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# Archaeometrical contributions in the Japanese architecture in France: the lodges of Albert KAHN's gardens (Boulogne-Billancourt, France)

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Photo : Conseil général des Hauts-de-Seine



West lodge



East lodge

## AKAHN project

Albert Kahn's gardens are located in the Hauts-de-Seine, France. There are several buildings including two Japanese lodges brought back from Japan by Albert Kahn around 1900.

As part of AKAHN's project, they were restored in 2015 and 2016 using a traditional Japanese method: complete dismantling and reassembling. The aim of this project is to understand this heritage (origin, construction in Japan and in

## Introduction

France, etc.) through a multidisciplinary approach combining archaeology, archaeometry, architecture, history, 3D representations, etc.

The present study was conducted as part of the scientific part of the project. We decided to study the wood, main component of the buildings, but also painted plasters, unknown. The study was conducted in two parts: the first one in situ and with non-destructive methods before restoration and then the second one on samplings and laboratory analysis when restoration.



Photo : Catherine LAVIER

## Aims

- To obtain the necessary information for the restoration,
- An initial and as accurate as possible of its state before restoration,
- To advance research on these houses,
- To improve our knowledge of Japanese architecture in France and Europe,
- To exchange collected data with Japanese researchers to supply dendrometrical databases.



Photo : Google Maps

## Wood

### Dendrometry:

15 dendro-means were realized, up to 31 samples or covering over a period of 192 years: one with hardwood and the rest with softwood. However, they did not allow us to establish the date of the construction of these lodges.

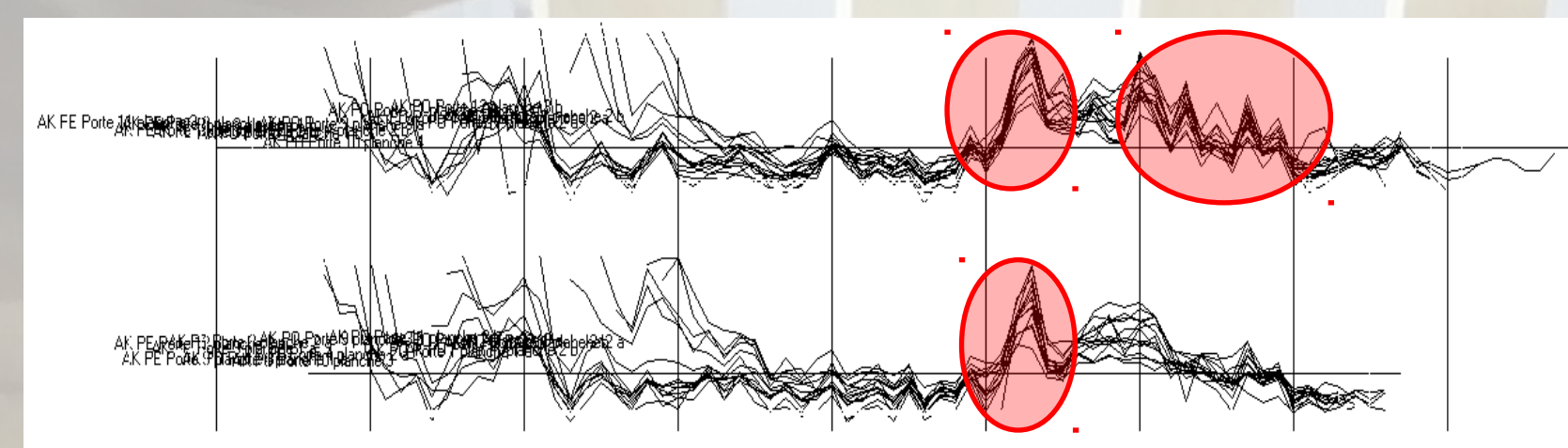


Figure 1: Mean 19: the two parts whose series have a specific and similar positive amplitude (in red).

The dendromorphology studies helped us to determine that some samples come from nearby trees and have similar growth characteristics (characteristic years; Figure 1). This permits us to establish that they were from the same kind of trees, the same forest and the same age.

Some averages contain wood from East and West houses proving that the timbers of these two buildings are from same areas and same periods. Both houses were probably built at the same time and with the same wood (Figure 2).

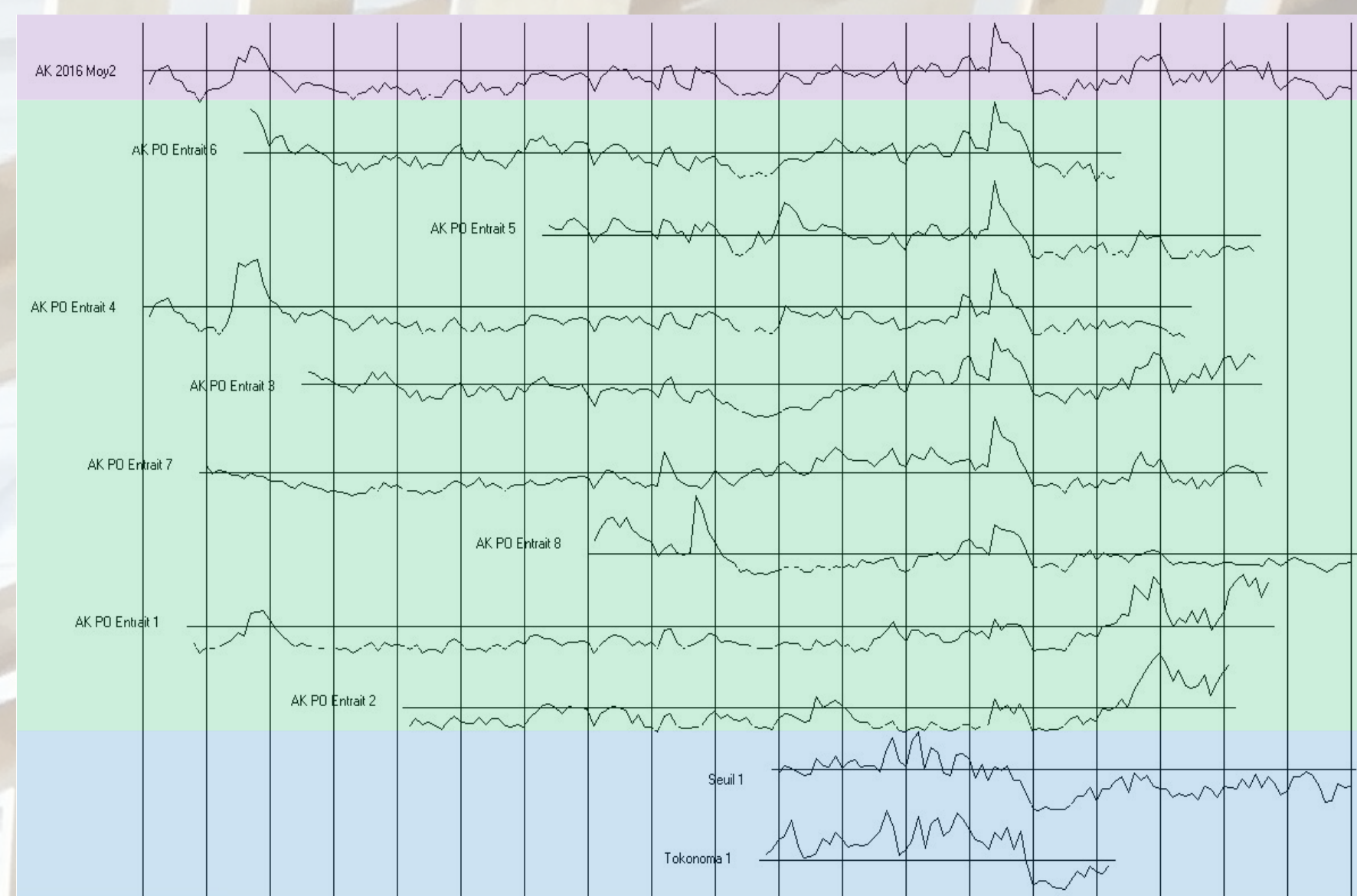


Figure 2: Mean "AK 2016 Moy 2" (in purple) incorporating elements from West house (in green) and East house (in blue).

### Xylology:

As the restoration work was only completed in June 2016, the majority of the wood is still being sampled. So far, we checked that some *Hinoki* cypress (*Chamaecyparis obtusa*), Japanese cedar *Sugi* (*Cryptomeria japonica*), *Sawara* cypress (*Chamaecyparis pisifera*), Himalayan cypress (*Cupressus torulosa*) and Larch (*Larix sp.*) were part of some of the timber used.

## Polychromies

### X-ray fluorescence (XRF):

The XRF analysis gave us to have a global vision of the paints used as well as the elements present in large quantities (major elements) such as calcium or zinc (Figure 3).

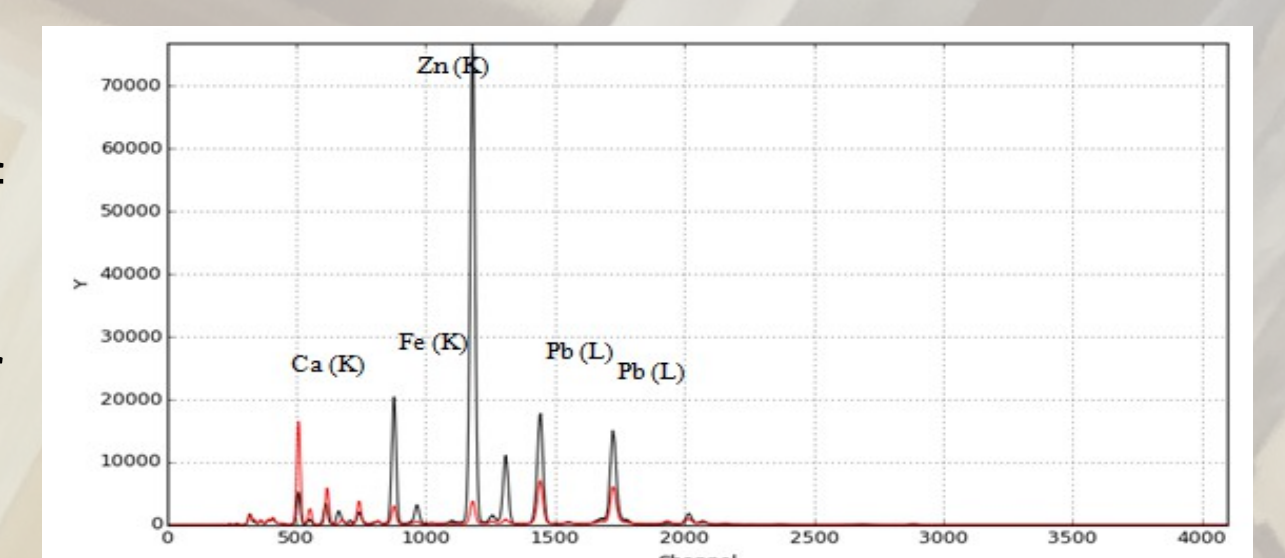
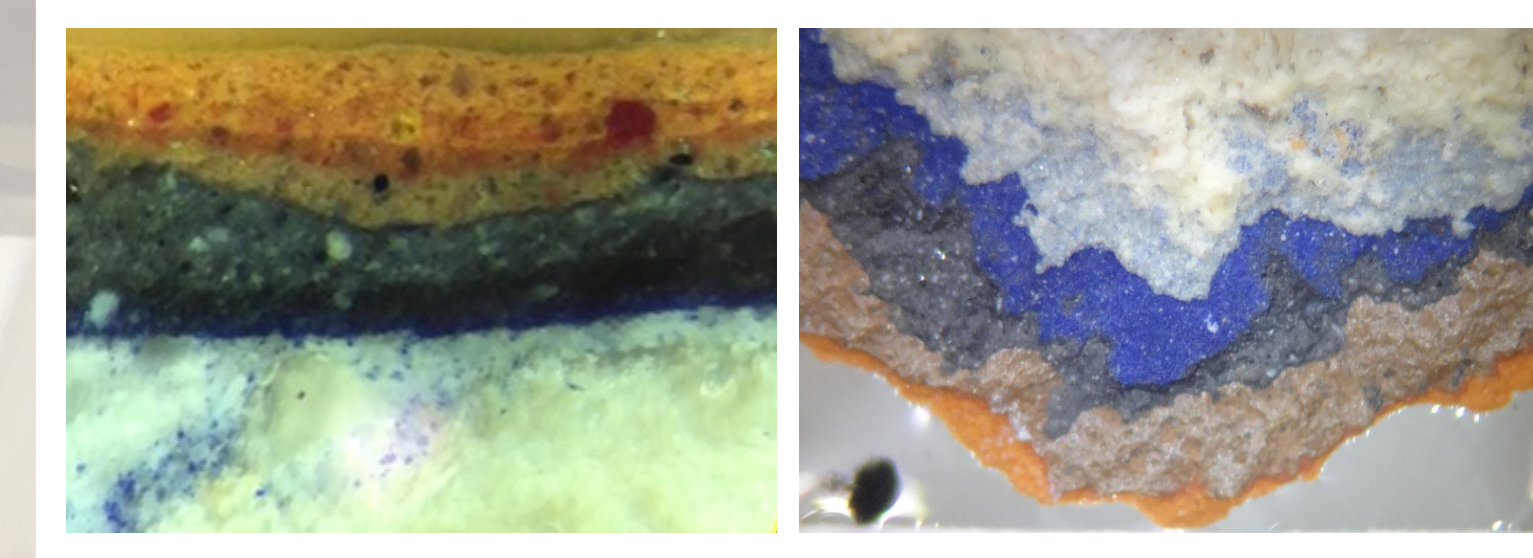


Figure 3: 2 orange paint spectra: the same elements are present, but their concentrations vary widely.

### Optical microscopy :



Observations by optical microscopy have allowed us to identify the blue paint (Figure 4) as the original one: it is present on a majority of restored painted plaster.

Figure 4: Left: cut; Right: view from below. Blue pigments are highly visible, which helps target the SEM-EDS analysis.

### Colorimetry:

We realized a lot of colorimetric measurements on different layers which gave us a better insight of the colors from the successive restorations.

### SEM-EDS (Scanning Electron Microscope):

Thanks to the analysis performed by SEM-EDS (Figure 5), the blue pigment was identified as synthetic ultramarine blue (or sodium aluminosilicate). It was used for restoration. We also found the presence of kaolinite (or potassium aluminosilicate).

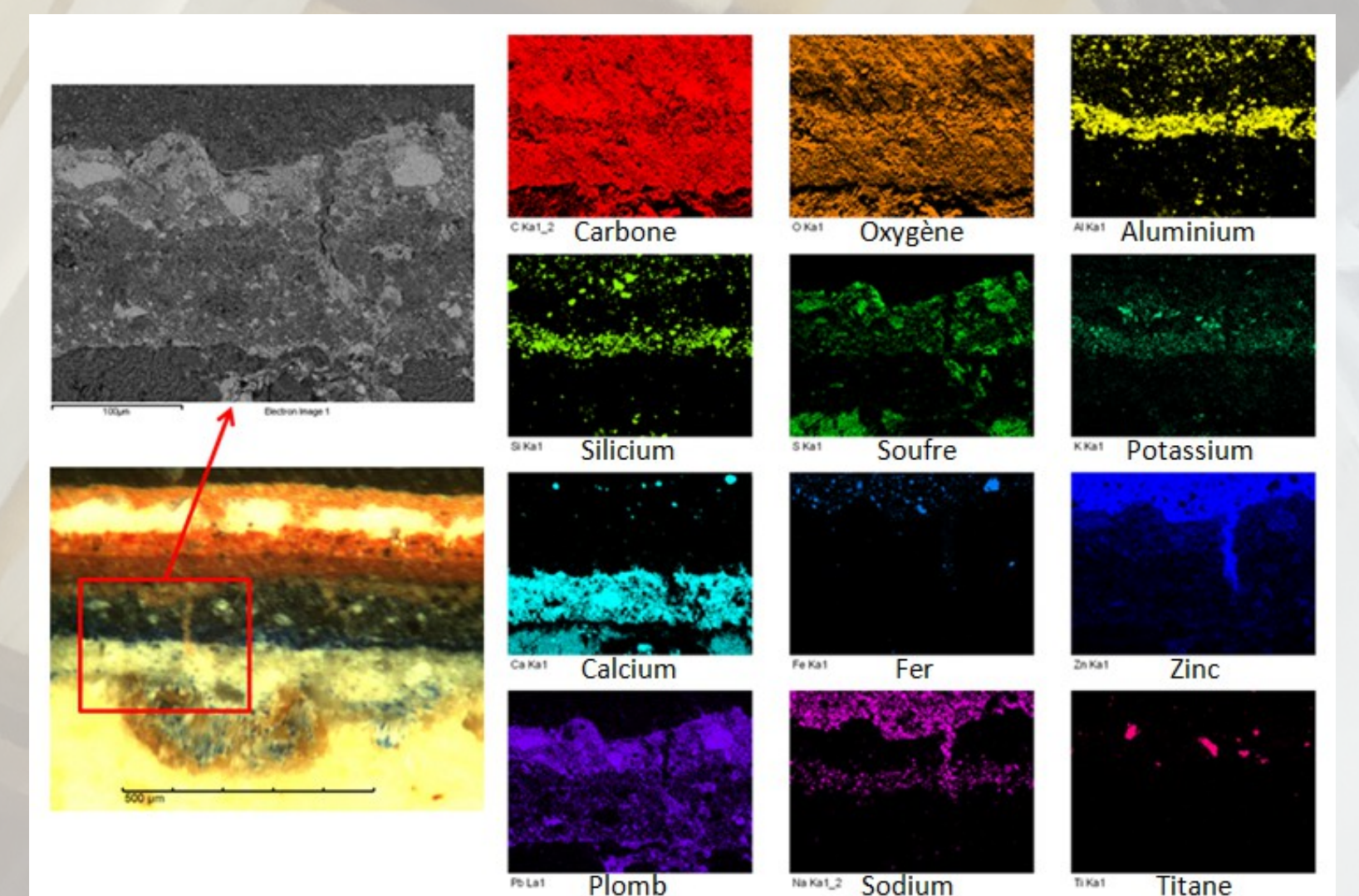


Figure 5: Map of an area of the sample AK14-2. The chemical elements are represented by different colors.

## Conclusion

WOODS: we already know that we are in the presence of multiple species. At the moment, the expected datings and provenance were not obtained because this part of project was ended in last June and that not reused timber just arrived in the laboratory. We can still say that some timbers of the two houses come from same areas which also confirm their contemporary building and that there were lots of timber prepared for both buildings and not separate lots by house. The xylological analysis helped us to identify species not expected for this kind of buildings: larch (*Larix sp.*) and Himalayan cypress (*Cupressus torulosa*) already indicating that supply circuits are larger than expected.



Left: East lodge being restored; Right: Blue paint test on plasterboard present on site.

POLYCHROMIES: numerous samples and systematical observation by optical microscope enabled us to define the

presence of blue on the deepest layer of several coats of paint. Thanks to SEM-EDS analysis, it was identified as ultramarine blue mixed with kaolinite. Colorimetric analysis coupled by optical microscope revealed a large number of restorations carried out in the 20<sup>th</sup> century, showing unknown interventions in the history of these pavilions.

Many archaeometric techniques were used and have already provided important information about the history of these two lodges, the information was used for restoration. The further dendrometrical analysis, combined with information from the carpenters-restorers will enable us to lead to new discoveries about the species, their provenance, their datings, etc. To be continued...