The PHySICAL project:

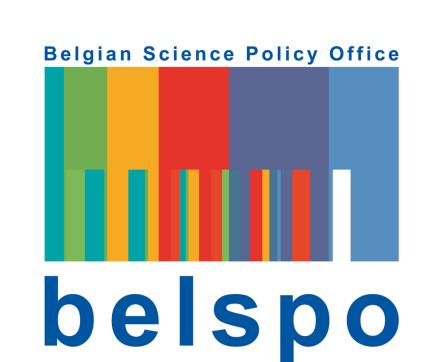
Research protocol applied on a Japanese buddha statue

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PROFOUND STUDY OF Hydrous and SOLVENT NTERACTIONS IN CLEANING ASIAN LACQUER

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Let's get PHySICAL

The research focuses on the scientific study of the interactions of solvents with lacquer surfaces to formulate "best practices" for cleaning Asian lacquers.

The emphasis is put upon possible changes in chemical as well as physical aspects of the lacquer through solvent and aqueous cleaning. Special attention is imposed to the lacquer collection of the Royal Museums of Art and History (RMAH), evaluating the current condition of the lacquerware and proposing strategies for safe cleaning and hence, concede their long-term preservation.

To elucidate the solvent/lacquer interactions chemical analyses are carried out at the Royal Institute for Cultural Heritage (KIK/IRPA) and Ghent University (UGhent), applying complementary chromatographic techniques. Evaluation of the visible aspects e.g. gloss, colour and physico-chemical surface pH investigations will be exploited by the RMAH staff.

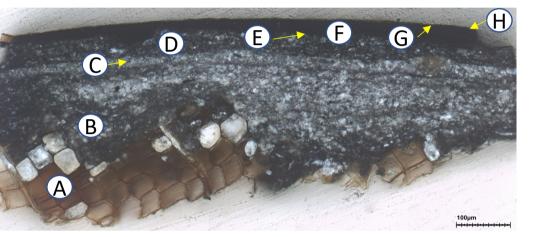
Amida descents for analysis

The Triade represents *Amida*, descending from the sky on the clouds, making the feast of charity and that of teaching, accompanied by Seishi, the hands in prayer, and Kannon holding the seat of the lotus for the soul of the dead. The archives provided us some information, like a letter dated 1st July 1957, addressed to the Chief Curator mentioning a legacy from a friend of the Museum, Mr Peeters. He describes the statue as follows: "A wooden statue representing the descent of Amida according to the vow: "If I can not appear before the one who would manifest the belief in my heart, accomplished all the virtues, emitted at the time of his death the desire to be reborn in my country, if I can not do that, I do not accept the enlightenment of Buddha."

The work is of good quality and interesting from an iconographic point of view: according to Peeters "it perfectly illustrates a very popular form of late Buddhism".

Study of literature on Asian Lacquer Selection and study objects from the Museum composition Reproduction of Asian Lacquer Literature study of cleaning of sensitive surface, international survey -> selection of solvents One layers samples Full layers samples Free films **Extraction tests** Sorption tests Physico-chemical parameters Analysis of extracts before and after solvents cleaning: Gloss, colour, pH, fluorescence Pre-concentrations LC-ToF/MS THM-Py-GC/MS Microtests on Museum objects Identification of extracted compounds Study of the interaction solvent-lacquer Formulation of a new solvent cleaning protocol Cleaning of a selected number of objects with Asian lacquer Research Dissemination to the specialists Progression of the research: done in progress to do

Optical light microscopy



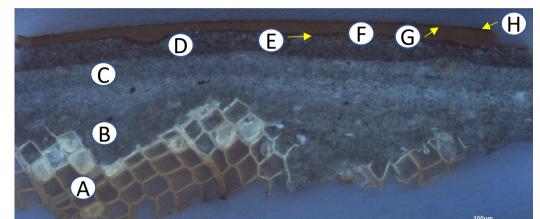


Figure 2,3: Cross-section under visible and ultraviolet (UV) light illumination. 200x magnification.

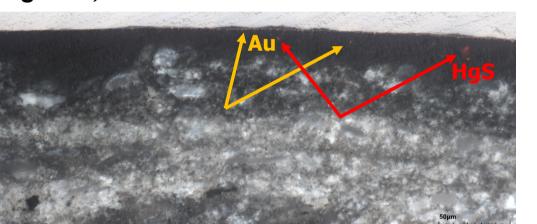
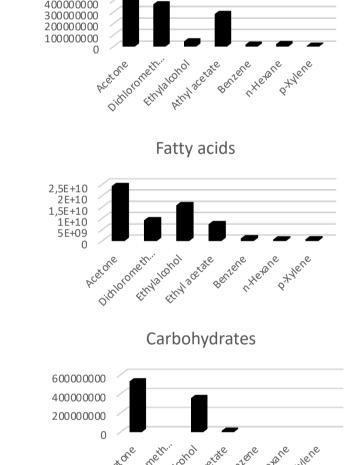


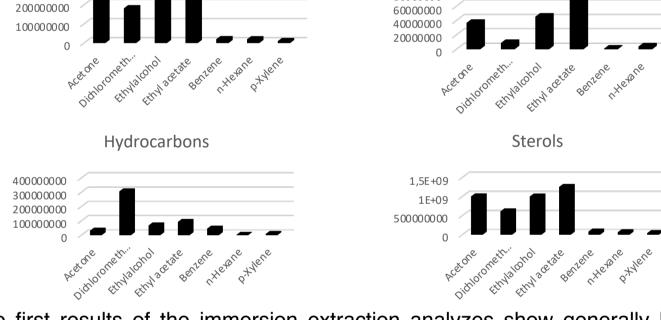


Figure 3,4: Cross-section under visible and ultraviolet (UV) light illumination. 500x magnification.

Splitless (BSTFA) GC/MS on single solvent immersion extractions



How it's done



The first results of the immersion extraction analyzes show generally high concentrations of lacquer monomers and degradation products in the polar extracts e.g. ethanol and acetone. Based on the results (which will be studied more in detail) the apolar solvents seem the safest option, they are however not very effective in terms of cleaning. To study the cleaning effect the mockups will be re-aged after immersion and studies will be performed on polar/apolar mixtures.

SEM-EDX analysis

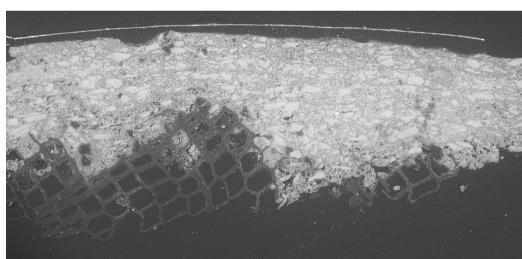


Figure 5: SEM image of the cross-section.

Figure 6: Layered Energy Dispersive X-Ray

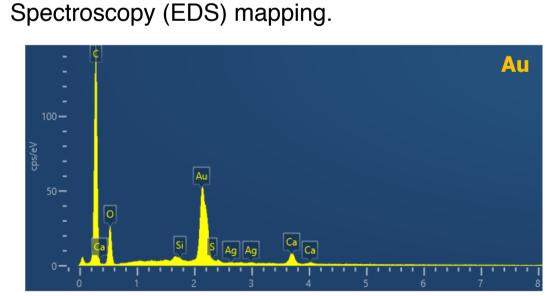


Figure 7: EDS-spectrum of Vermillion (HgS) in second lacquer layer F.

Figure 8: EDS-spectrum of gold (Au) in layer

Peak area % terpenoid components in layer F

Pinaceae

and History.

ayer Name

Gold layer

Second lacquer

First lacquer layer

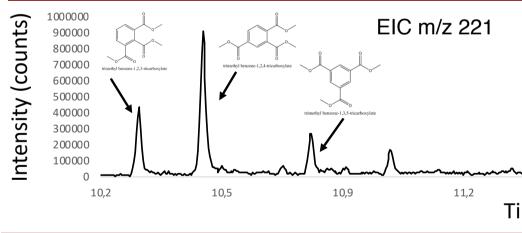
Py-GC/MS layer-by-layer analysis

Dipterocarpus

On O By B By B'By B'By B'By B'By B'By Ch

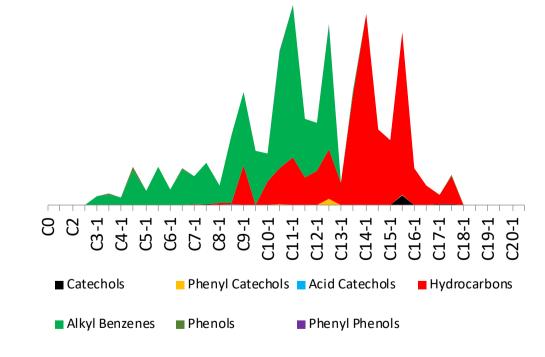
■ acid ■ keto-acid ■ keto-phenyl ■ phenyl

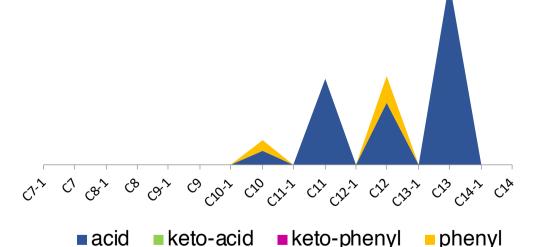
Py-GC/MS on surface extractables



In the surface extraction analyzes we identified a serie of carboxylated benzenes. This was performed by analyzing a water droplet that was left on the surface for 1 minute.. Till now its unknown how these components form, however its thought that they form from the alkenyl side chains of lacquer Time (min.)

Mock-up production and ageing



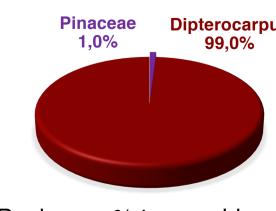


Graph VI: Gestalt graph representing peak areas of Asian lacquer (Anacard) marker molecules in the **TOW** mock-up.

Graph VII: Gestalt graphs representing peak areas of thitsi (Anacard) marker molecules in the **TOW** mock-up.



Thitsi Tung Oil Wood oil Figure 9: Production of the



Graph VIII: Constituents sample **TOW**

Ingredient Amount (%)

Peak area % terpenoid components in sample **TOW**

Phenyl Catechols Acid Catechols Hydrocarbons

Graph I, II, III: Gestalt graphs representing peak areas of Asian lacquer (Anacard) marker molecules.

Graph IV, V: Gestalt graphs representing peak areas of thitsi (Anacard) marker molecules.

Table I: Layer descriptions of the statue sample

Figure 11: Japanese Triade, 18th Century, Japan, EO.3319. Royal Museum of Art

Description

brownish transparent layer

Layer of thick black lacquer

Very thin brownish transparent layer

grey ground layer, quite compact although

Lower ground layer Dark grey ground layer, grainey and compact Inorganic material ((Ca, Si, Mg, Al?)

Third lacquer layer | Very thin transparent layer

We need you!

Experiences within the conservation work-field are needed to focus the PHySICAL research and take lacquer cleaning to the next level. For this we need your expertise! Would you like to help us and make the research applicable within the lacquer conservation community, then please take part in our survey. This first phase focusses on the materials and formulations used in the aqueous and solvent cleaning of Asian lacquer. The information gained will help to select or discard specific cleaning formulations.

Application materials such as gels, tissues etc. is an important part in a cleaning treatment, but will not be taken into account for the moment, as it is subject of the follow-up survey.

Survey QR Code





Acknowledgements

mock-up samples and ageing.

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Sampling area

Results of the

layer of urushi lacquer

analytical study

gold powder (Au) and thitsi lacquer.

Vermillion pigment (HgS), soot, gold powder (Au) and thitsi lacquer admixed

with wood oil (*Dipterocarpus sp.*), pine

Probably thitsi and soot? (not analyzed)

Proteinaceous binder (animal glue?) Inorganic material (Ca. Si. Mg. Al?) Proteinaceous binder(animal glue?)

