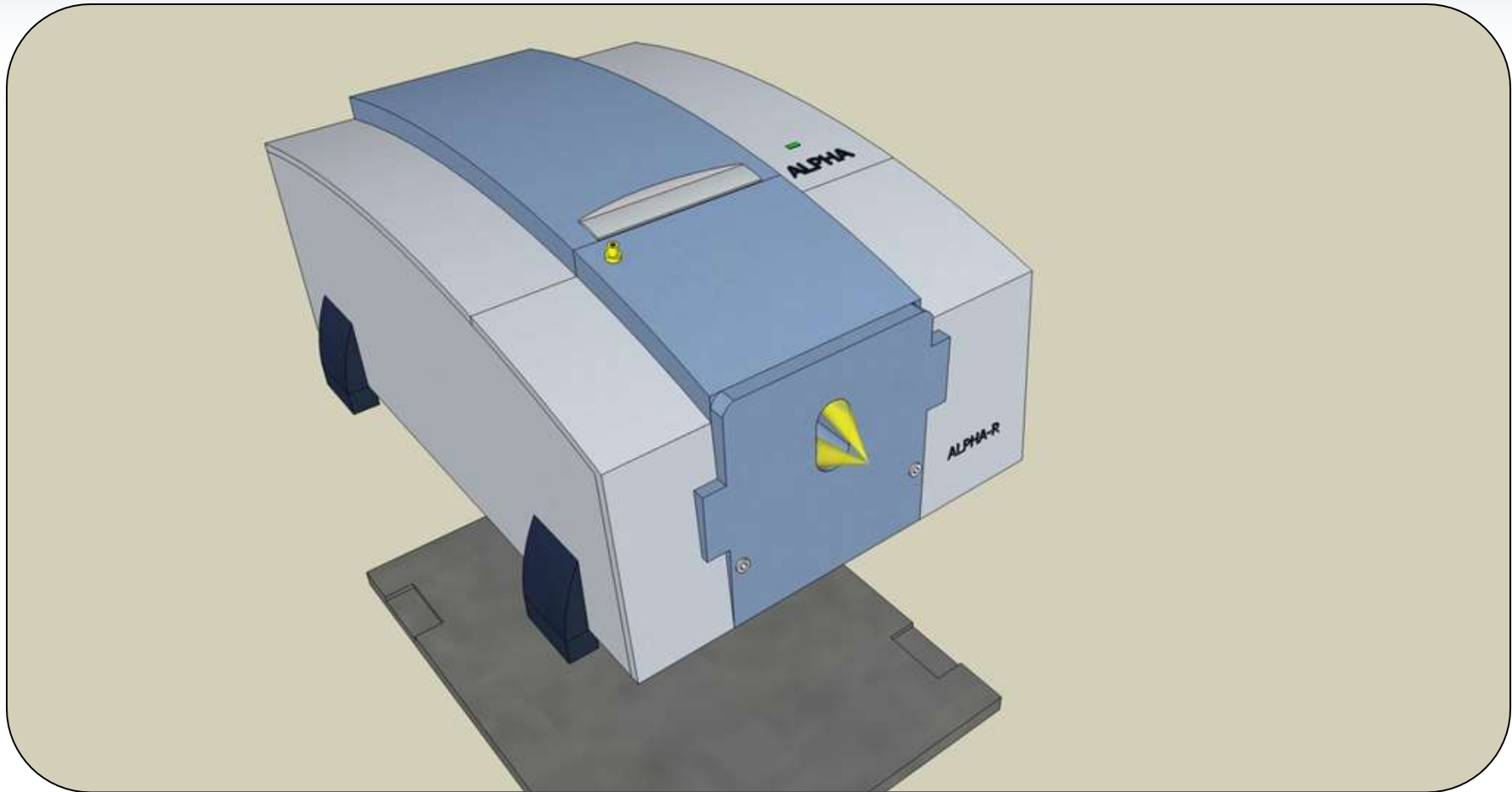
Tripod Option



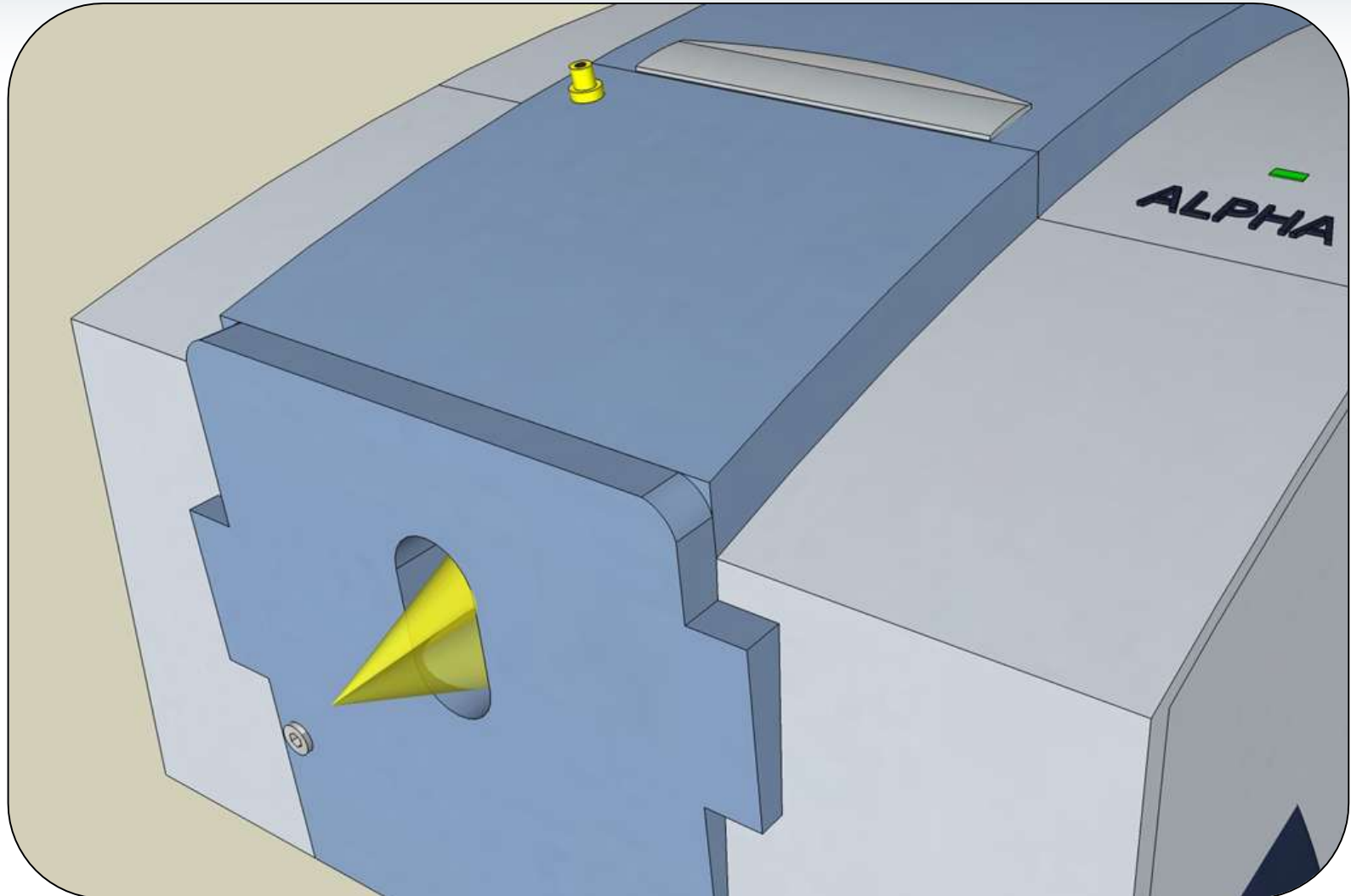
Standard tripod with geared head and adaption baseplate with focus position adjustment



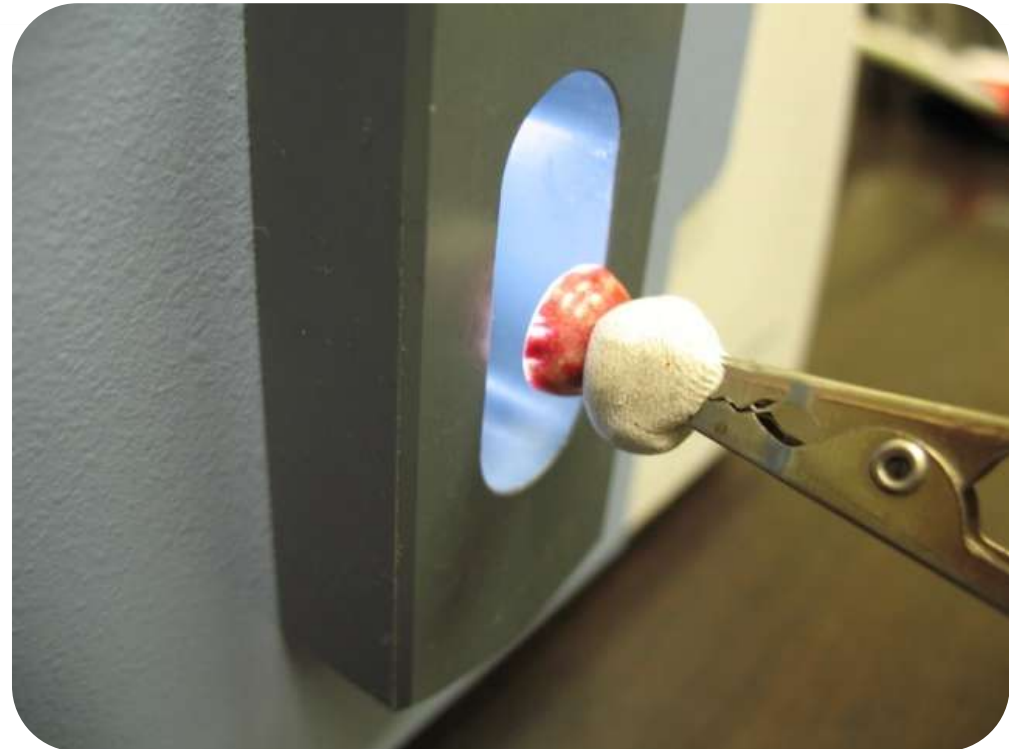
ALPHA-R



ALPHA-R

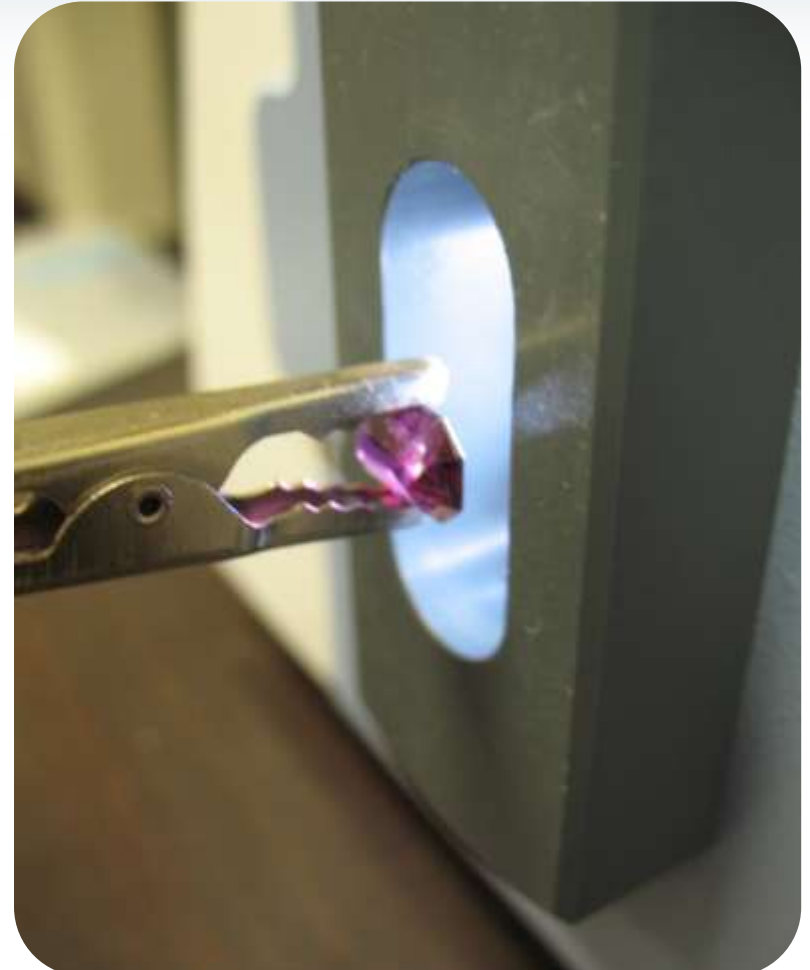


In Lab FT-IR Analysis Gems and Stones



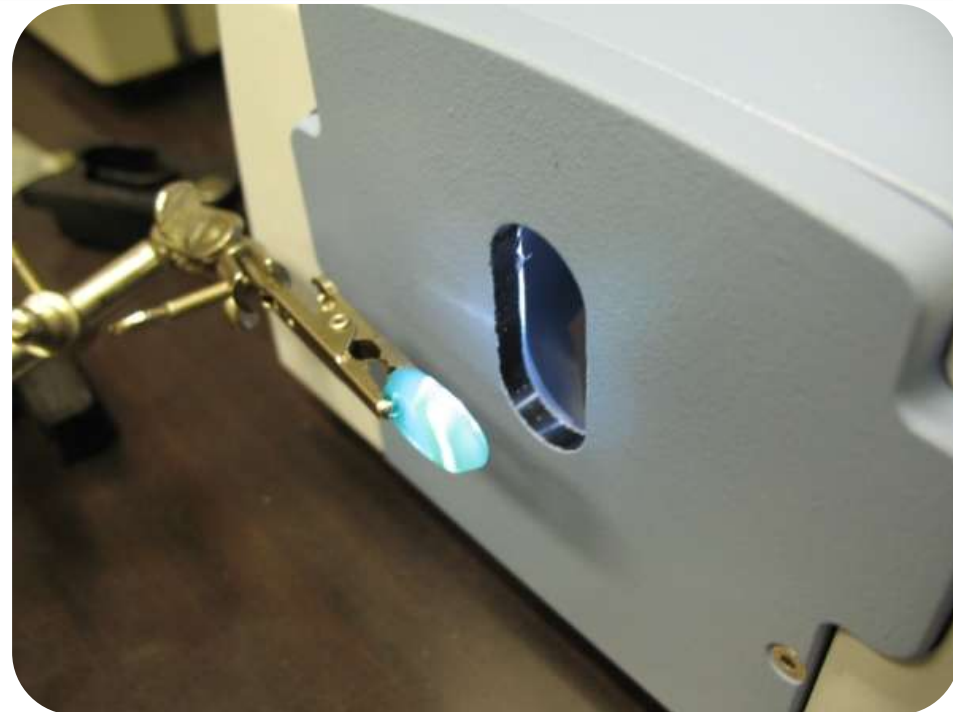
Cooperation with S. Nunziante Cesaro, CNR Rome

In Lab FT-IR Analysis Gems and Stones



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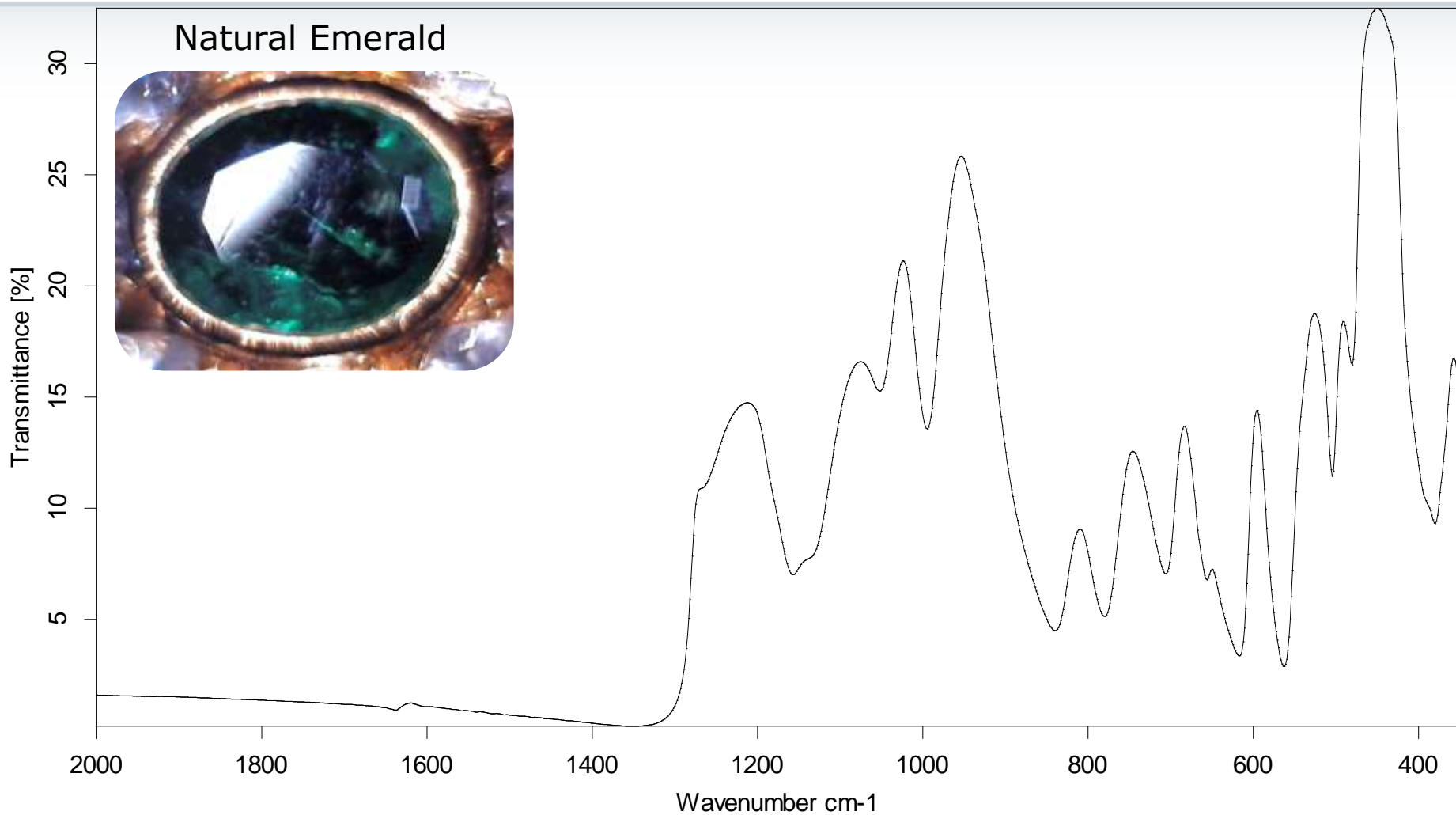


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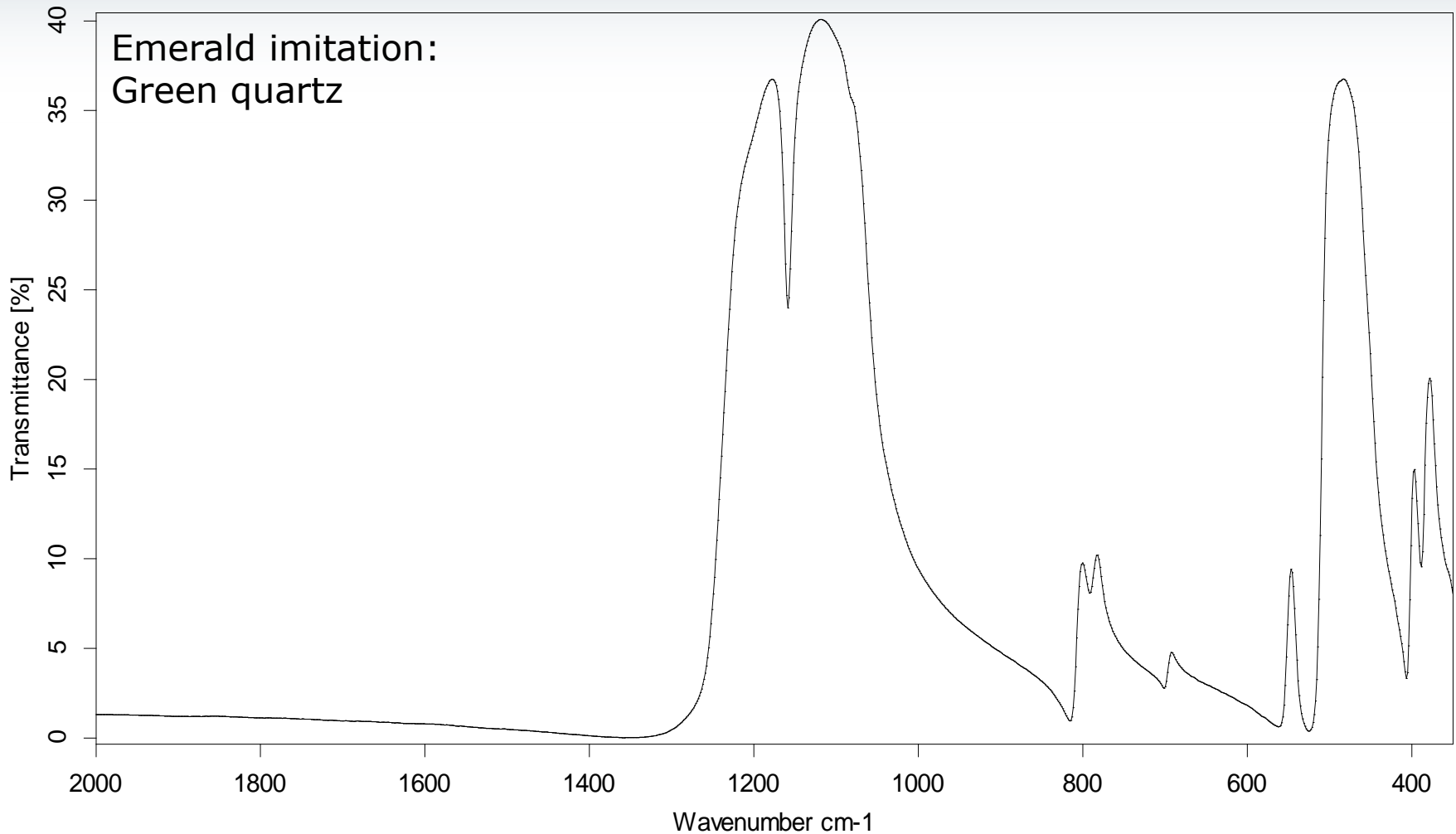


Natural Emerald



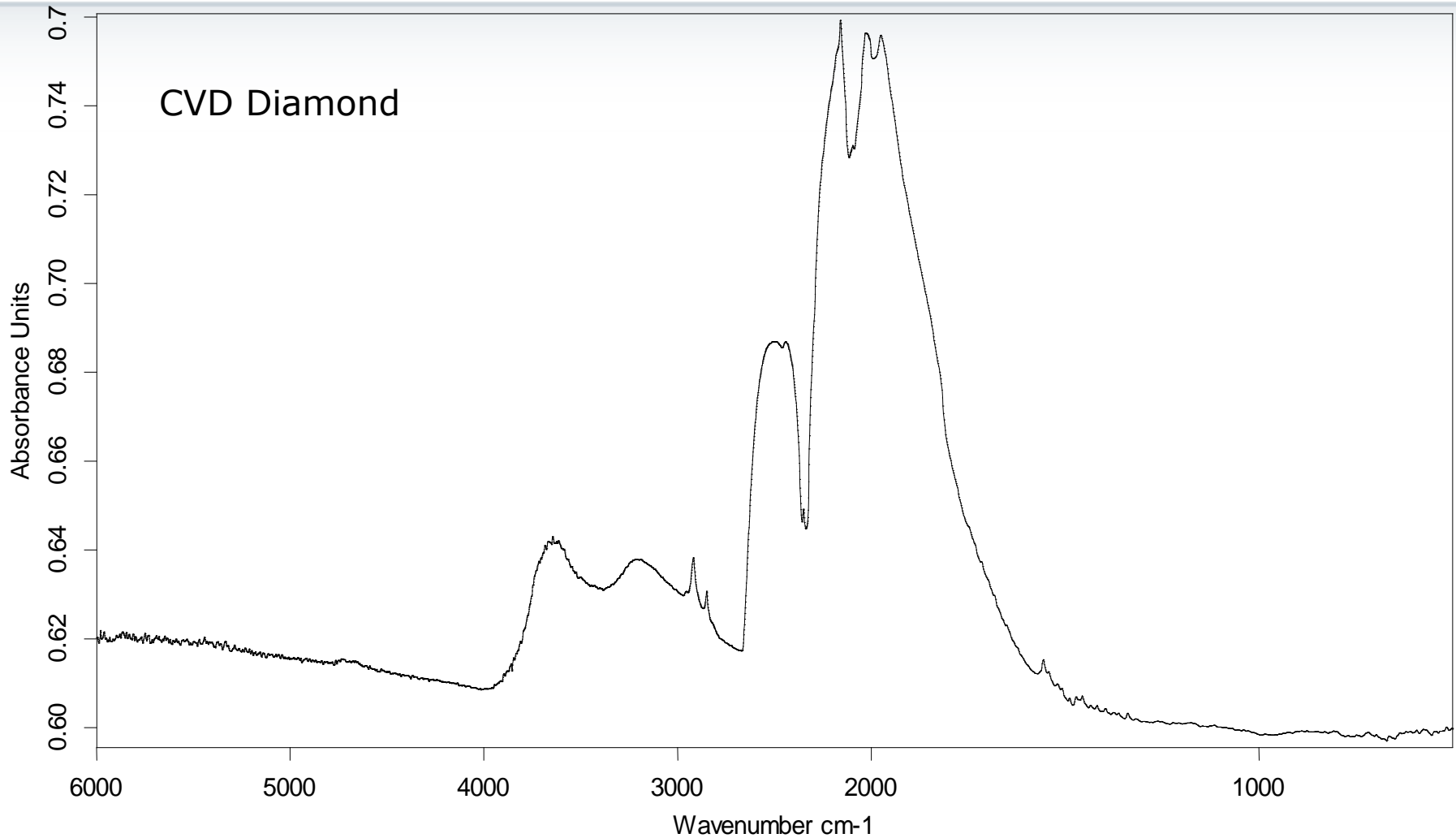
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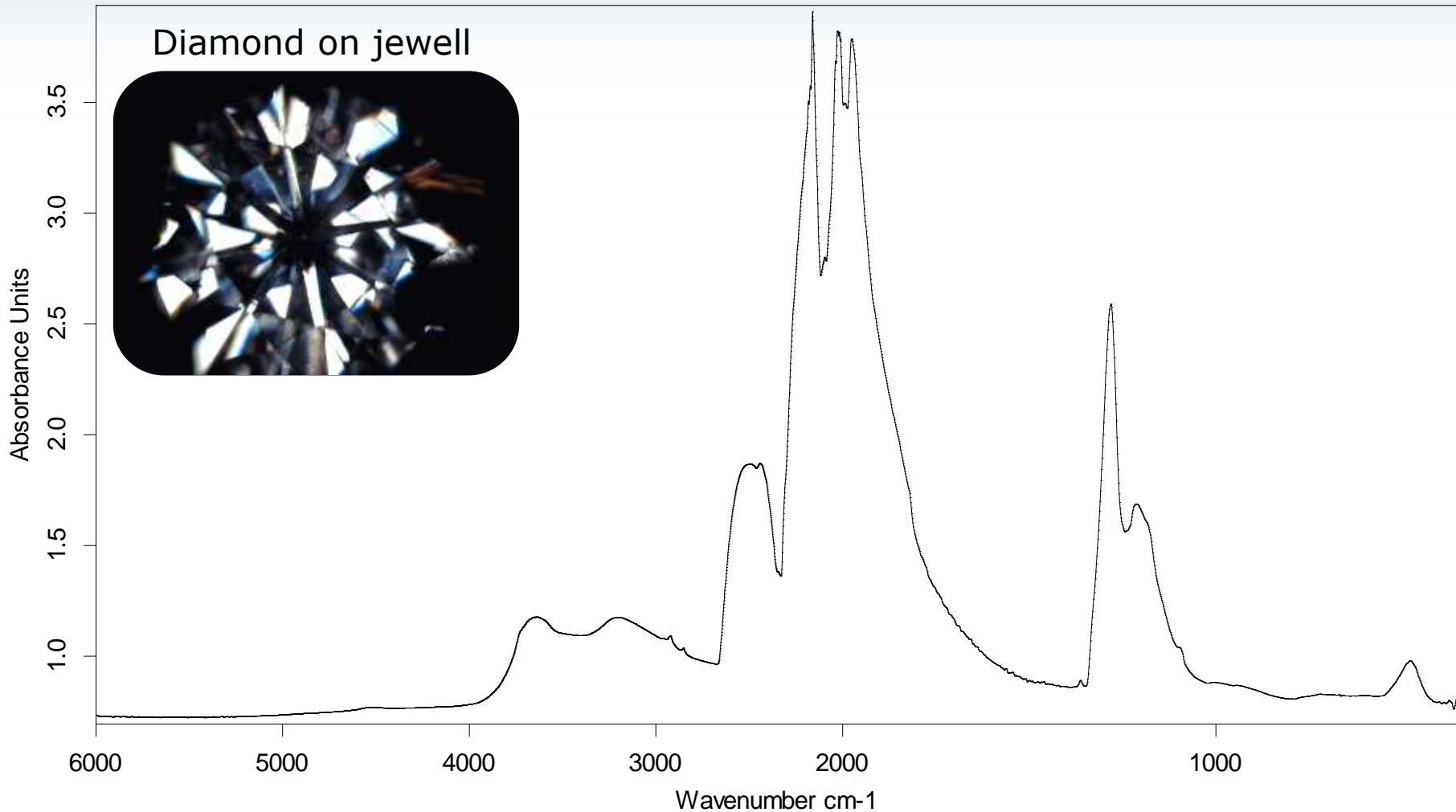
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In Lab FT-IR Analysis Gems and Stones



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In Lab FT-IR Analysis Gems and Stones



Cooperation with S. Nunziante Cesaro, CNR Rome

In Lab FT-IR Analysis: Test Samples Measuring Reference Spectra

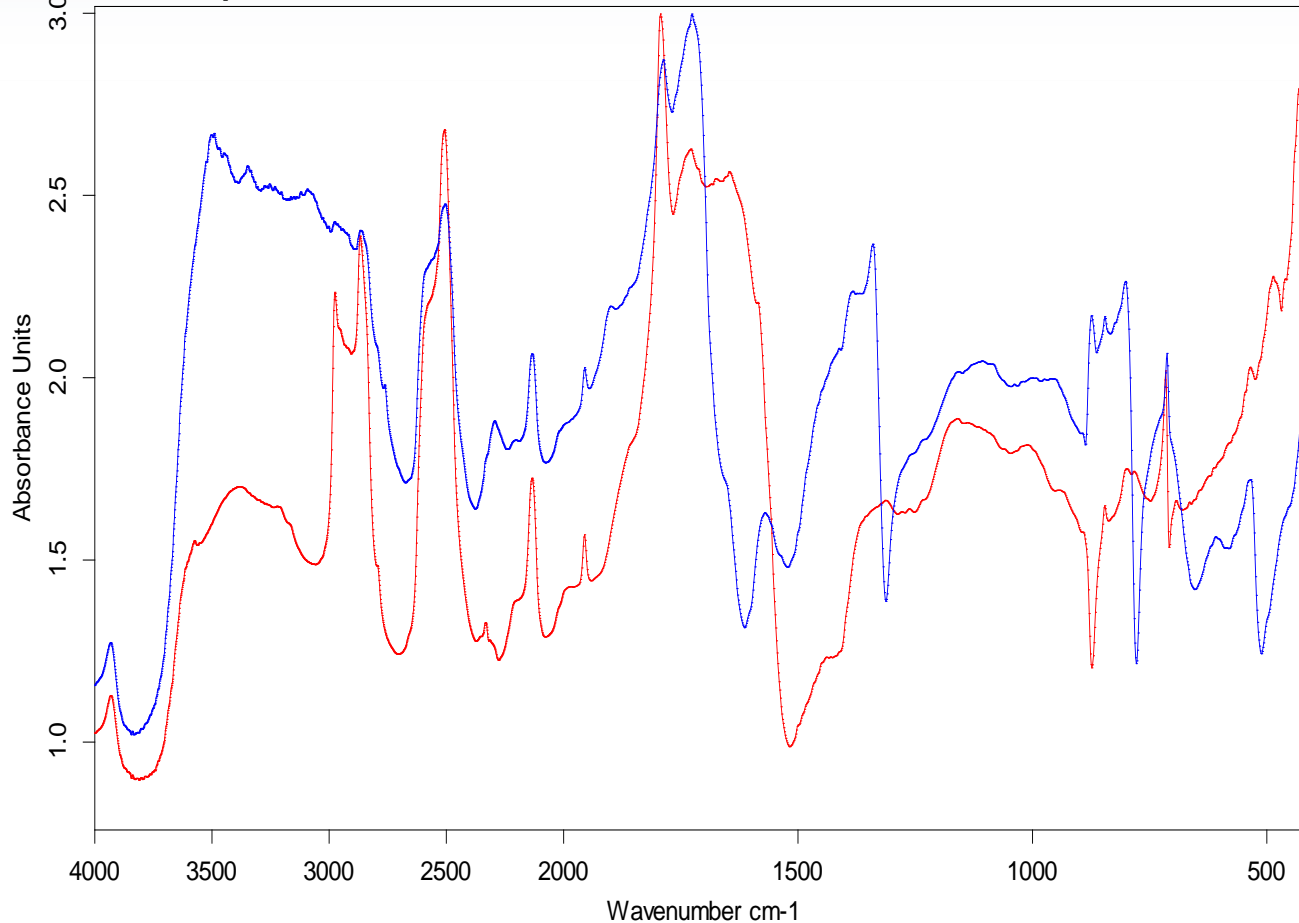


Cooperation with C. Miliani et al., CNR Perugia

In Lab FT-IR Analysis: Test Samples Measuring Reference Spectra



Sample: coated stone



Red: Cleaned Stone
Blue: Coated stone

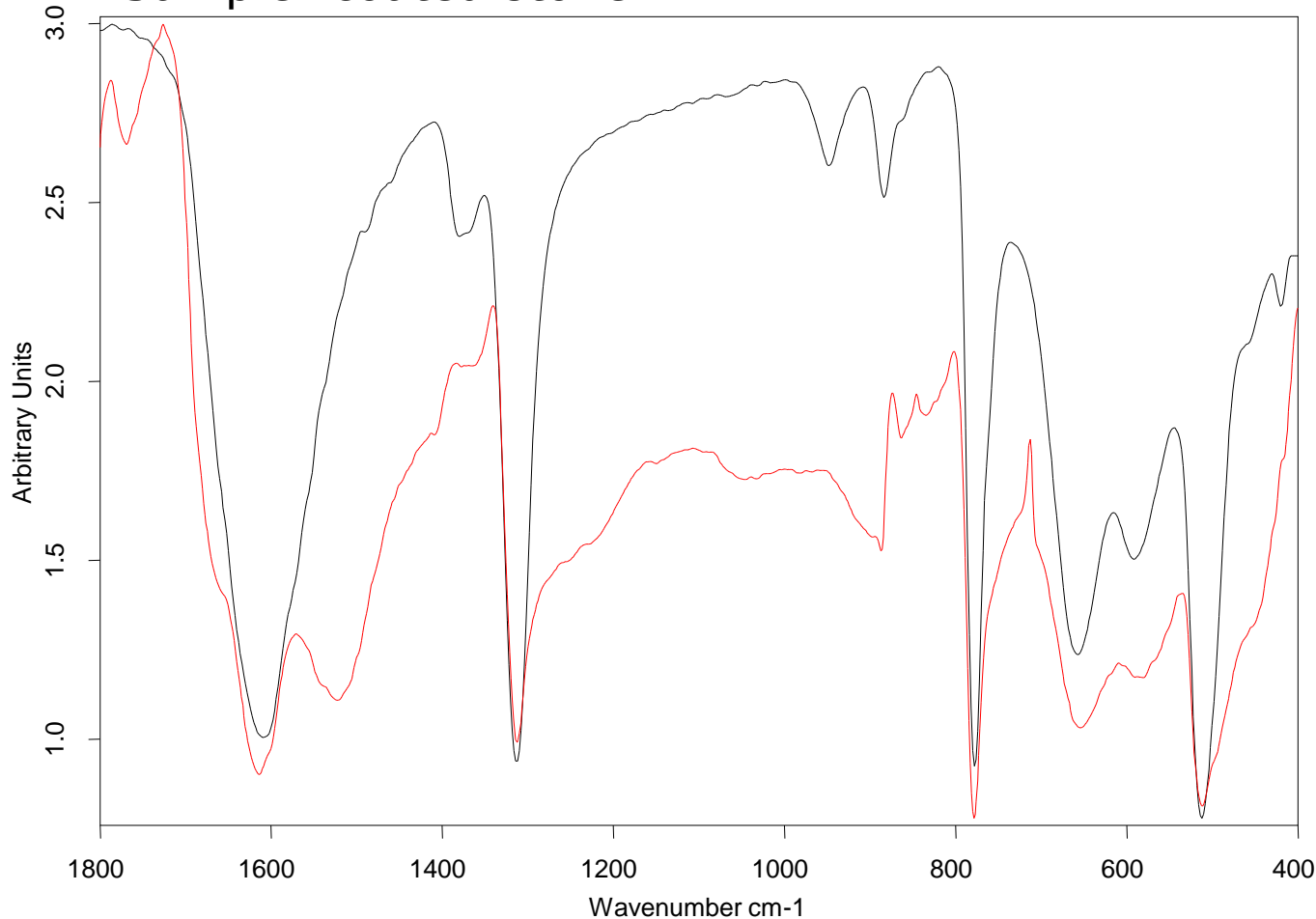
Cooperation with C. Miliani et al., CNR Perugia

In Lab FT-IR Analysis: Test Samples

Measuring Reference Spectra



Sample: coated stone



Red: Coated Stone, REFL

Black: Calcium Oxalate
Monohydrate, TR
Reference
Spectrum

Conclusion:
Calcium Oxalate on
the stone

Cooperation with C. Miliani et al., CNR Perugia

In situ FT-IR Analysis: Sculptures

Italy, Florence, Loggia dei Lanzi, Jun 2011

Giambologna, Ratto delle Sabine, XVI Century

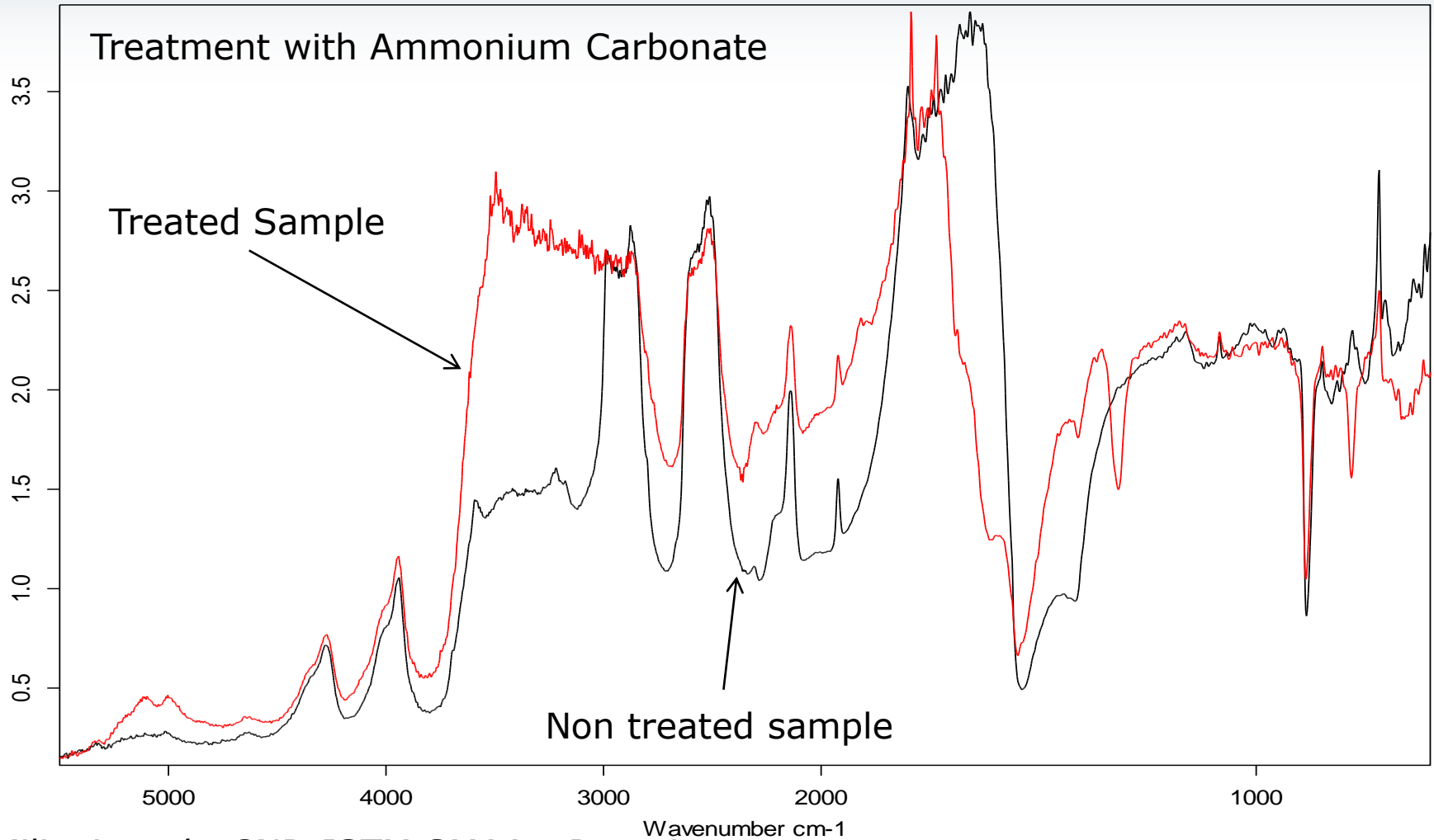


C. Miliani et al., CNR-ISTM SMAArt Perugia

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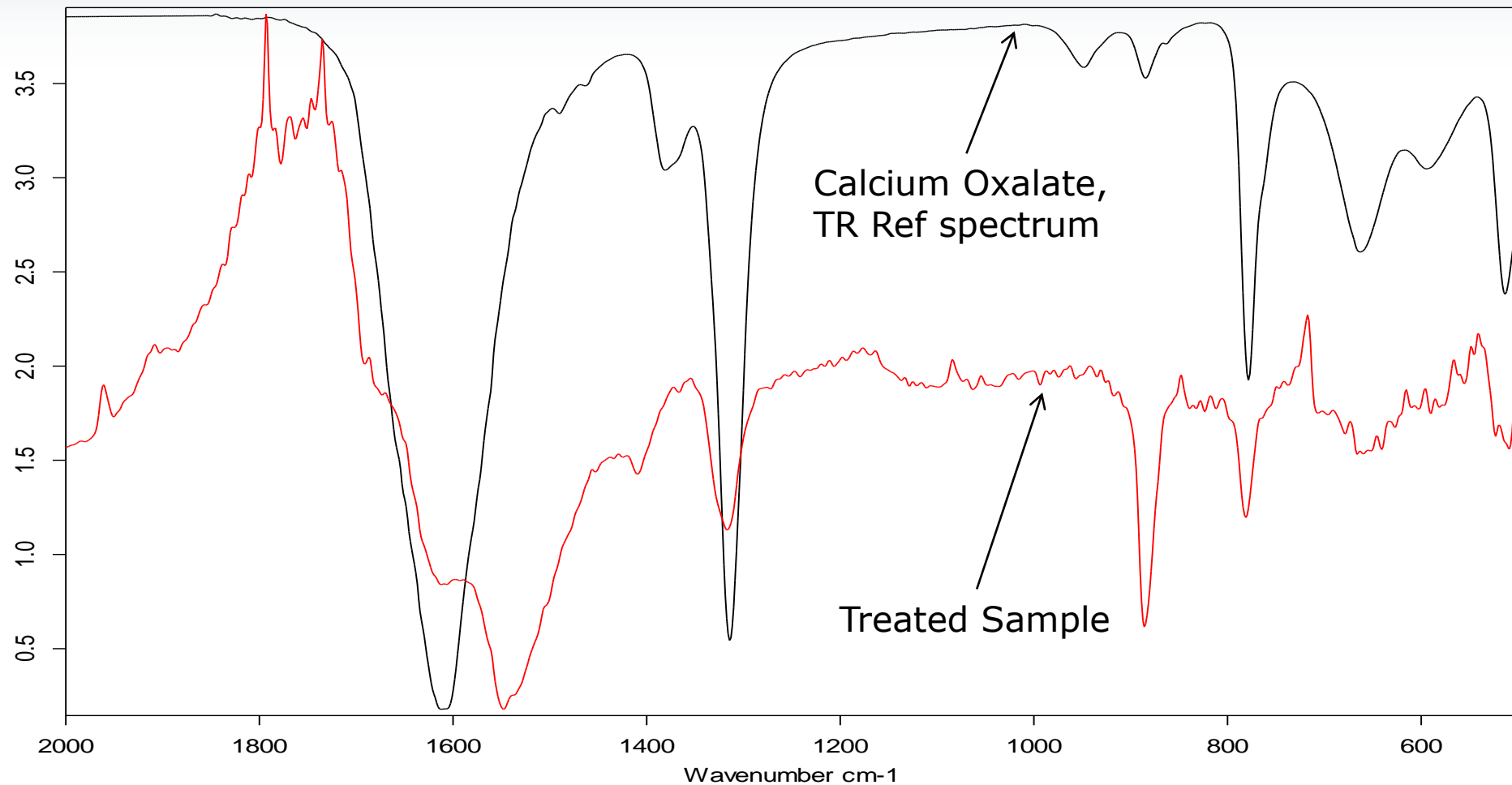
Giambologna, Ratto delle Sabine, XVI Century



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C. Miliani et al., CNR-ISTM SMAArt Perugia

In situ FT-IR analysis: Mural Paintings

Italy, Bologna, Palazzo Fava - Dec, 2008
Francesco Albani, XVI Century



Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna

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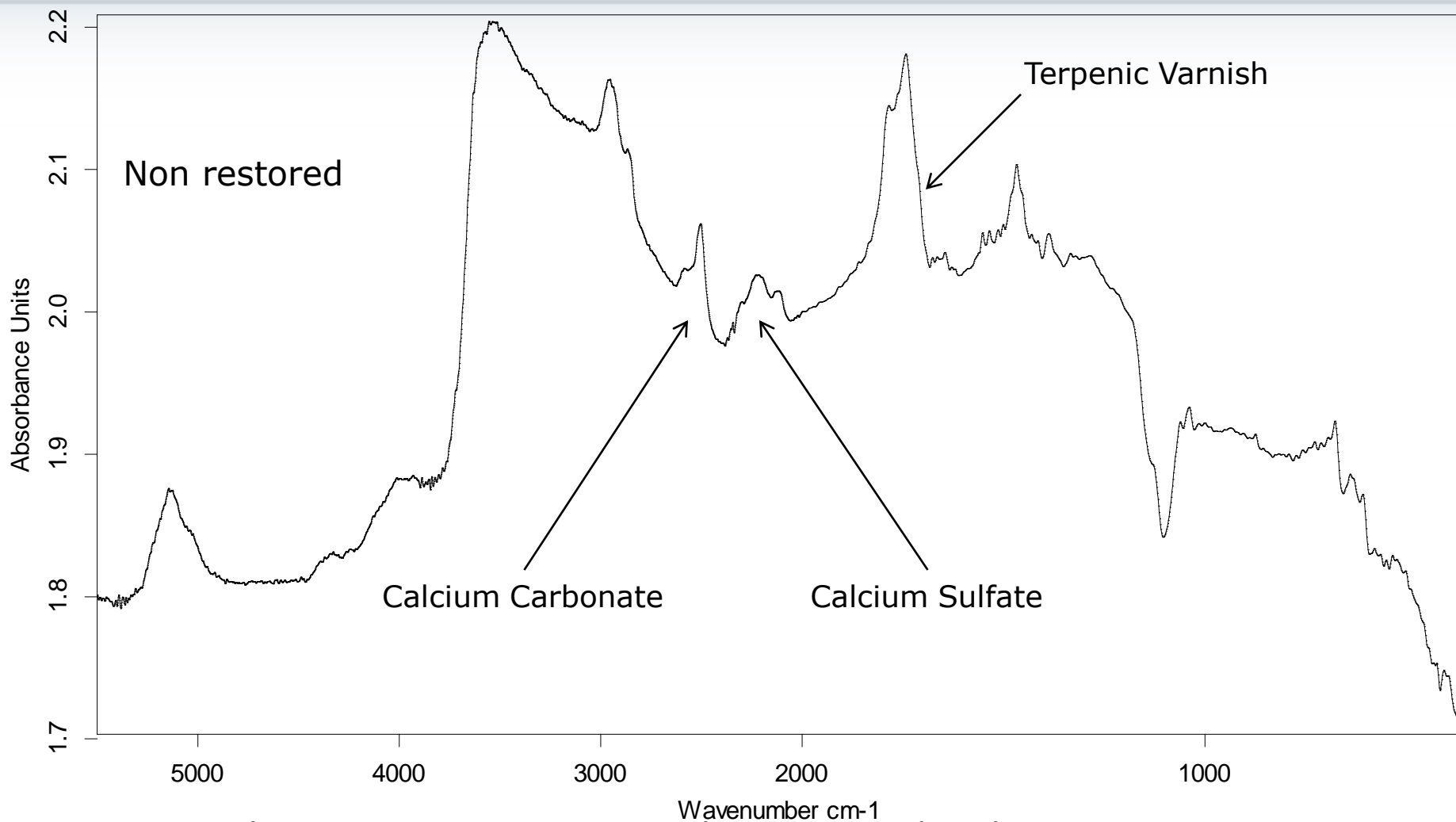


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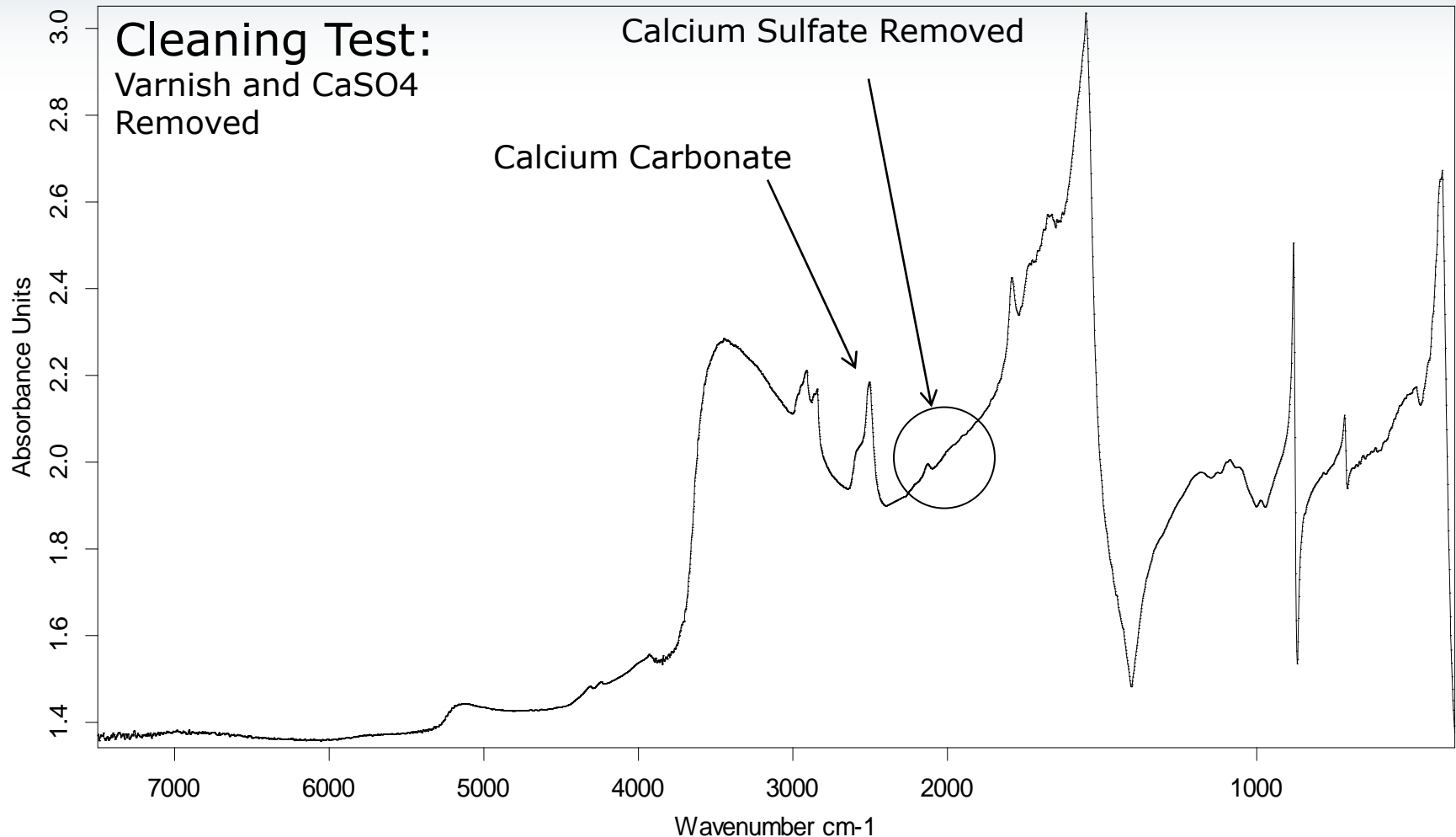
Francesco Albani, XVI Century



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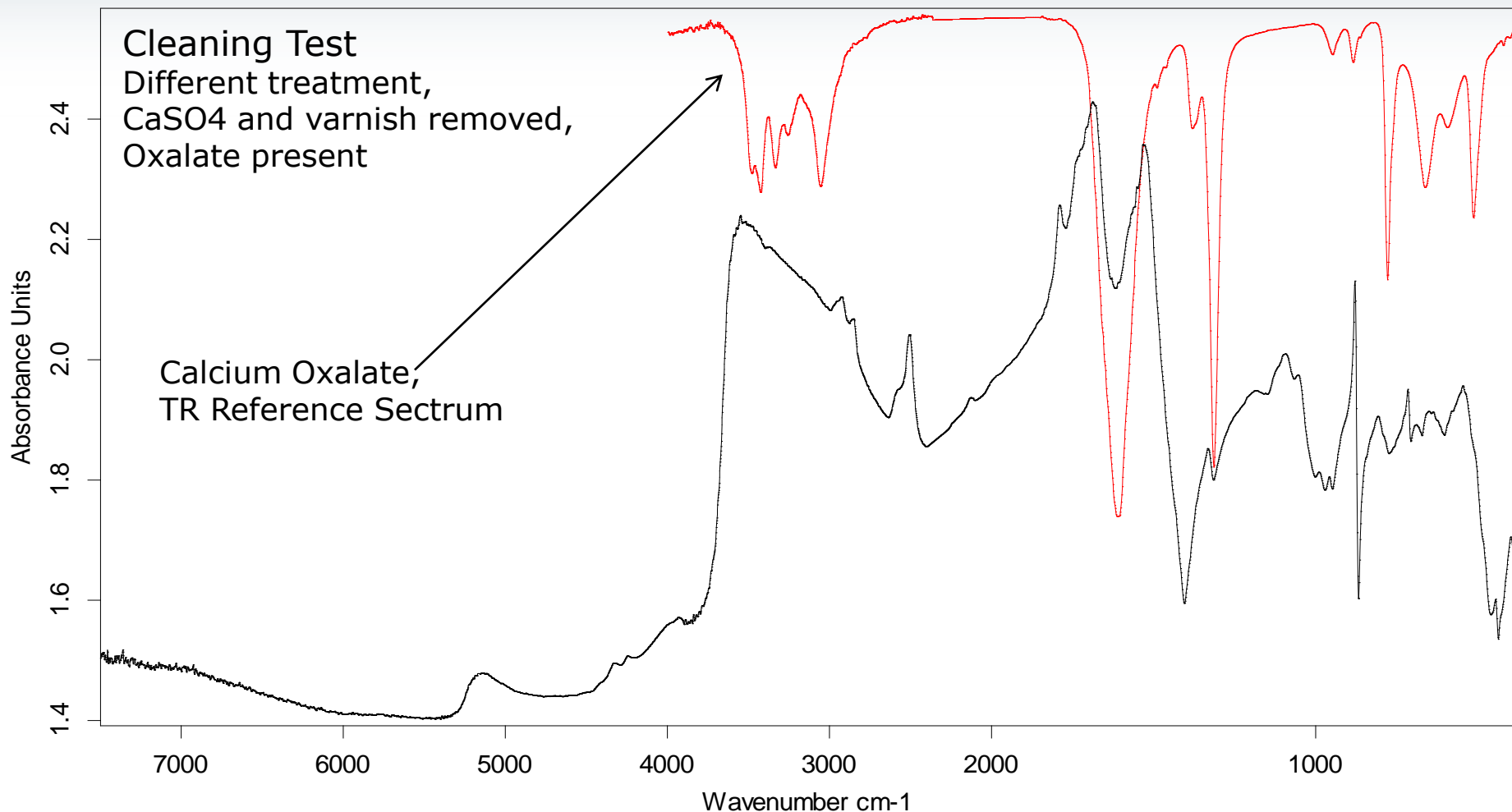


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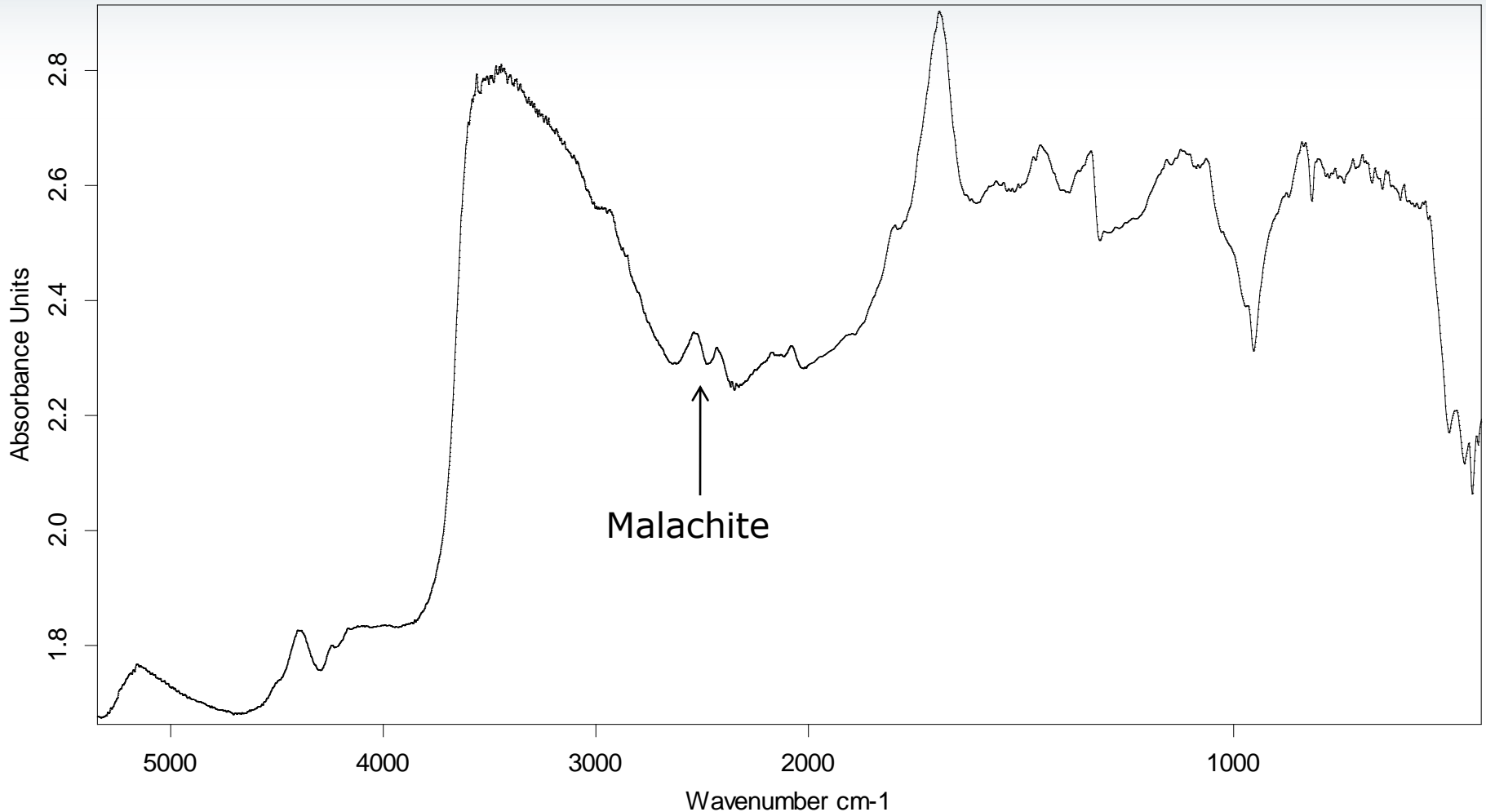
Italy, Verona, San Bernardino Church (XV Century), Sala Morone – Apr, 2010



Cooperation with F. Monti and L. Olivato, University of Verona, and G. Poldi, University of Bergamo (1)

In situ FT-IR analysis: Mural Paintings

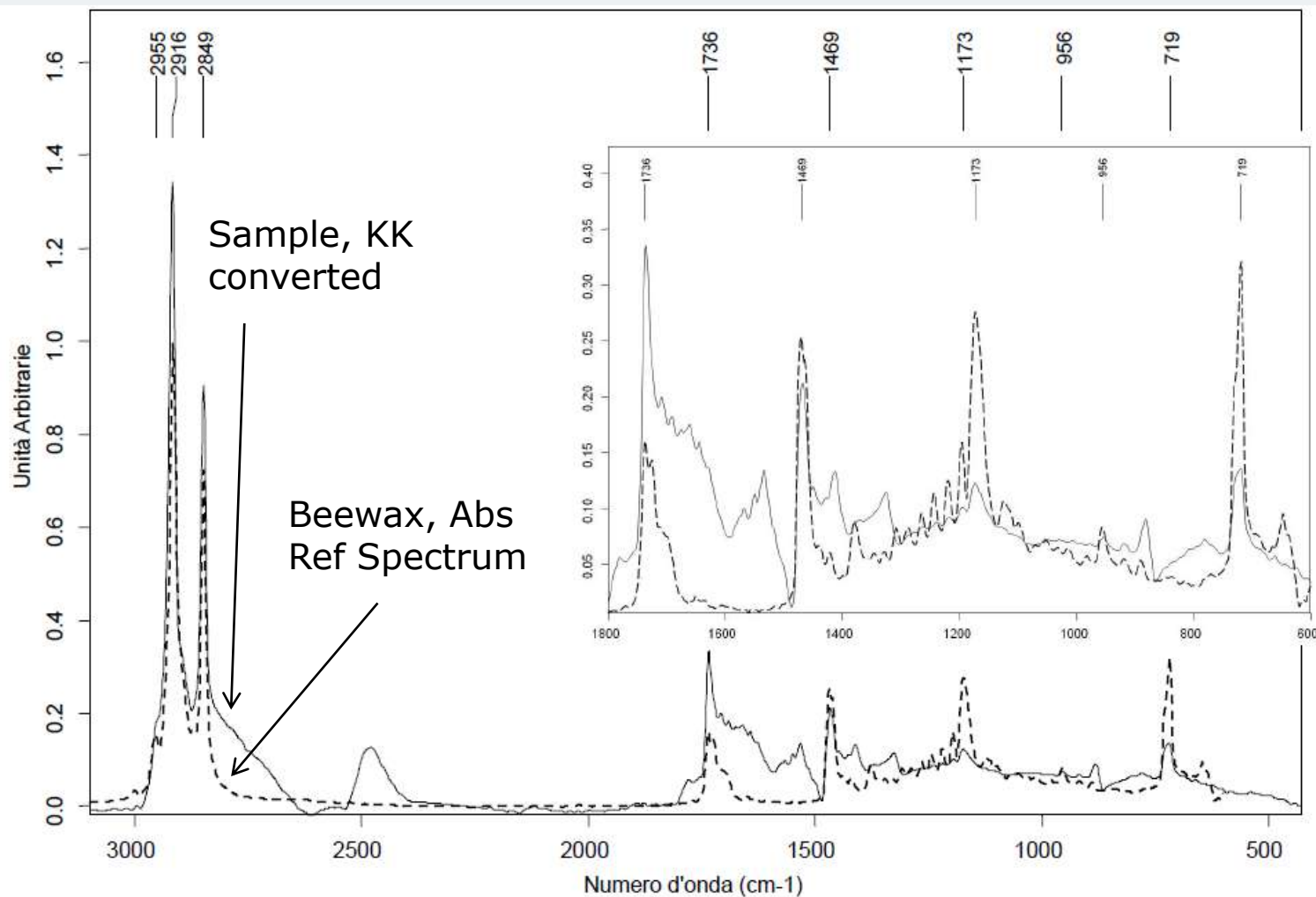
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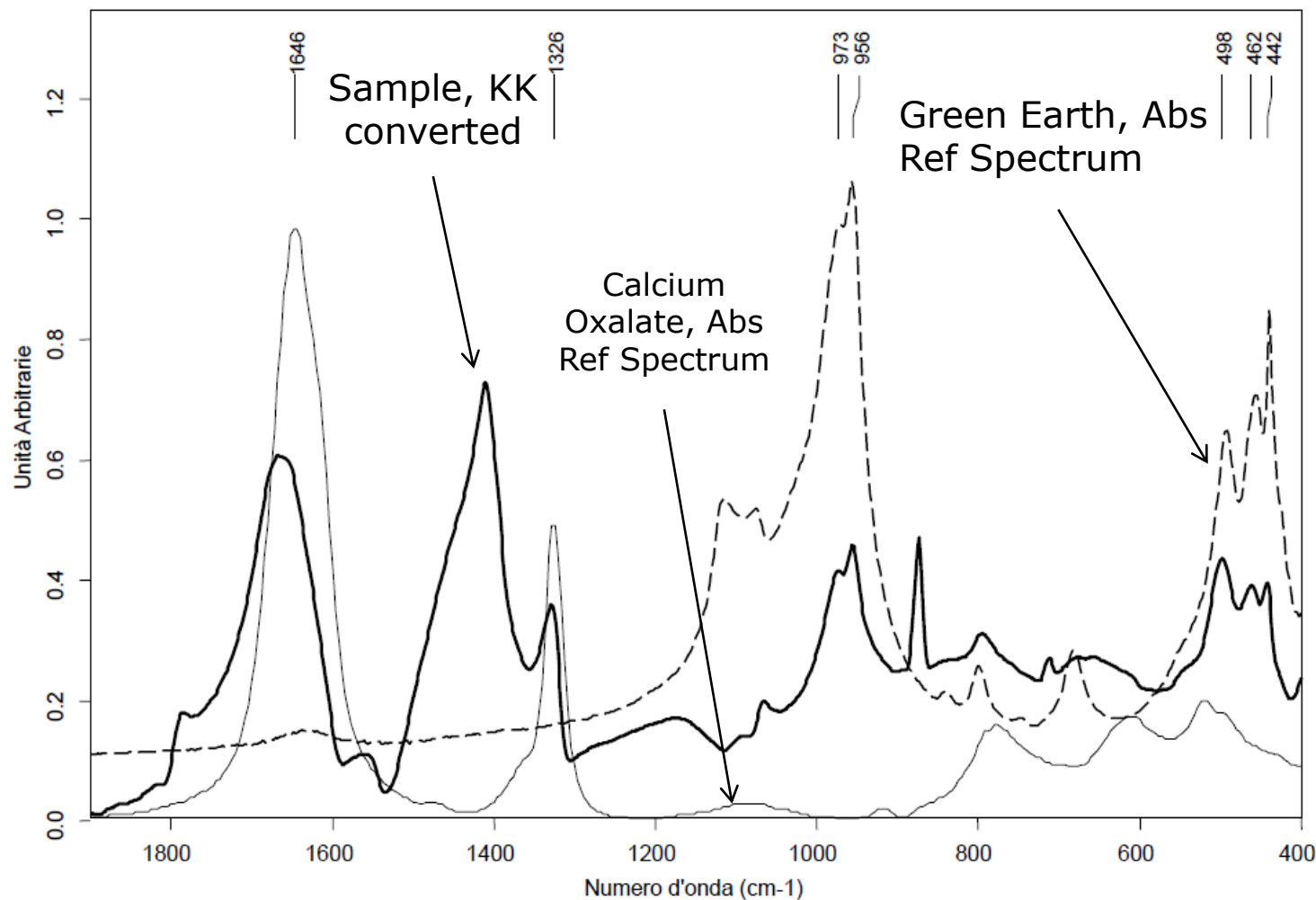
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In situ FT-IR analysis: Mural Paintings

Italy, Bologna, San Colombano Church - May 2010

Still not attributed, XIII Century

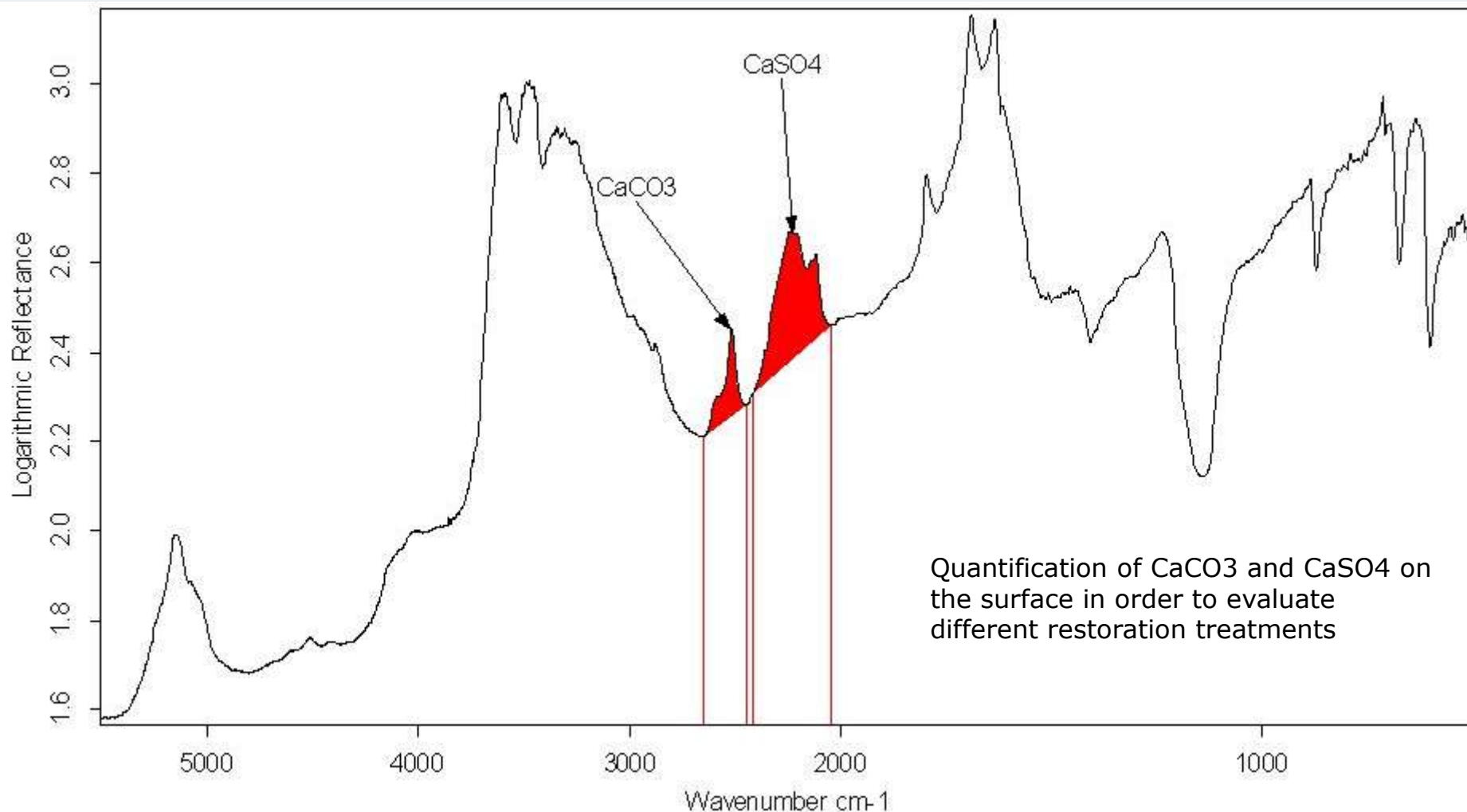


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In situ FT-IR analysis: Mural Paintings

Italy, Rome, Chiesa del Gesù - Dec 2010

F. Zuccari, La cacciata degli angeli ribelli, XVI-XVII Century

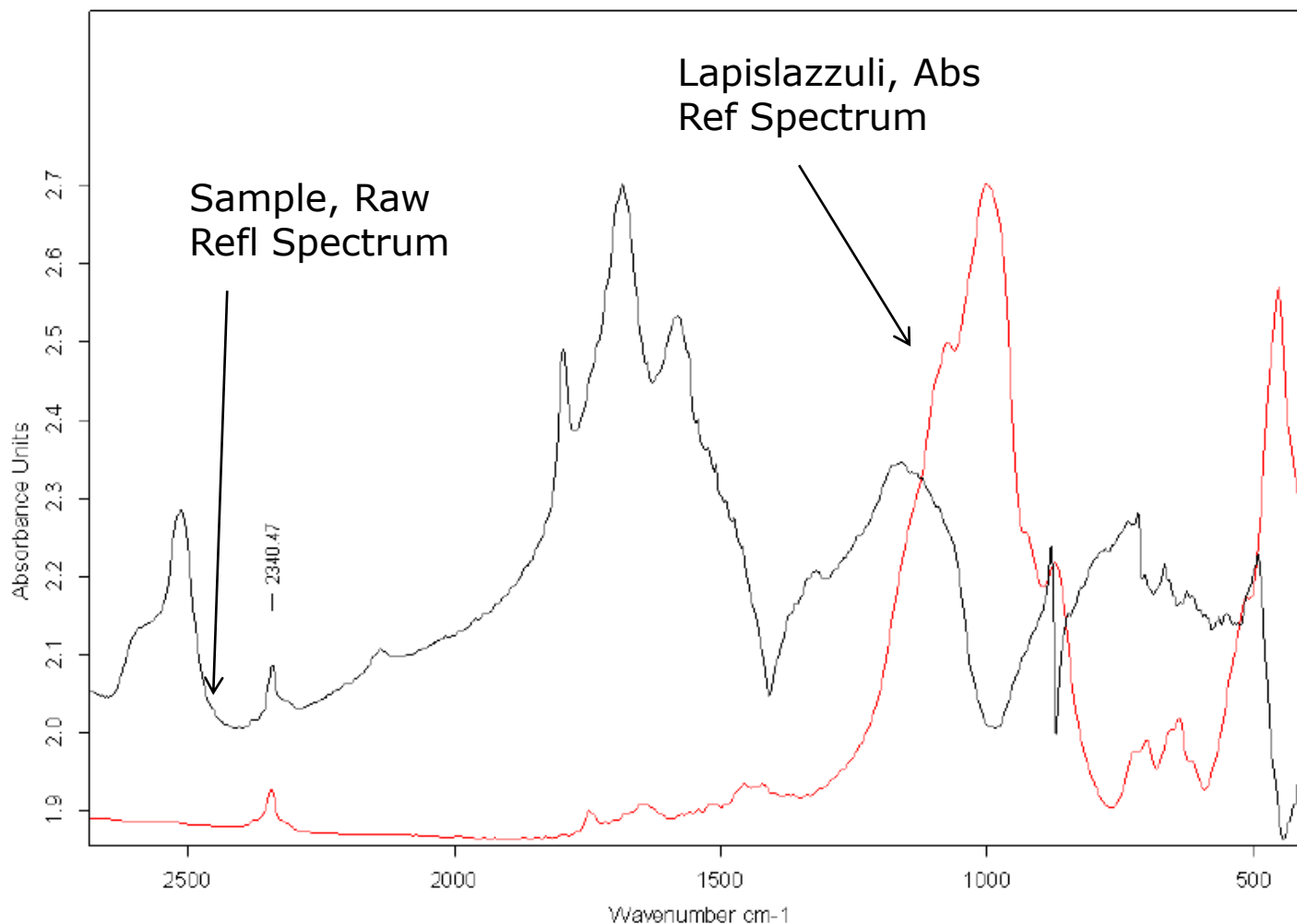


Cooperation with M. Positano, EmmeBi Arte - Roma

In situ FT-IR analysis: Mural Paintings

Italy, Rome, Chiesa del Gesù - Dec 2010

F. Zuccari, La cacciata degli angeli ribelli, XVI-XVII Century



Cooperation with M. Positano, EmmeBi Arte - Roma

In situ FT-IR analysis: Oil Paintings

Italy, Bologna, Restoration Lab - Aug, 2009

Nunzio Rossi, Chiesa della Certosa, XVII Century

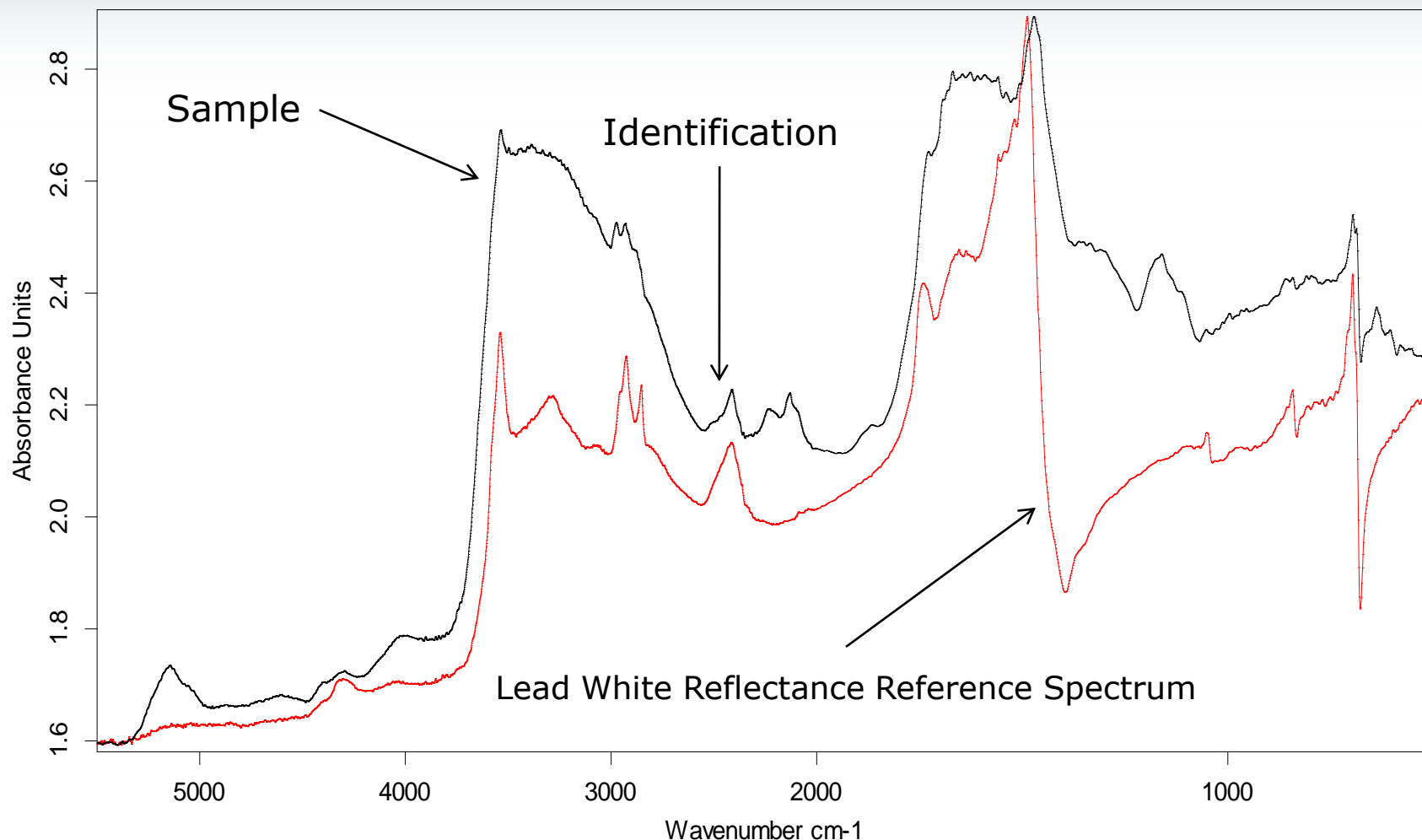


Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna

In situ FT-IR analysis: Oil Paintings

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Nunzio Rossi, Chiesa della Certosa, XVII Century

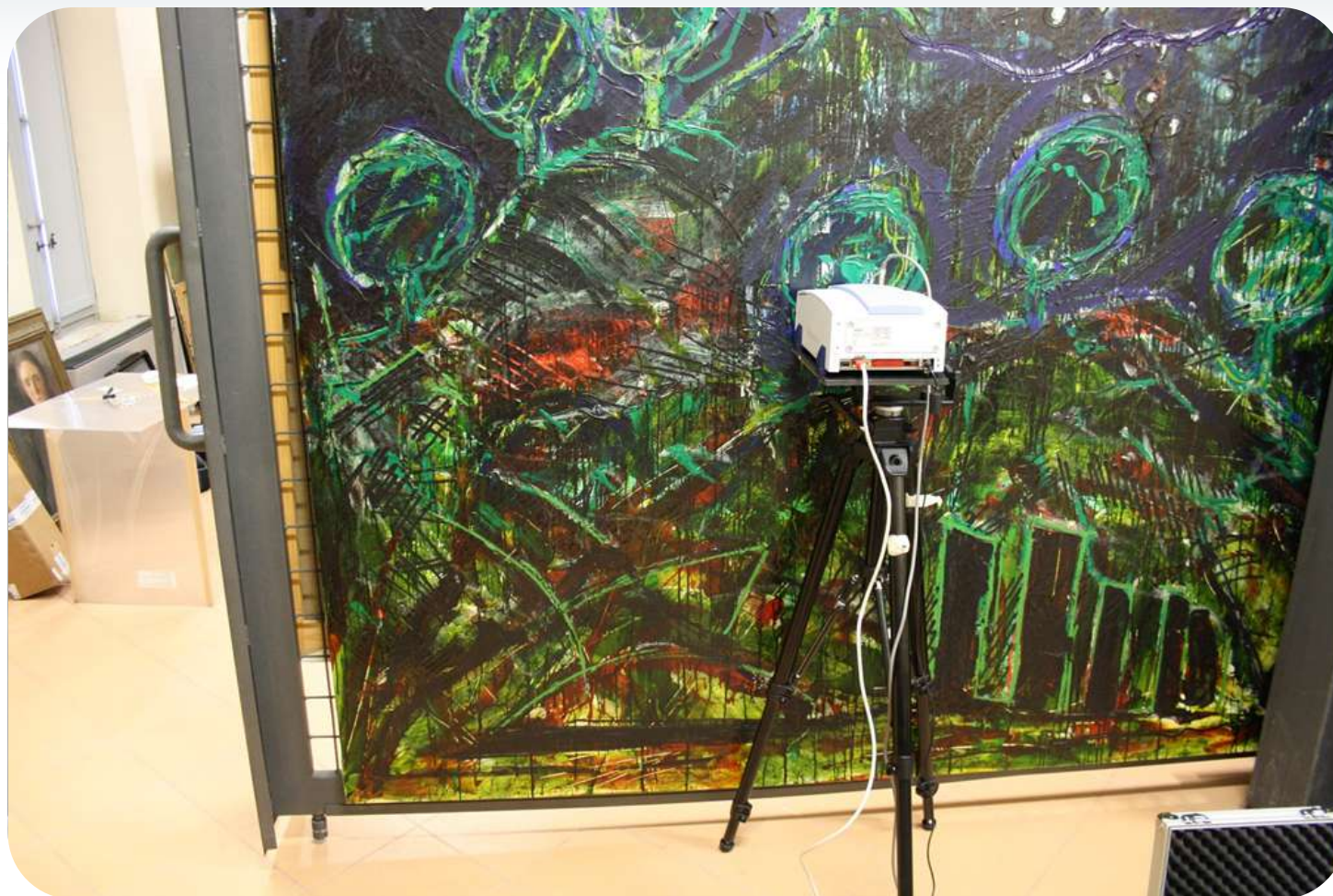


Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna

In situ FT-IR analysis: Modern Paintings

Italy, Parma, CSAC - Gen, 2010

Mario Schifano, Notte tempo, 1986

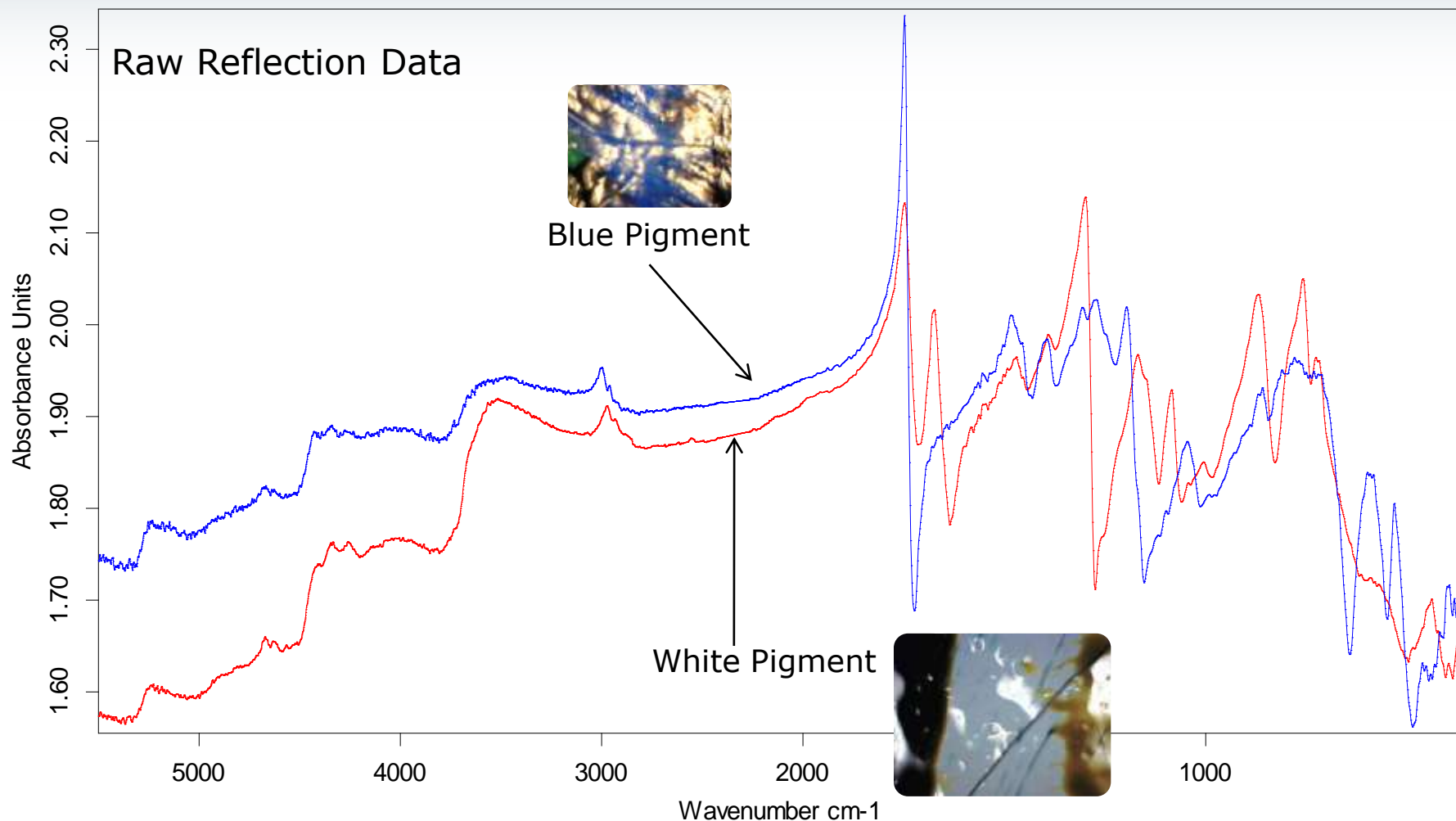


Cooperation with P.P. Lottici, D. Bersani, A. Casoli, University of Parma (5)

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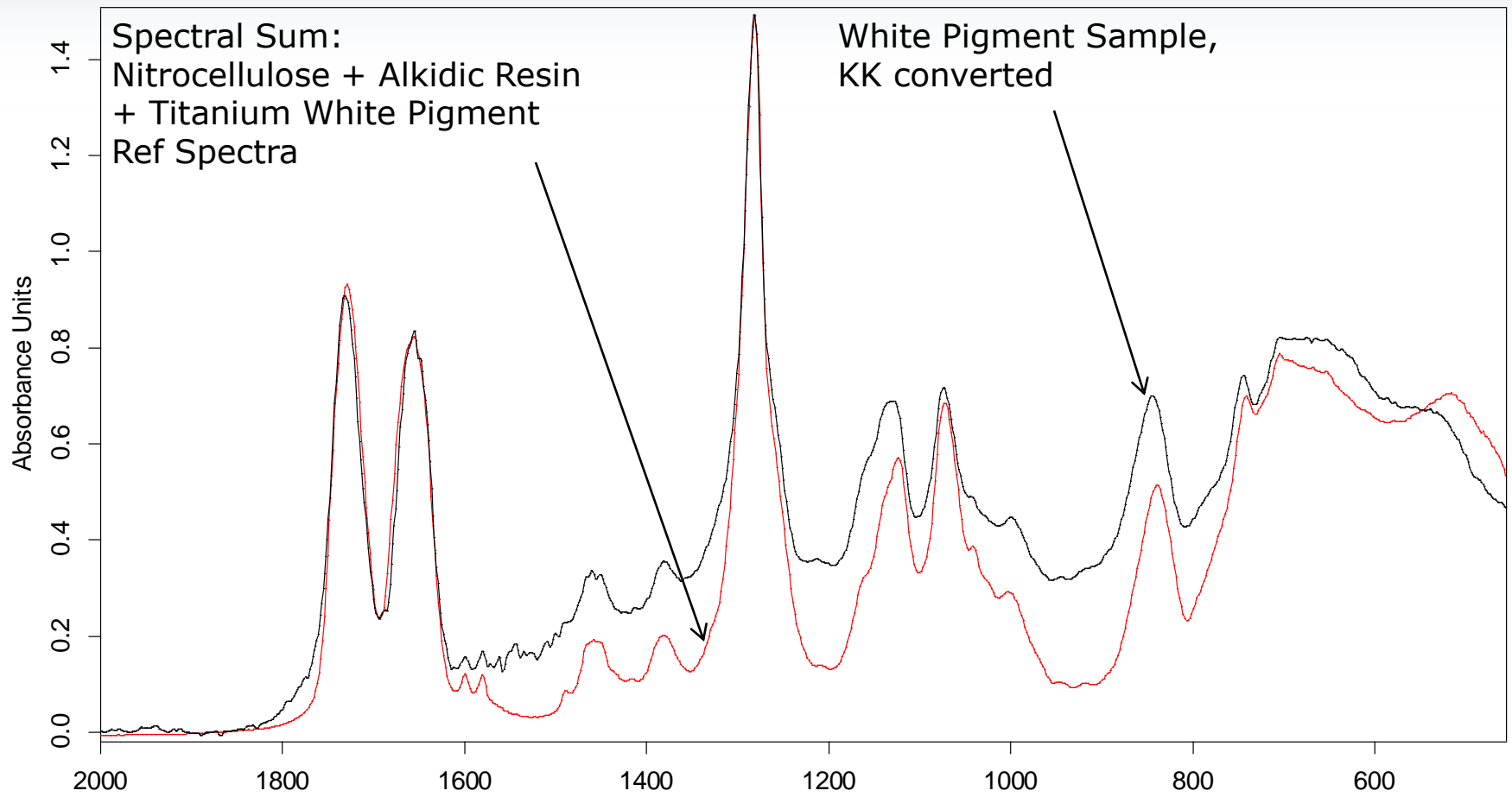


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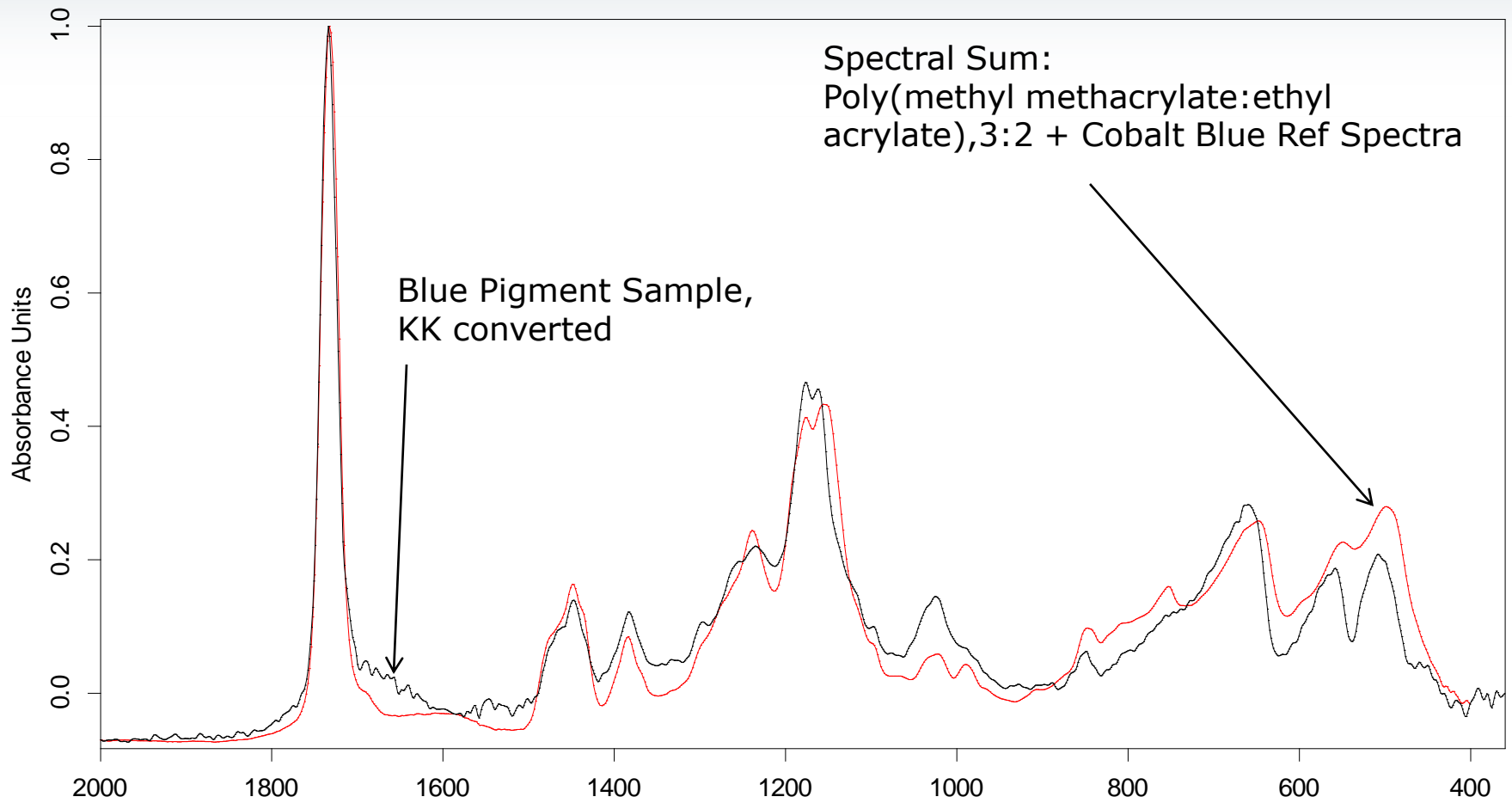


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In situ FT-IR analysis:

Italy, Bologna, Pinacoteca Nazionale - May, 2009

Polittico di Giotto, XIV Century



Bibliography:

"Il polittico di GIOTTO nella Pinacoteca Nazionale di Bologna. Nuove letture", D. Cauzzi, C. Seccaroni - Centro Di, 2009



Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna (3, 4, 6)

In situ FT-IR analysis:

Italy, Bologna, Pinacoteca Nazionale - May, 2009

Polittico di Giotto, XIV Century



Analysis integration
with handled XRF



Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna (3, 4, 6)

In situ FT-IR analysis:

Italy, Bologna, Pinacoteca Nazionale - May, 2009

Polittico di Giotto, XIV Century

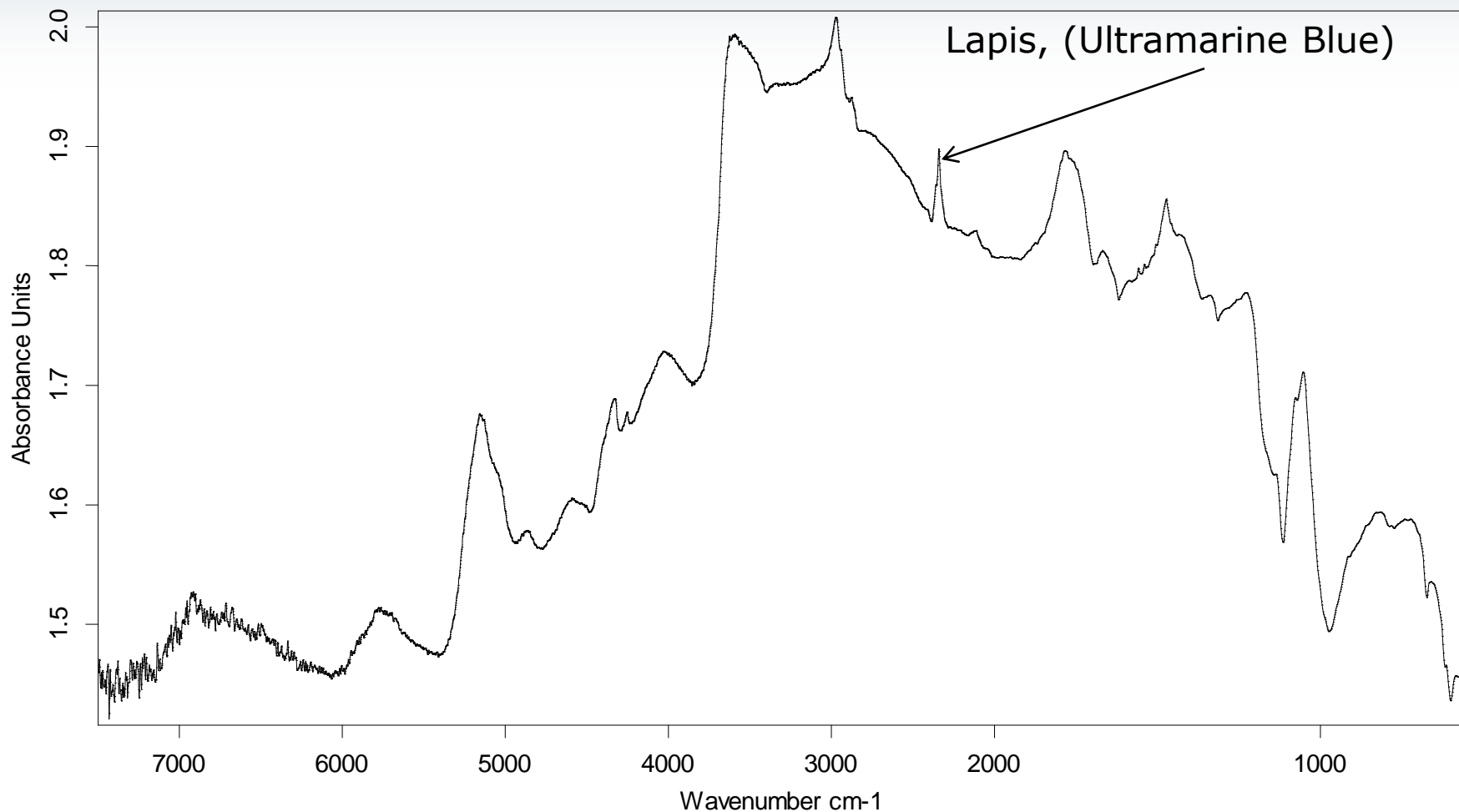


Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna (3, 4, 6)

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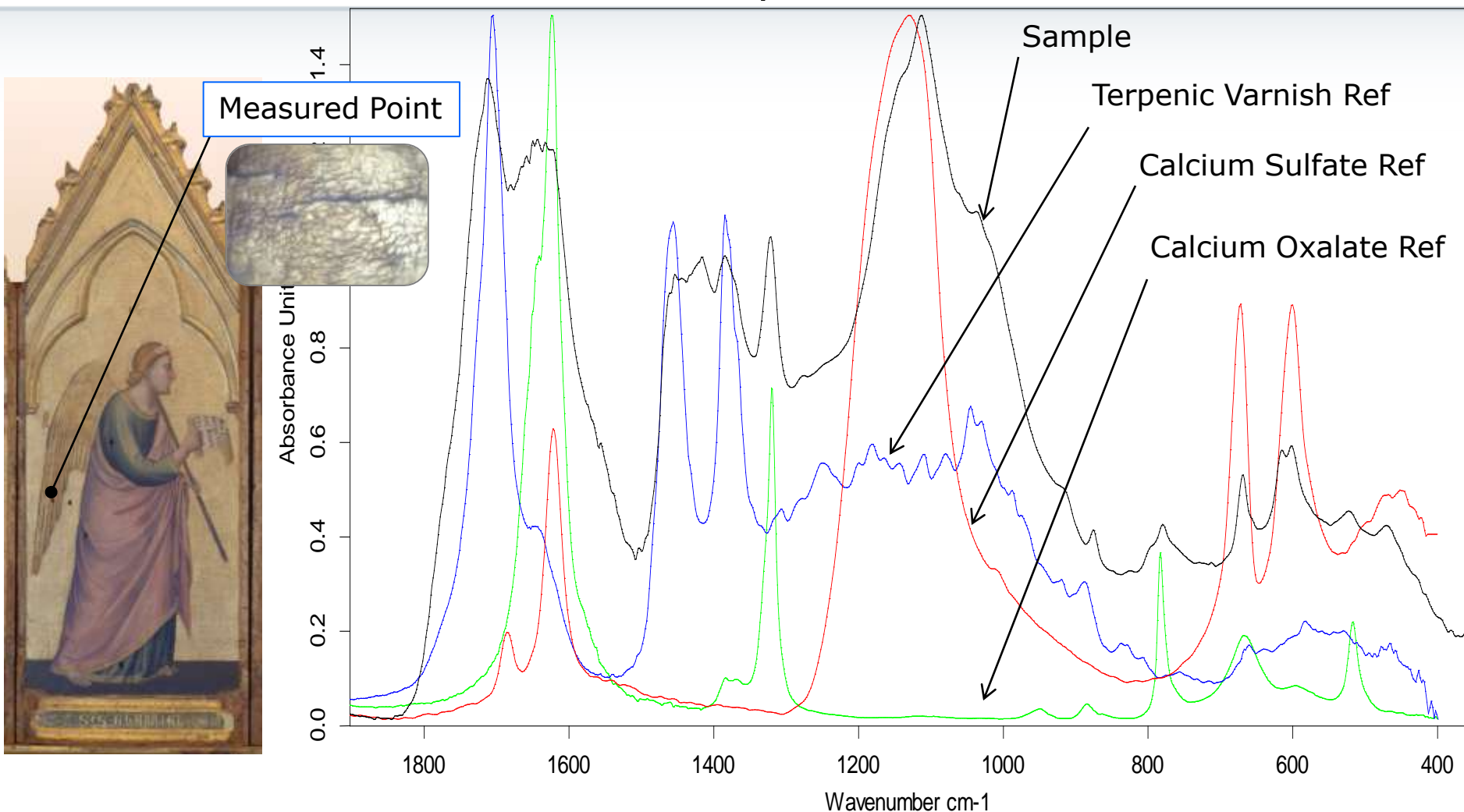


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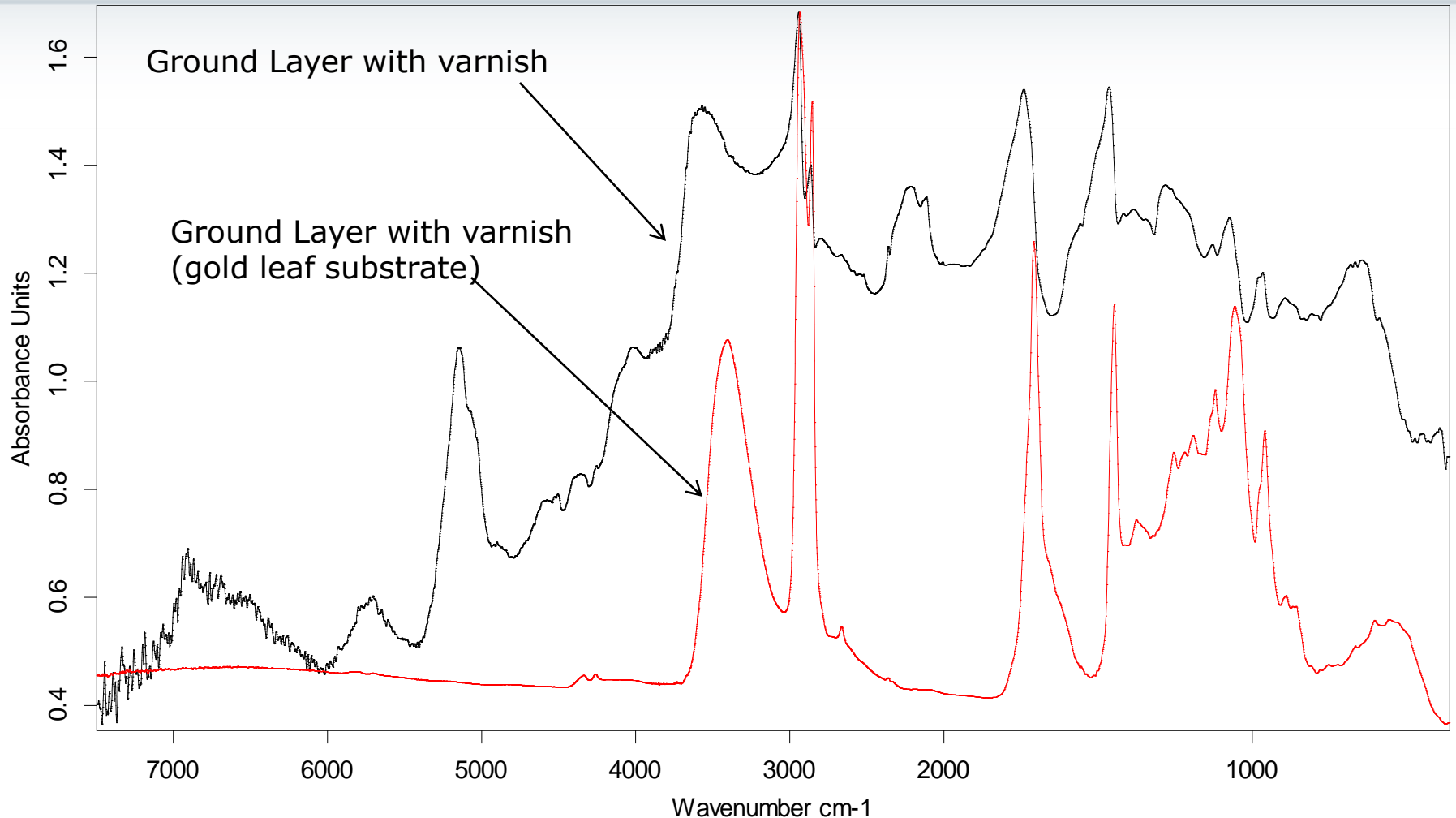
Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna (3, 4, 6)

In lab FT-IR analysis: Test samples Pigments and ligands



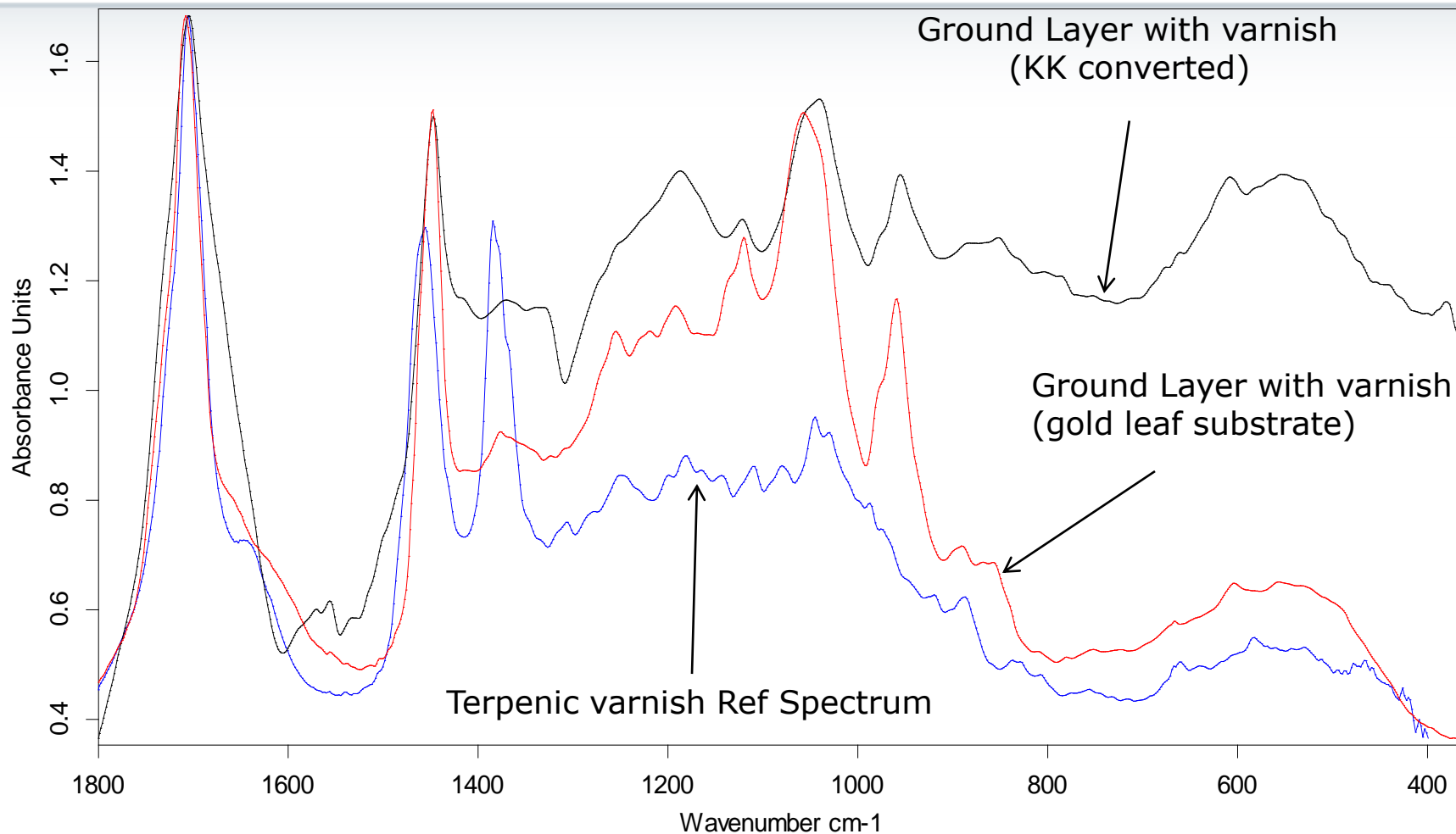
Cooperation with Opificio delle Pietre Dure (Florence) and CNR-Florence

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Cooperation with *Opificio delle Pietre Dure (Florence)* and *CNR-Florence*

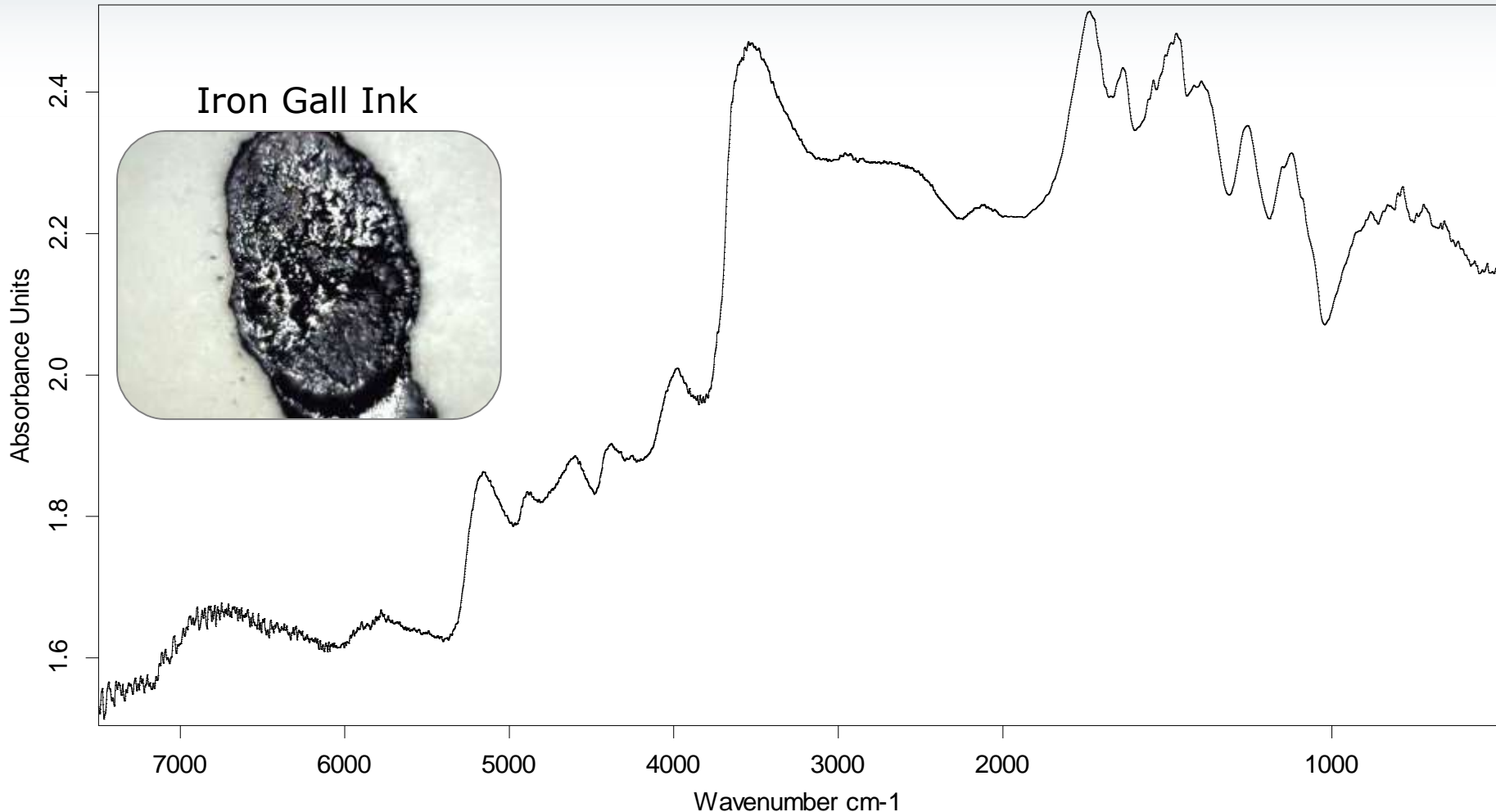
In lab FT-IR analysis: Inks and papers Ancient papers and manuscripts



Cooperation with Maurizio Aceto, University of Piemonte Orientale

In lab FT-IR analysis: Inks and papers

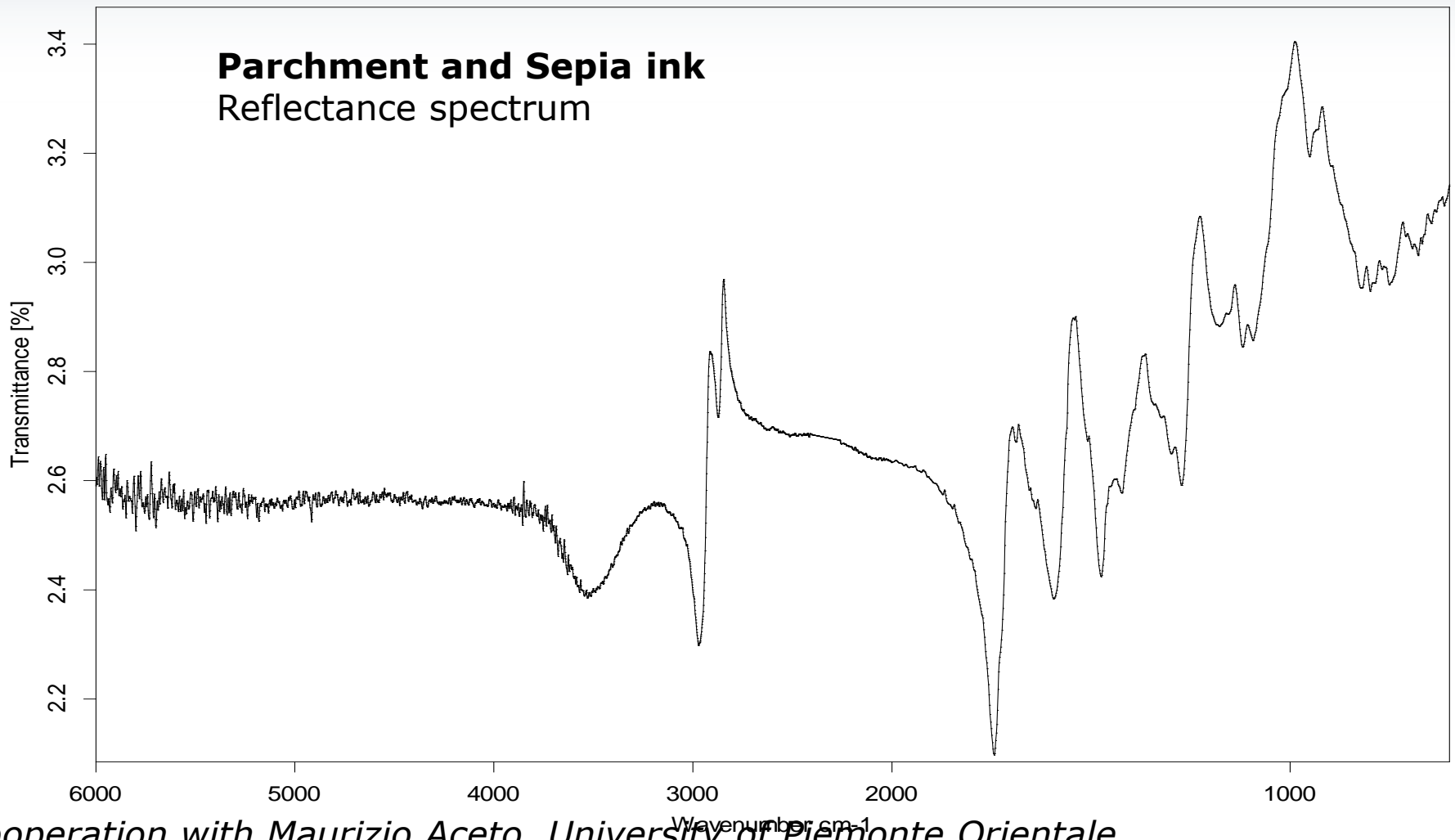
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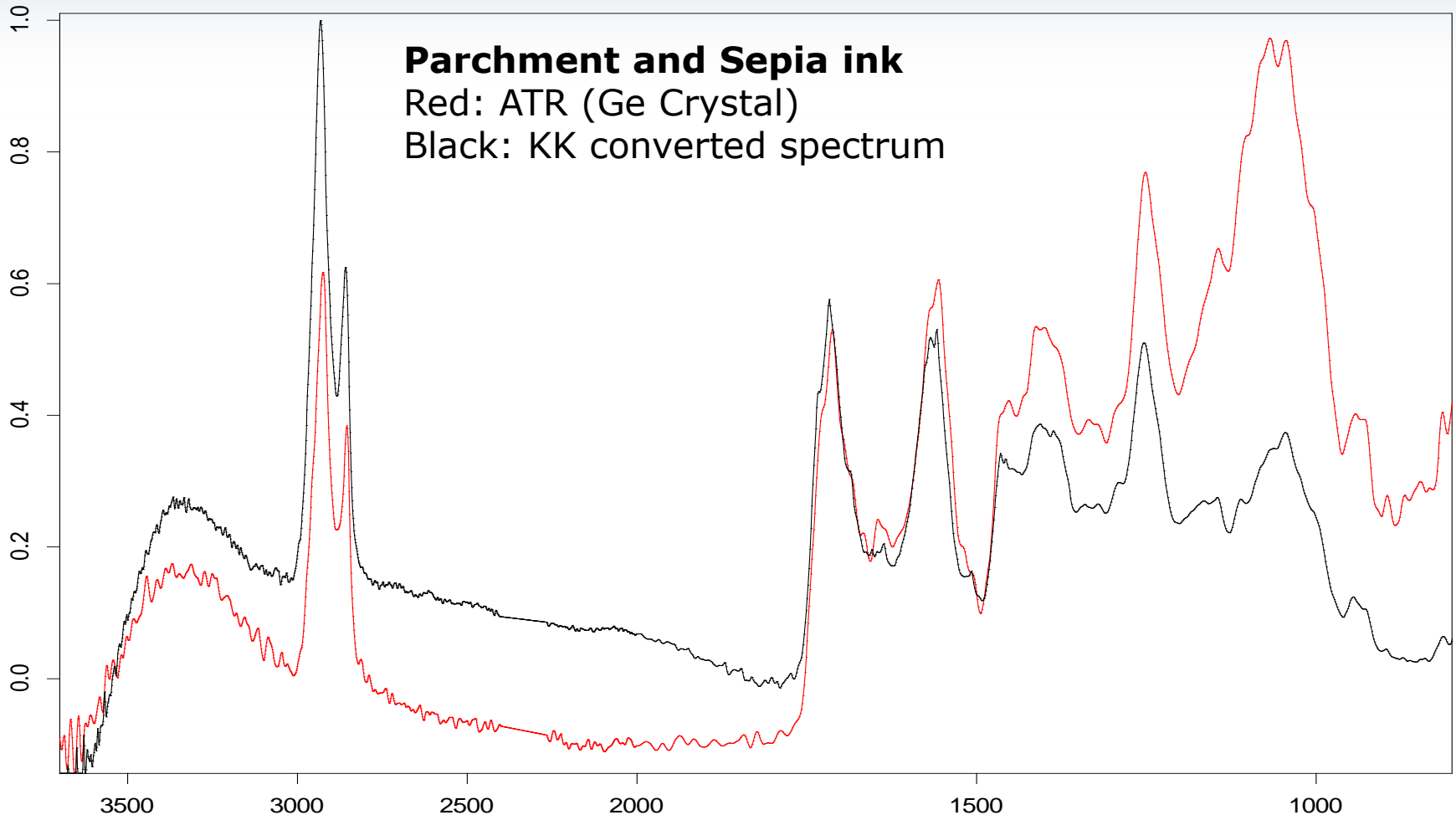
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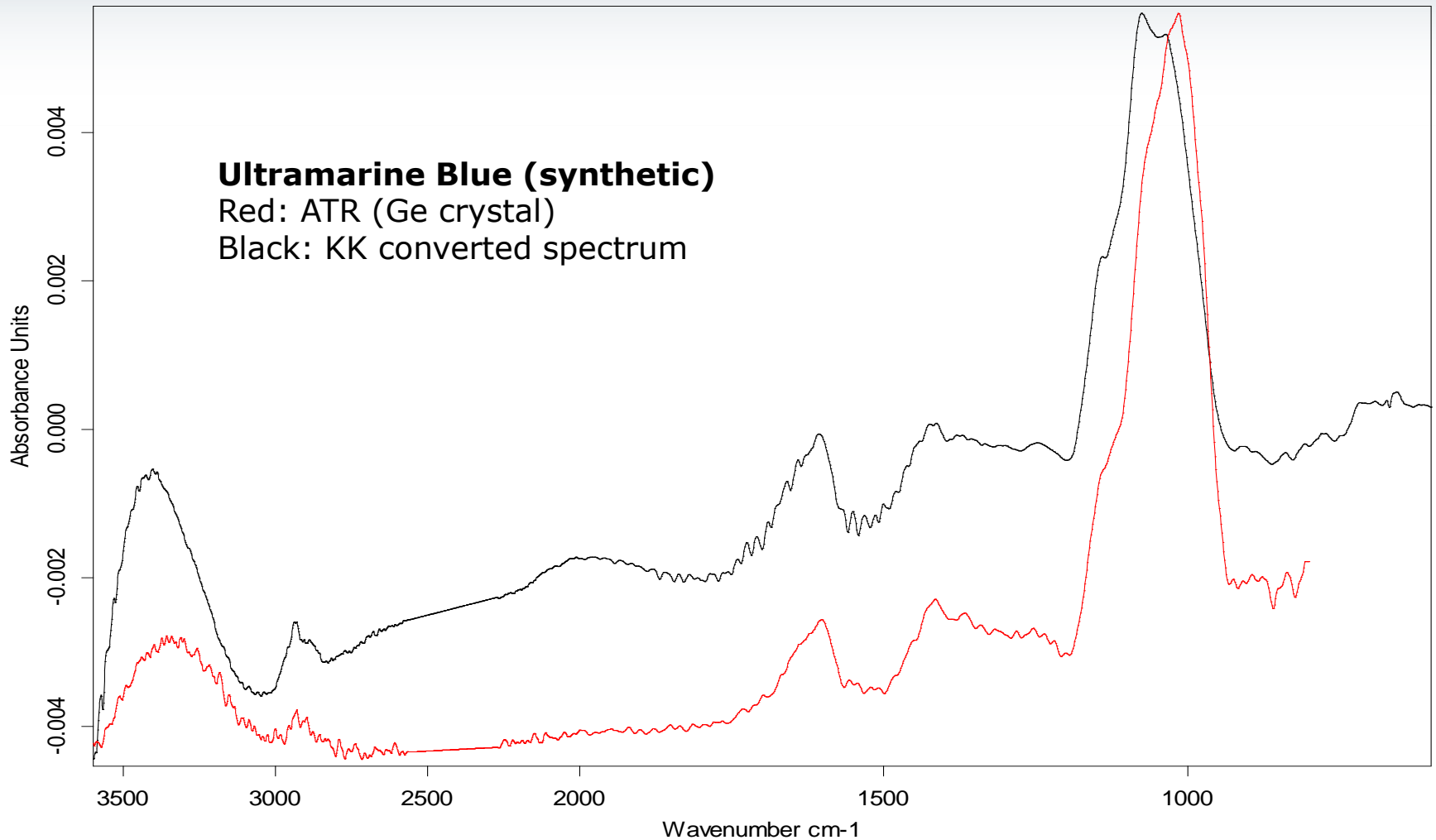
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In situ FT-IR and Raman analysis:

Italy, Bologna, Pinacoteca Nazionale - Feb, 2010

Francesco Francia, Mural Painting, XVI Century

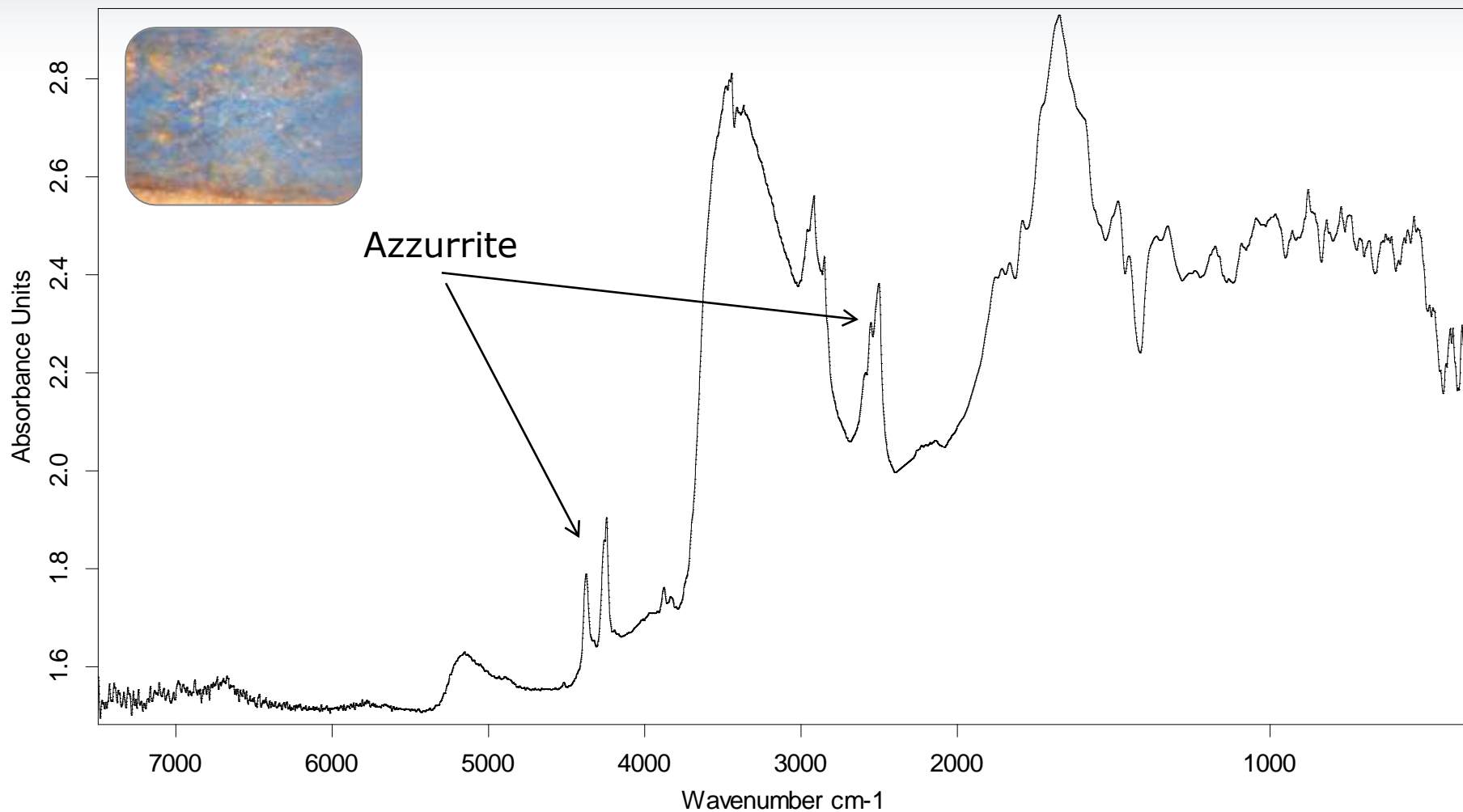


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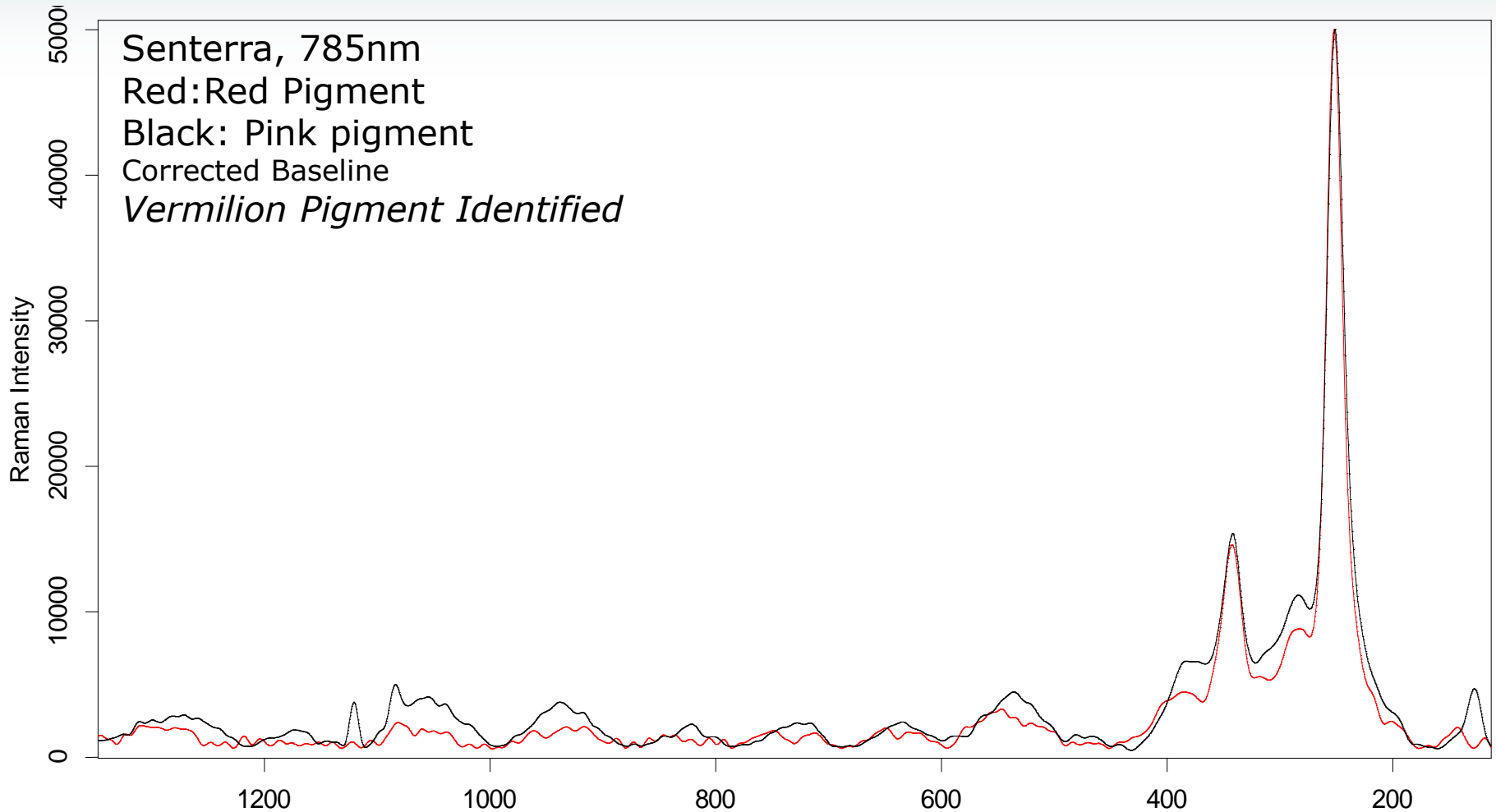
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In situ FT-IR analysis: Tapestries



Italy, Milan, Gallery Moshe Tabibnia, Headquarters of MATAM (Museum of Antique Textile Arts in Milan) Cultural Association – April, 2010

Kaitag from MATAM Collection



Courtesy of Gallery Moshe Tabibnia

*Cooperation with MATAM Cultural Association (Milan),
G. Poldi, University of Bergamo and S. Bruni, University of Milan (2)*

In situ FT-IR analysis: Tapestries



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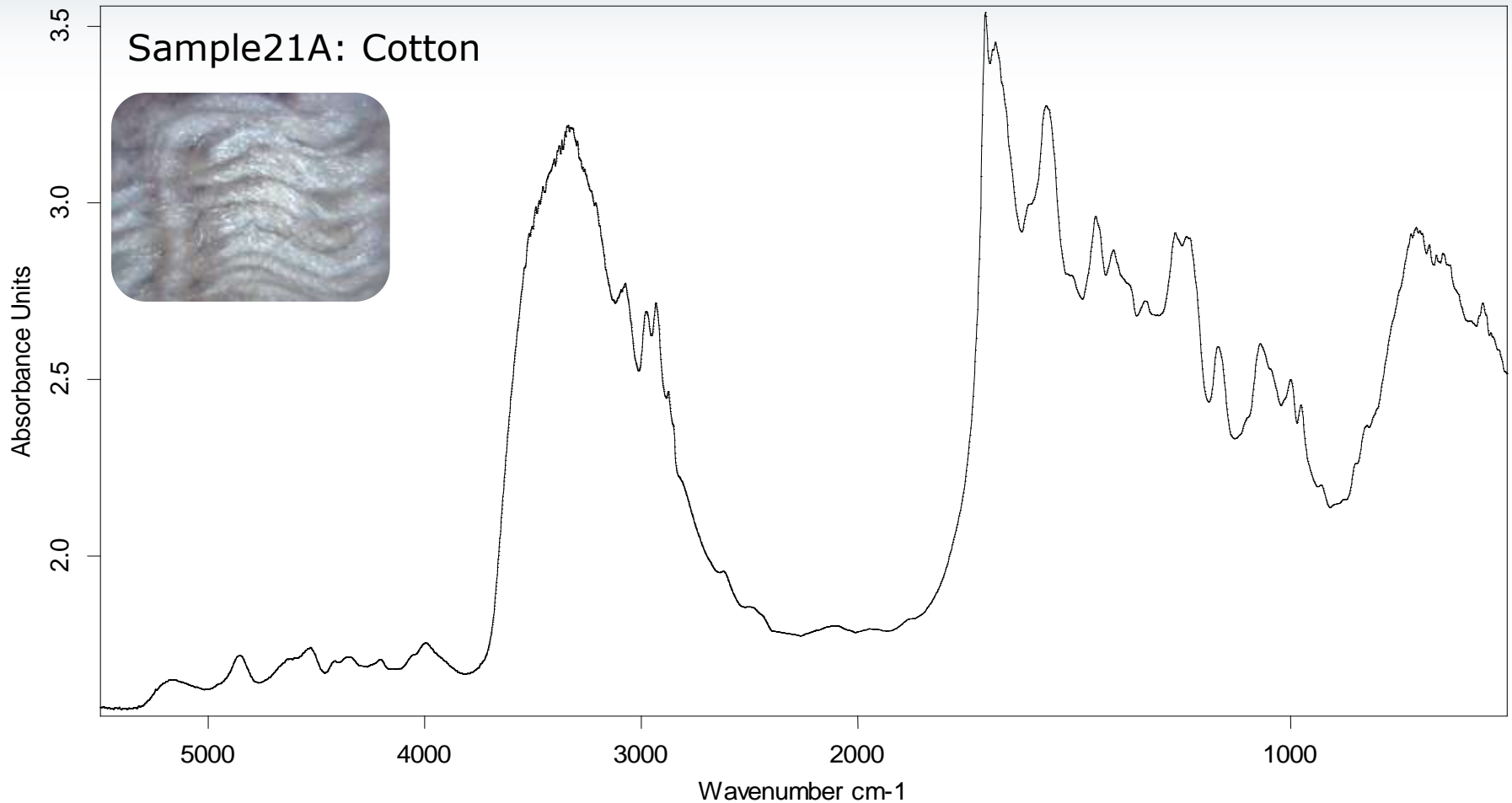
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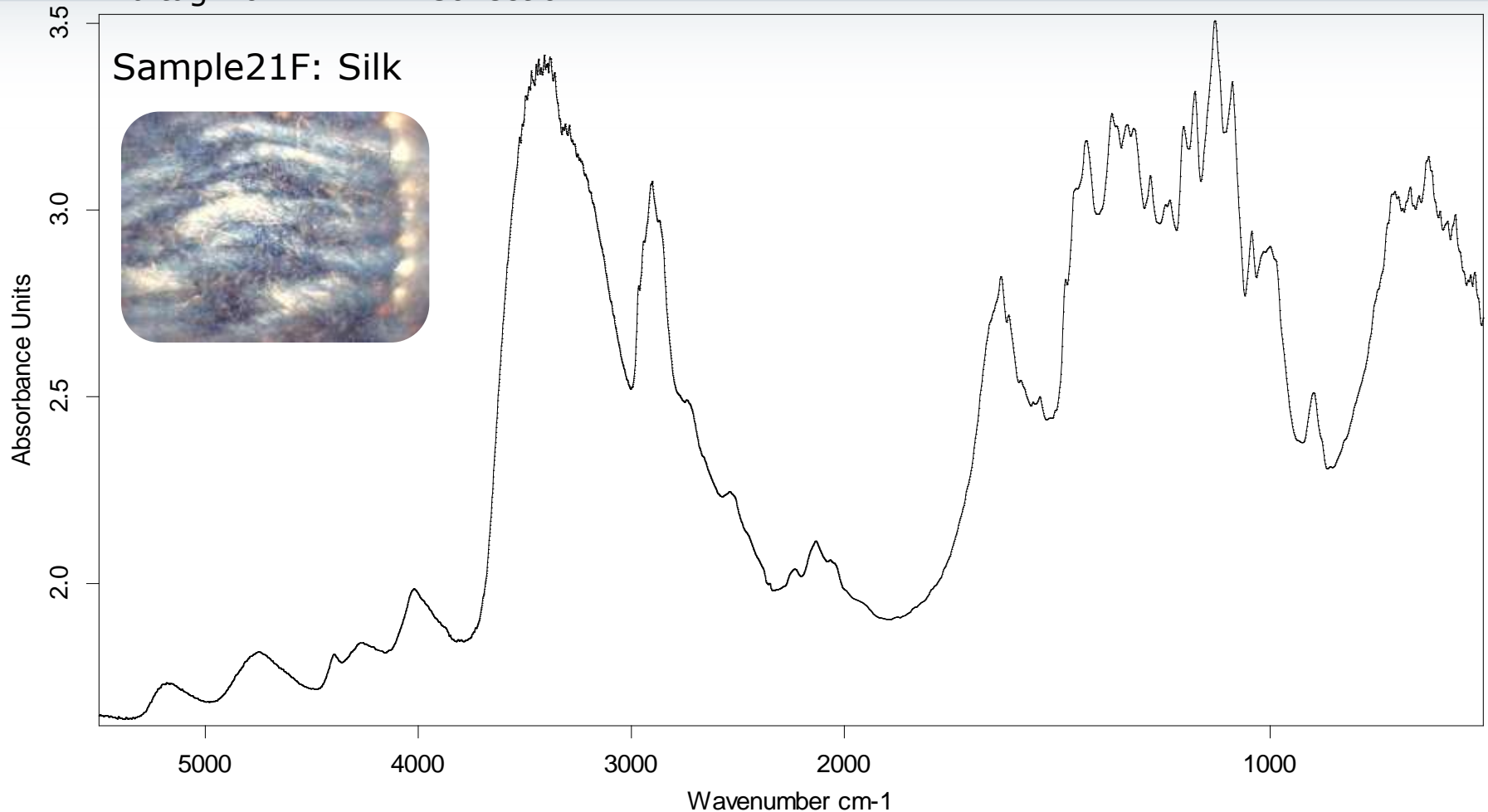


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In Lab FT-IR analysis: Woods

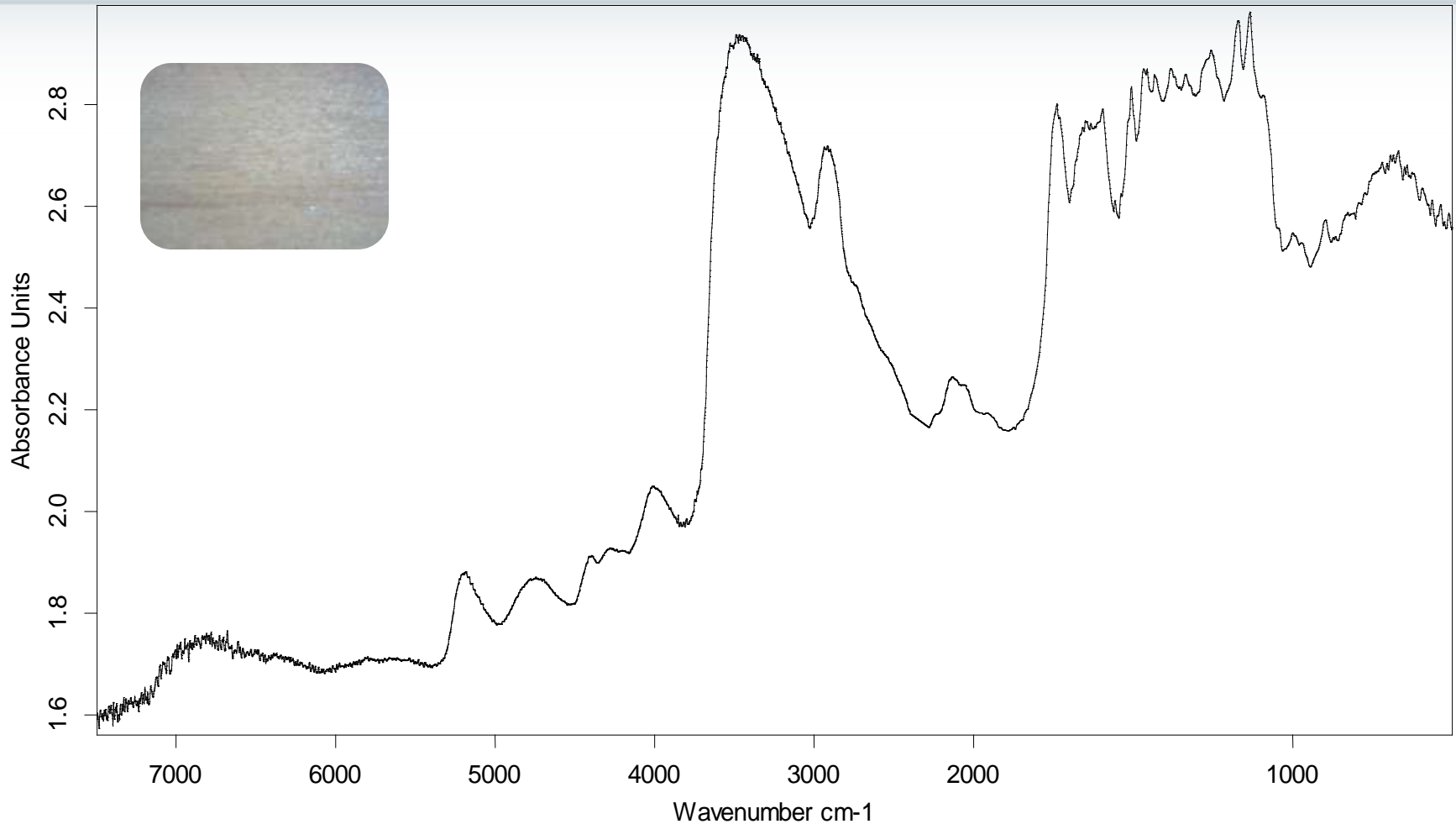
Test samples – Feb, 2010



Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna

In Lab FT-IR analysis: Woods

Test samples – Feb, 2010



Cooperation with Diego Cauzzi, Soprintendenza BSAE di Bologna

High-End Applications:

Analysis on ice: ALPHA at low temperature! –
July, 2010



Boxing the ALPHA...



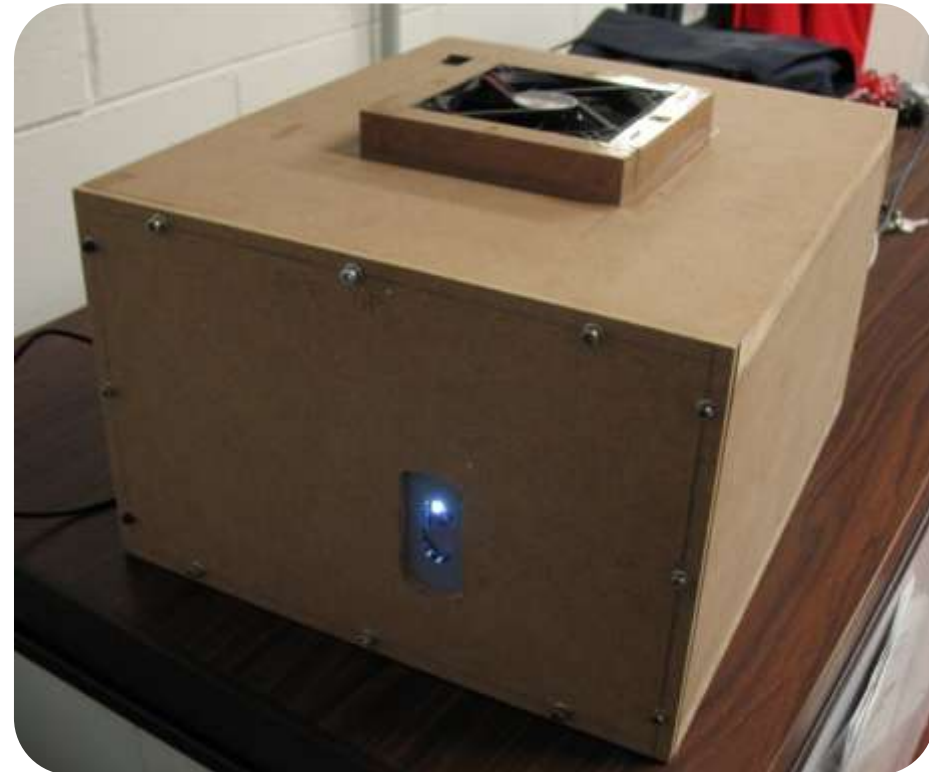
Cooperation with V. Maggi, University of Milano Bicocca and A. Marcelli, INFN LNF

High-End Applications:

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July, 2010



ALPHA Boxed!



Cooperation with V Maggi, University of Milano Bicocca and A. Marcelli, INFN LNF

High-End Applications:

Analysis on ice: ALPHA at low temperature! –
July, 2010



Into the cold chamber



Cooperation with V. Maggi, University of Milano Bicocca and A. Marcelli, INFN LNF

High-End Applications:

Analysis on ice: ALPHA at low temperature! –
July, 2010



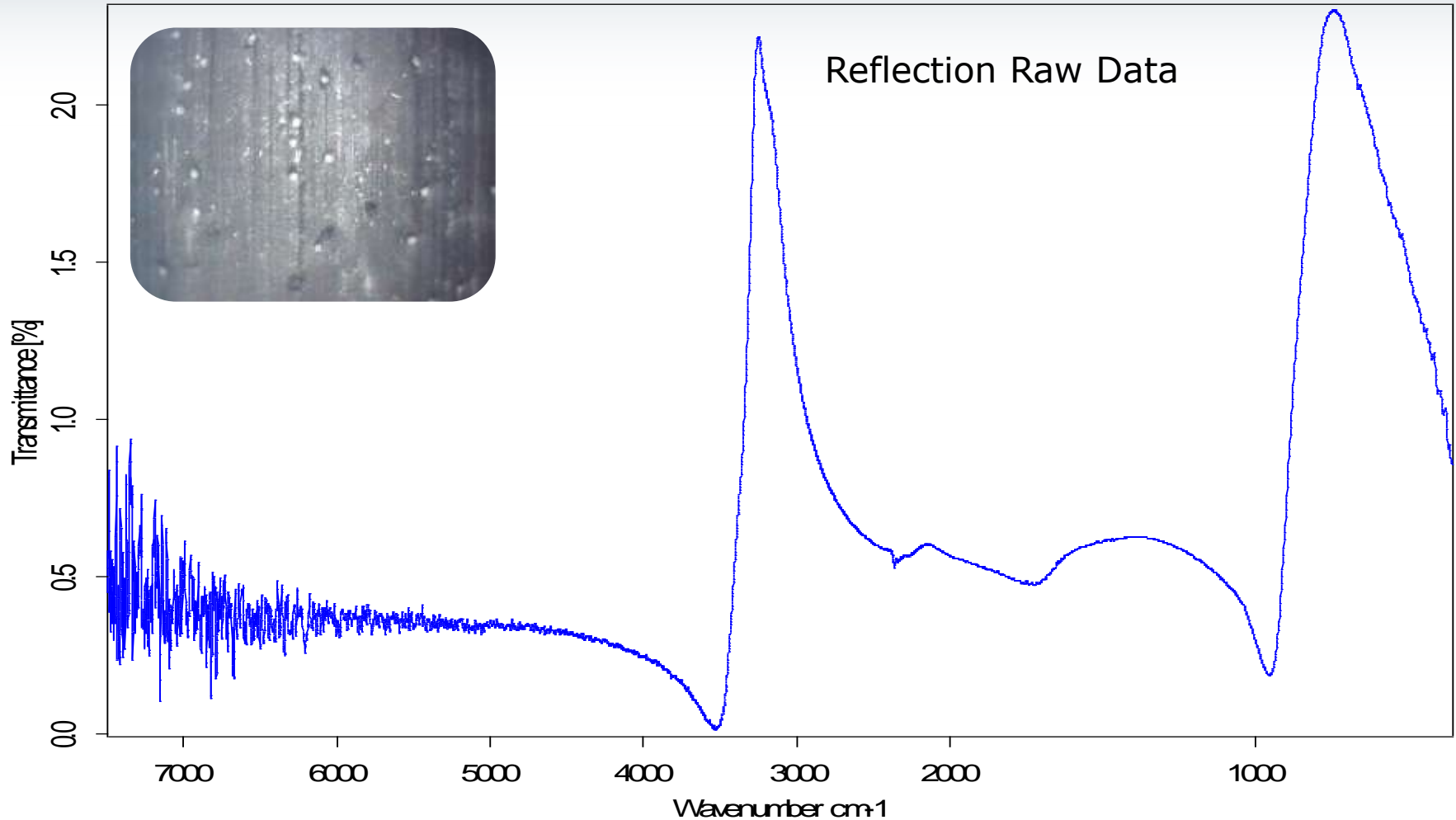
The Experiment



Cooperation with V. Maggi, University of Milano Bicocca and A. Marcelli, INFN LNF

High-End Applications:

Analysis on ice: ALPHA at low temperature! –
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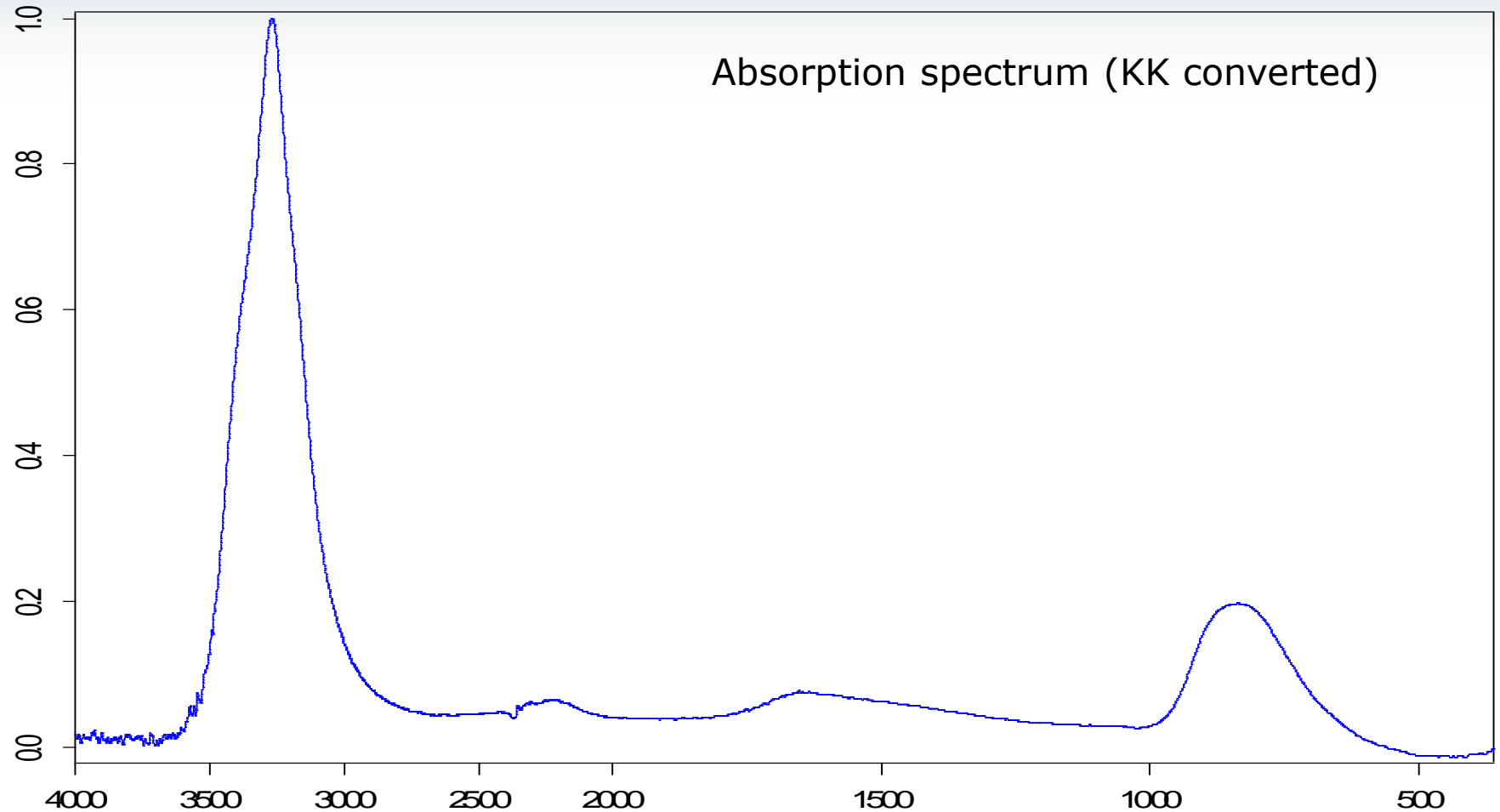


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Acknowledgment



Bruker Optics Milan would like to thank all the colleagues and customers involved into the development of these applications.

A special mention goes to:

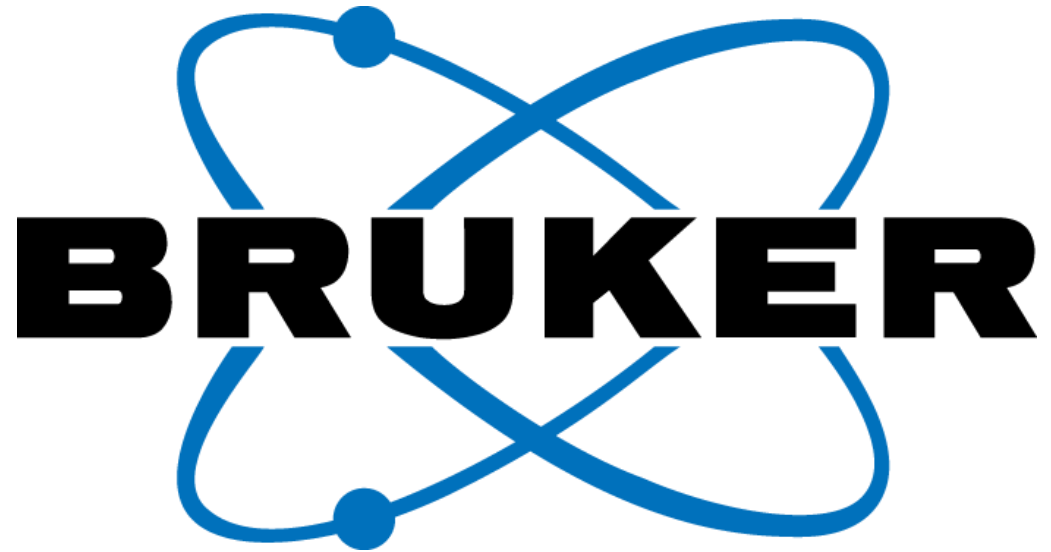
- *Costanza Miliani and her group pushing us into the right direction and for sharing her experience*
- *Stella Nunziante Cesaro for all the time spent together and for the idea of the application of such a technique on gems and stones*
- *Diego Cauzzi for all the useful discussions and for giving us the possibility to directly test the ALPHA-R on many famous art works*

Publications



Ref	Title	Author	Reference ALPHA-R	Year	Editor
1	Storia, conservazione e tecniche nella libreria Sagramoso in San Bernardino a Verona	M . Molteni	pagg 152-163, Efficacia delle analisi spettroscopiche integrate – FTIR, XRF e vis-RS – sulle pitture della Libreria Sagramoso. <i>G. Poldi, D. Sali</i>	2011	ZeL Edizioni
2	Kaitag, arte per la vita. Tessuti ricamati del Daghestan	AAVV	pagg 121-136, Sul colore dei Kaitag. <i>S. Bruni, E. De Luca, V. Guglielmi, G. Poldi, F. Pozzi</i>	2010	Silvana Editoriale
3	Ricerche per lo studio e la valorizzazione dei beni culturali - Sperimentazioni in Emilia-Romagna - Atti del Convegno, Ferrara 26 Marzo 2010	Ministero per i beni e le attività culturali	Cover + pagg 8-19, Il Polittico di Giotto della Pinacoteca Nazionale di Bologna: primo caso di applicazione di una nuova strumentazione per l'analisi FT-IR in situ. <i>D. Cauzzi, D. Sali</i>	2010	Ministero per i beni e le attività culturali
4	Restauro: sinergie tra pubblico e privato - XVII Salone dell'Arte del Restauro e della Conservazione dei Beni Culturali a Ambientali - Ferrara 24-27 Marzo 2010	Ministero per i beni e le attività culturali	Pagg 173-175, Il Polittico di Giotto della Pinacoteca Nazionale di Bologna: primo caso di applicazione di una nuova strumentazione per l'analisi FT-IR in situ. <i>D. Cauzzi, D. Sali</i>	2010	Ministero per i beni e le attività culturali
5	Studio mediante tecniche spettroscopiche delle opere pittoriche Notte Tempo (In Italia) e Senza Titolo di Mario Schifano	K. Tama, Tesi di Laurea. Relatori: A. Casoli, P. P. Lottici. Correlatore: D. Sali		2010	Università degli Studi di Parma, Corso di Laurea Specialistica in Scienze per i Beni Culturali
6	Il Polittico di Giotto nella Pinacoteca di Bologna - Nuove letture	D. Cauzzi, C. Seccaroni	Pagg. 52-57, Analisi FT-IR in situ con strumentazione portatile. <i>D. Cauzzi, D. Sali</i>	2009	Centro Di

- Bands for the Analysis of the $\text{CaSO}_4\text{-H}_2\text{O}$ System by Mid-Infrared Reflection Spectroscopy, *F. Rosi et al.*, App. Spec. 64, 8 (2010)
- CO_2 entrapment in natural ultramarine blue, *C. Miliani et al.*, Chem. Phys. Lett. 466, 148-151 (2008)
- Indagini FTIR in Riflettanza, *C. Miliani et al.*, in Raffaello: la rivelazione del colore. Il restauro della "Madonna del Cardellino" della Galleria degli Uffizi, a cura di *M. Ciatti, C. Frosinini, A. Natali, P. Riitano*, Firenze (2008)
- Fiber-Optic Fourier Transform Mid-Infrared Reflectance Spectroscopy: A Suitable Technique for in Situ Studies of Mural Paintings, *C. Miliani et al.*, Appl. Spec. 61, 293 (2007)
- Reflection anomalies related to $n=1$, *A. Roeseler and E-H Korte*, Vibr. Spec. 43, 145-163 (2007)
- Mid-Infrared Fiber Optics Reflectance Spectroscopy: a Non-Invasive Technique for Remote Analysis of Painted Layers. Part I – Technical Set Up, *Fabbri et al.*, Appl. Spec. 55 (2001) 420



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