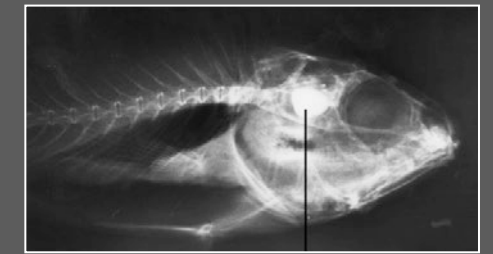
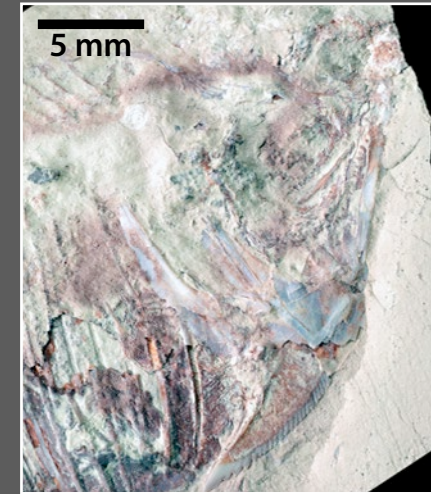


IPANEMA European ancient material synchrotron research platform

Loïc Bertrand

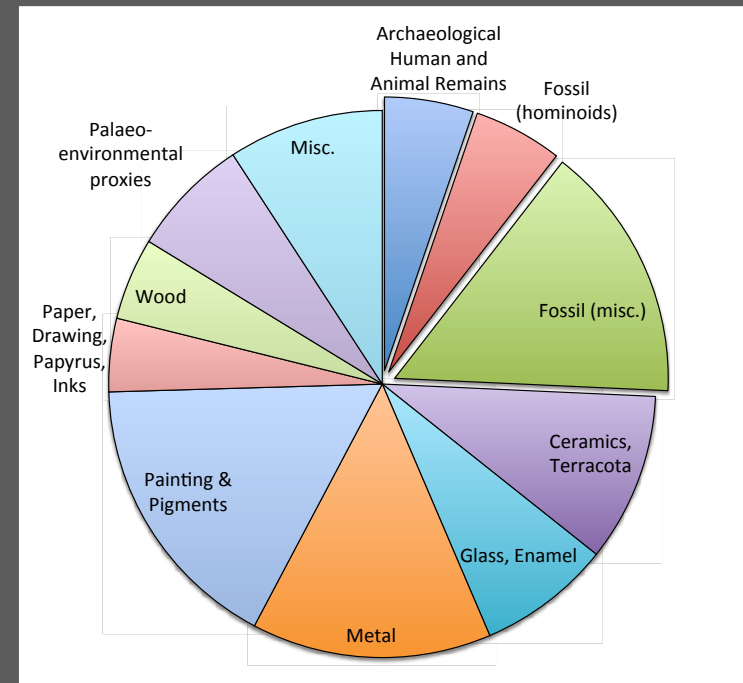


the only platform
dedicated to ancient materials
research at a large-scale facility



<http://hmita.geology.uiowa.edu>

in the context of the rapid
growth of the use of
synchrotron methods for
ancient materials: 50% of the
800+ publications are less than
5 year old!

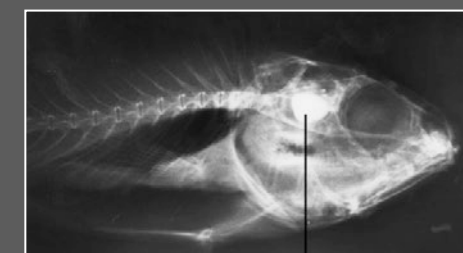
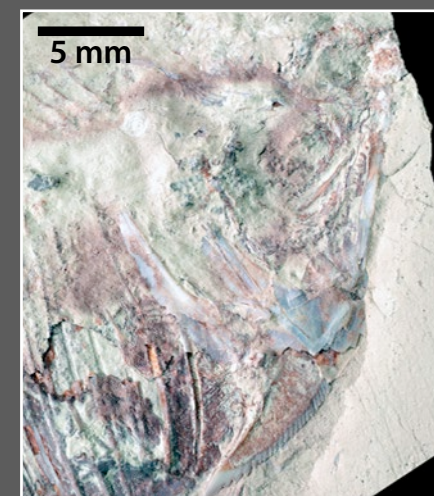


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<http://hmita.geology.uiowa.edu>



at Synchrotron SOLEIL,
Saclay, France (start: 2008)



new premises open in Sept.
2013 (laboratories, offices)



PUMA beamline optimised
for ancient materials studies



European and international consultation

3 × 4 working groups (100+ scientists)

numerous discussions

over the past 10 years: meetings, 4 conferences and satellite workshops, round table discussions, 5 international training schools...



European and international consultation

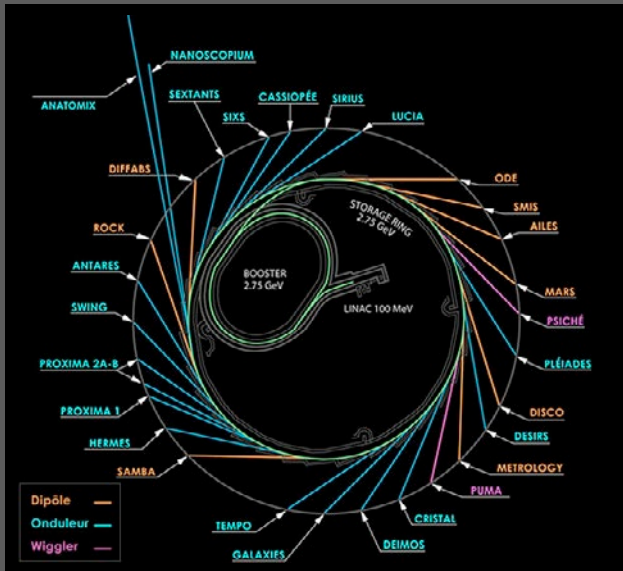
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direct feedback from projects and users

198 synchrotron projects submitted since 2008 (54% accepted) on **15** SOLEIL beamlines work at several other synchrotron facilities





European and international consultation

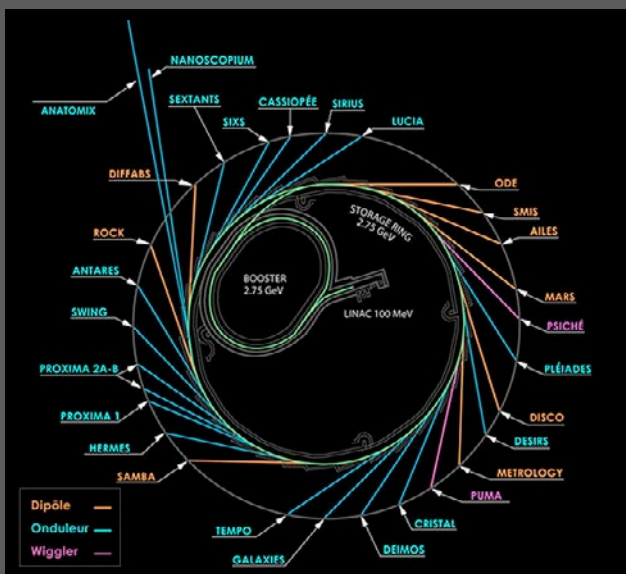
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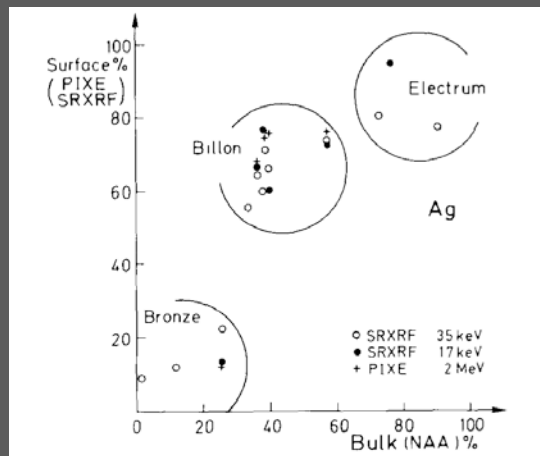
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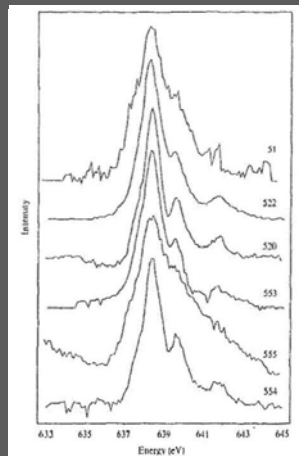


partners

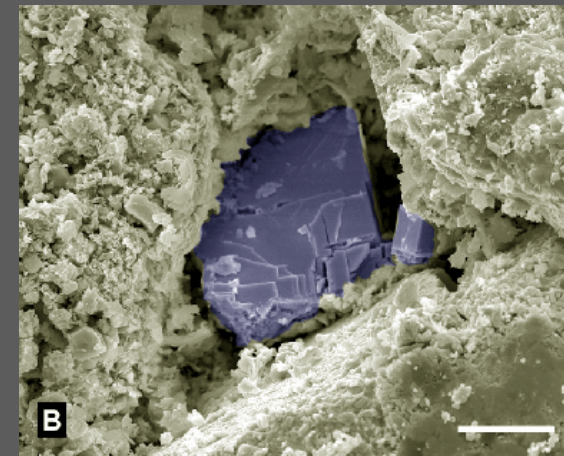
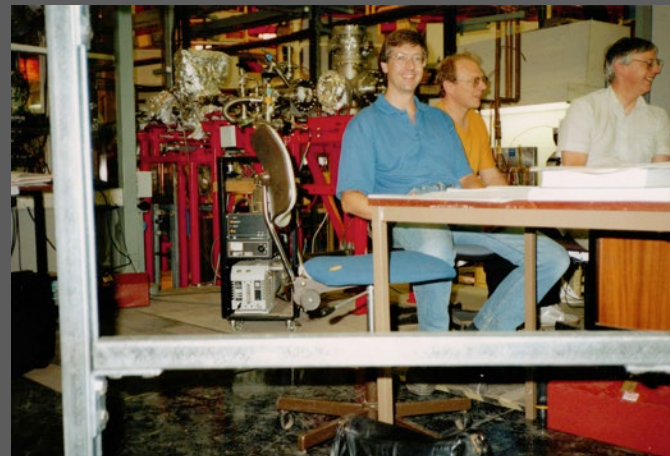




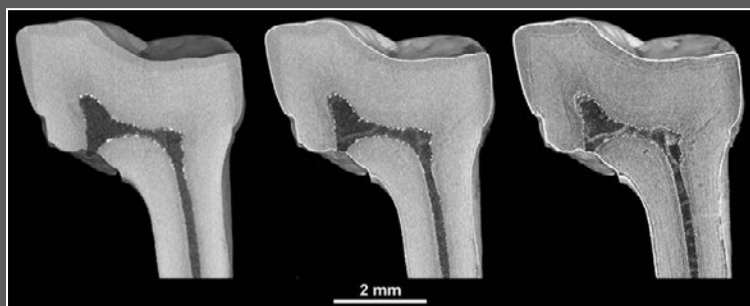
1989 P. Chevallier (LURE) *et al.* show that synchrotron XRF discriminates ancient Gaulish coins



1995 P. Schofield (London NHM) *et al.* study the color of ancient glasses by performing Fe and Mn X-ray speciation



1999 Ph. Walter (C2RMF) *et al.* demonstrate that Egyptians mastered lead chemistry to synthesise cosmetics



2006 P. Tafforeau (ESRF) *et al.* demonstrate the power of phase-contrast μ CT to image fossils



2008 J. Dik (TU Delft) *et al.* are able to visualise a hidden Van Gogh painting by scanning of an entire painting

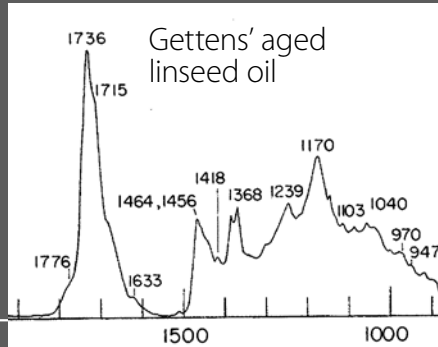


2010 J.-P. Échard (Musée de la Musique) *et al.* identify the process used by A. Stradivari to finish his musical instruments



cello from Jaques Boquay, bef. 1715

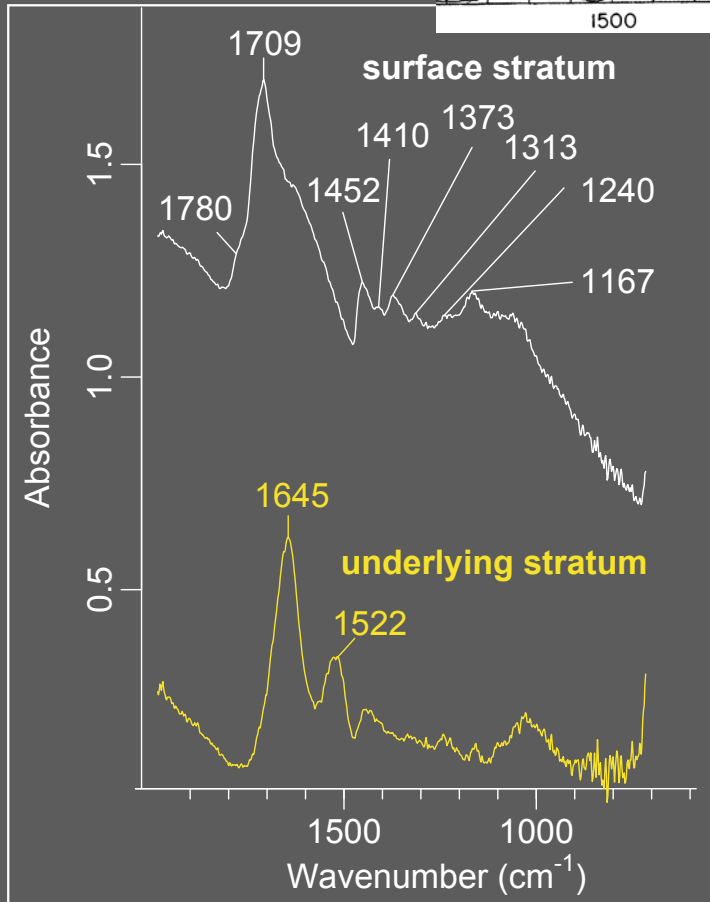
SR infrared spectroscopy,
10x10 μm^2



Meilunas et al., 1990

ancient materials are...

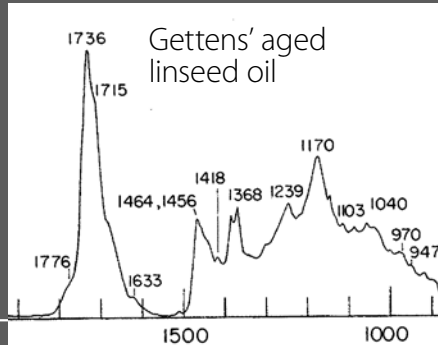
- essential for **Humanities and environmental research**
- interesting for their **long-term evolution**
- but also for their **out-of-equilibrium properties**
- **heterogenous** at all scales





cello from Jaques Boquay, bef. 1715

SR infrared spectroscopy,
10x10 μm^2



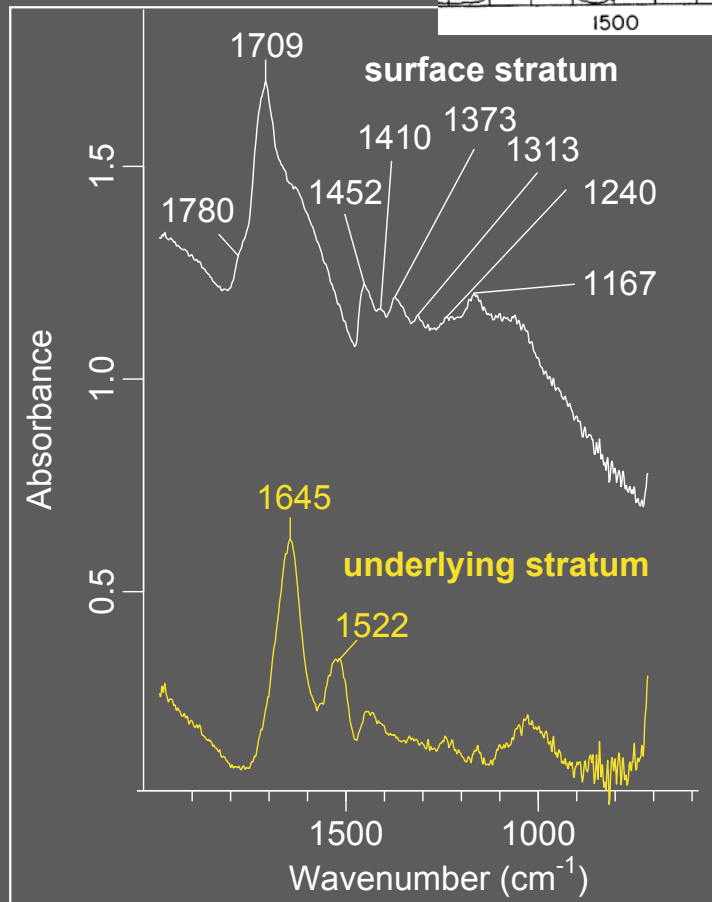
Meilunas et al., 1990

ancient materials are...

- essential for **Humanities and environmental research**
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... an analytical challenge

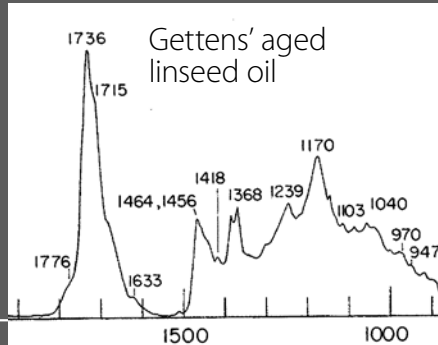
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- representativeness of results is critical
- validation of methods is difficult
- specific handling, sampling and conservation conditions often apply





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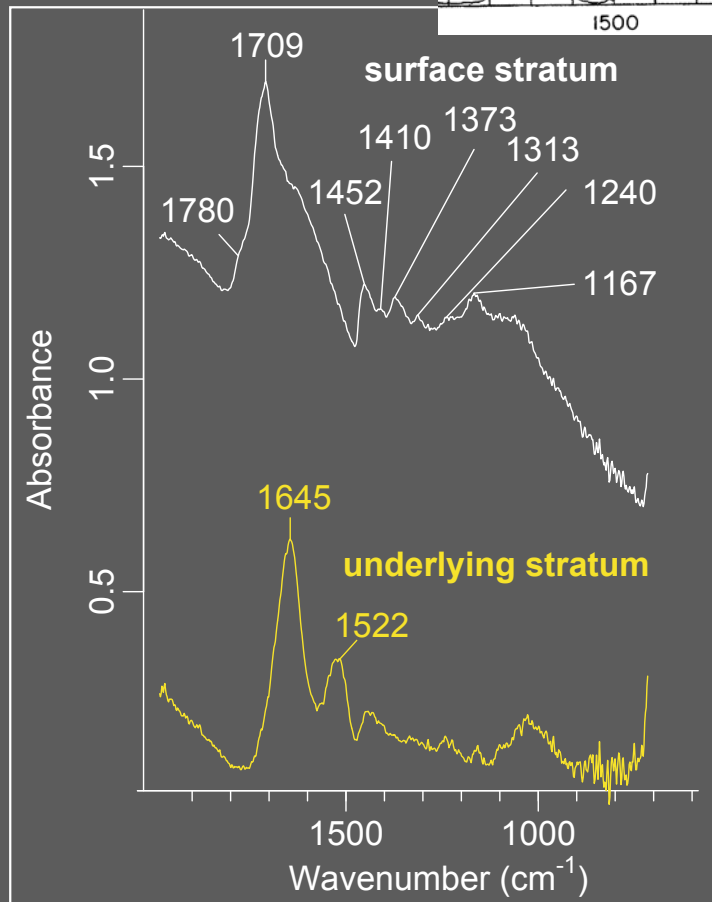
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... an analytical challenge

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... leading to organisational tours de force

- bridging distinct cultures around objects
- erratic lines of funding
- not a gimmick to advertise physics facilities



clarifying research targets

**work on corpuses and collections
rather than individual objects**



"Zinc white"
paints (ZnO)



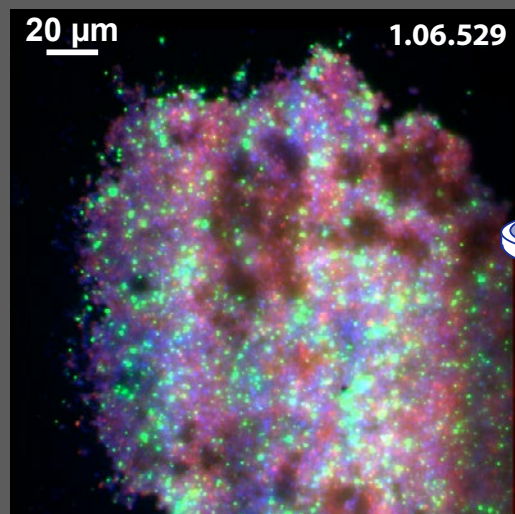
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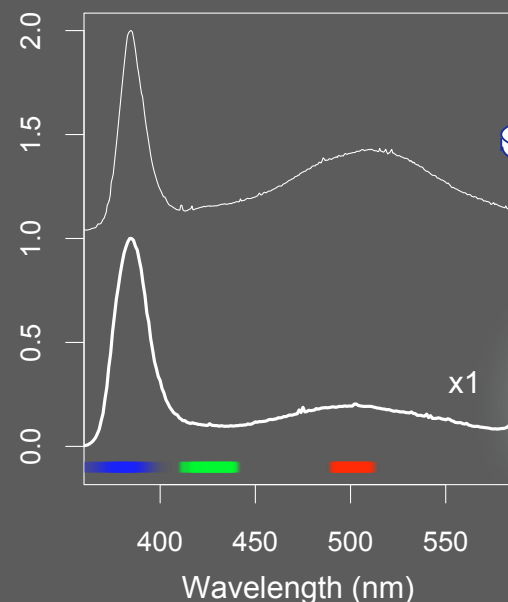
from day-to-day questions to fundamental
ancient materials research

corrosion of archaeological metals, diffusion of
consolidants, imaging of fossil microfauna, built
environment, rock art, preventive conservation...

high-resolution luminescence signature of heritage
materials, radiation damage mechanisms



40× obj.
pps: 320 nm



40× obj.
(20 μm)²



optical fibre
6 mm²

$\lambda_{\text{exc}} = 275 \text{ nm}$



"Zinc white"
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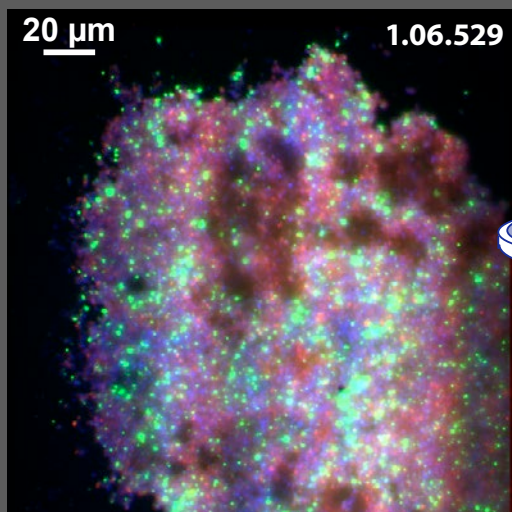
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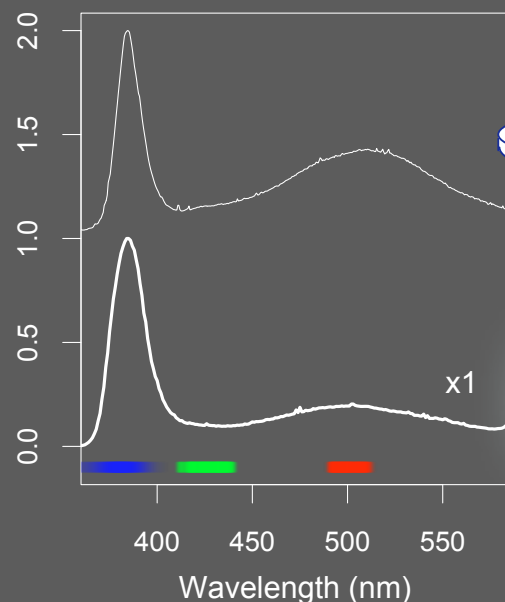


enhanced user support

sample preparation, data processing
presentation of instrumental capabilities
stability, calibration



40× obj.
pps: 320 nm



40× obj.
(20 μm)²



optical fibre
6 mm²

$\lambda_{\text{exc}} = 275 \text{ nm}$

developing novel methodologies

a step beyond mere use of existing methods

experiment preparation

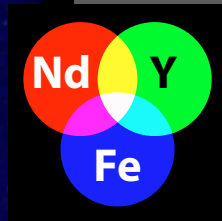
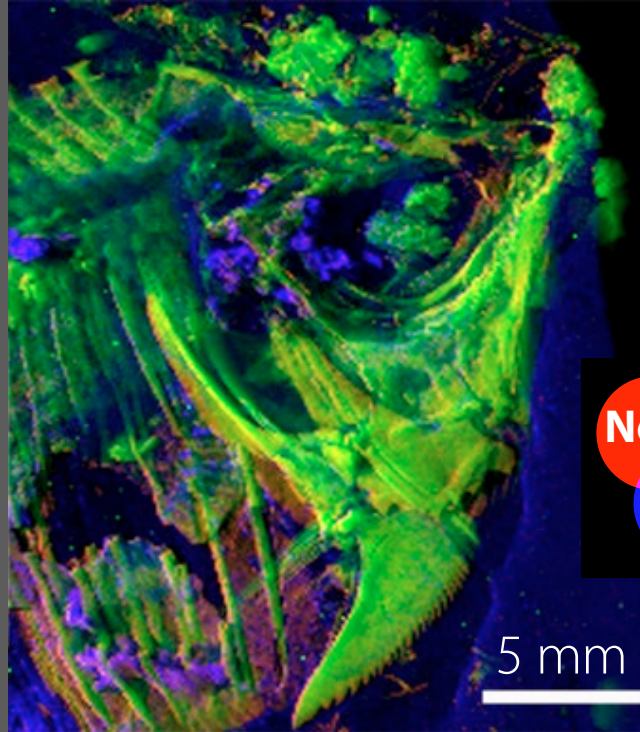
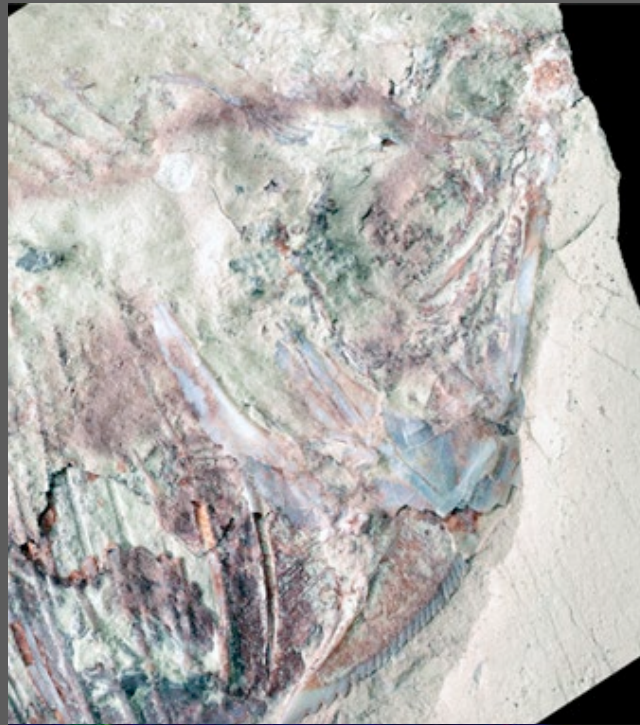
optimal sample preparation

data processing, mining and archival

improved processing software

image statistical analysis

Exceptionally preserved
Cretaceous flat fossils (100 Ma)



developing novel methodologies

a step beyond mere use of existing methods

experiment preparation

optimal sample preparation

data processing, mining and archival

improved processing software

image statistical analysis

new or improved instruments

developing dynamics (spatial, spectral) in imaging

UV luminescence imaging

X-ray scanning and 3D imaging

more quantitativeness

connecting existing instruments

towards a **better coordinated European and international environment** for ancient material characterisation?

improved service to users

practical know-how is central!

focus on medium-term projects

strict proposal evaluation based on ancient materials criteria

dedicated methodological research



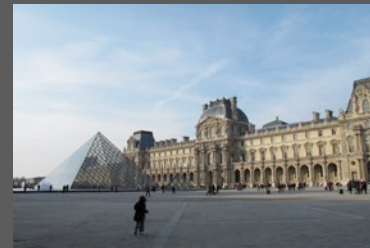
large-scale facilities



mobile platforms



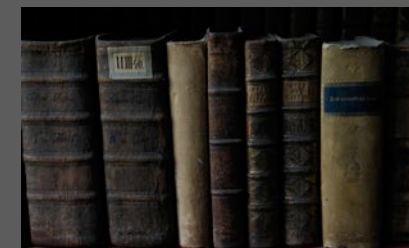
data repositories



museums



sites



archives

towards a **better coordinated European and international environment** for ancient material characterisation?

improved service to users

practical know-how is central!

focus on medium-term projects

strict proposal evaluation based on ancient materials criteria

dedicated methodological research

join involved infrastructures

connecting large-scale facilities: synchrotron, neutron, dating, laser...

interface with lab and portable instruments

joint instrumental development

heritage data curation

dissemination in the museum or at the site



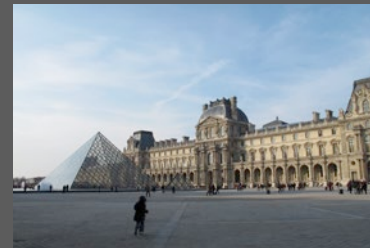
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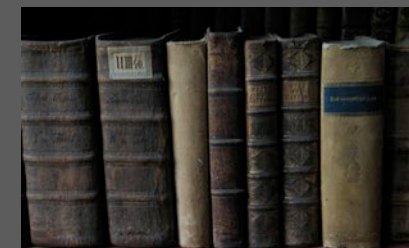
data repositories



museums



sites



archives

thank you for
your attention!



9–12 sept. 2014 Musée du Louvre, Paris

Synchrotron radiation and neutrons in art and archaeology Conference

Conférence Rayonnement synchrotron
et neutrons pour l'art et l'archéologie



Invited speakers

Matthias Alfeld
Emilie Chalmin
Catherine Dejoie
Trinitat Pradell
Ritimukta Sarangi
Marco Stampanoni

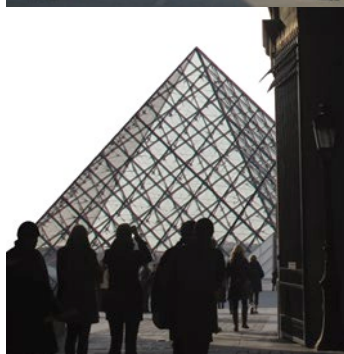
International scientific committee

Annemie Adriaens
Loïc Bertrand
Joris Dik
Koen Janssens
Aparva Metha
Jennifer Mass
Martin Radtke
Ina Reiche
Jean Susini
Josefina Pérez-Arategui
Robert van Langh



Public session Wednesday September 10, afternoon Louvre auditorium

*Session publique
10 septembre
après-midi
Auditorium du Louvre*
Uwe Bergmann
Robert van Langh
Philippe Sciau



www.sr2a-2014.org

deadline for abstract submission: April 15

organised by C2RMF, CRCC, IPANEMA, LAMS, LAPA, LRMH, The Louvre Museum,
MNHN Prehistory department and PATRIMA.

with the financial support of



9–12 Sept. 2014, Louvre museum, Paris
www.sr2a-2014.org

Deadline for abstract submission: **April 15**
Deadline for early registration: **June 15**