The Japanese Tower, commissioned by King Leopold II of Belgium in 1900 and designed by the French architect Alexandre Marcel, was finished and inaugurated in 1904. This building presents a remarkable variety of decorative techniques and materials, including Japanese lacquer executed using specific and complex decorative techniques. Preliminary research on the interior decorations allowed the rediscovery and highlighting of a large and unique collection of lacquerwork and architectural Japanese ornaments from the Edo and Meiji period, combined with European artefacts. This paper focuses on the study of the extensive use of Japanese lacquer found in the upper floors of the Tower. This focus was facilitated by collaboration with other specialists, which granted a better understanding of the secrets of this extraordinary piece of cultural heritage and the development of a preservation plan for the interior decoration.

Keywords: Urushi, Japanese lacquer, Japanese architecture, conservation, European and Japanese interior decoration

Introduction
The reddish silhouette of the Japanese Tower of Laeken in Brussels is well known in Belgium. Built along the border of the Royal Domain in early 1900, the tower was criticized as a whim of King Léopold II. Once built it was barely used; it was closed during the two World Wars and then from 1947 due to lack of funding — until recently, only its entrance hall and ground floor could be visited.

In 2010, the Belgian building agency requested a preliminary study of the upper floors of the building from the Fenikx Company (Fenikx bvba) with the aim of defining the work needed to re-evaluate and protect the tower. During this study, a substantial ornamental decorative scheme was revealed, part of which was realized in Japanese lacquer. The identification of the extensive use of Japanese lacquer in a significant number of decorative elements was revealed through archival and technical searches, scientific analyses, and collaboration with international specialists (Deceuninck et al., 2014).

Tower history and description
The Japanese Tower at the Royal Domain in Laeken dates to 1904 and is a combination of reused elements manufactured in Japan and a construction of the French architect Alexandre Marcel at the request of Leopold II, King of Belgium. The construction of the timberwork started in 1902 (Kozyreff, 2001). Even though Belgian craftsmen built the main part, the 35-m high building was initially assembled without nails in accordance with traditional Japanese techniques (Marcel, 1911).

Inspired by the temples of Nikko (Kozyreff, 2001), the architect adapted the interior decoration by mixing Japanese and European techniques and spread the overall design over several floors. He incorporated the entrance hall from the Panorama du Tour du Monde at the 1900 Paris Universal Exhibition, which had been purchased at the King’s request. To give the building an authentic cachet, the art dealer Maison Reynaud of Yokohama delivered much of the interior and exterior décor, including carved wooden doors and panels, gilded metallic plates, the first- and third-floor ceilings, furniture, silk and tatami mats (Bure, 1902). A range of materials, including paper, textiles, European and Japanese painting on wood, European and Japanese sculpture, European painting on canvas, glass, metal, and furniture were incorporated into the interior (Fig. 2).
The tower consists of six main chambers connected by an external stairwell with 10 intermediate levels. The interior was equipped with modern features such as running water, a lift, and central heating. The spiral staircase is decorated with panels of kinkarakawa-gami (Waillez, 2005) surrounded by frames decorated with aventurine (also known as bronzine), a European imitation of the Japanese technique of nashiji. The aventurine included metallic flakes (in this case copper) mixed with European varnish to give a gold-flecked appearance. The aventurine decoration had become green, due to corrosion of its copper constituents.

The first floor has a polychrome decoration based on the legend of Urashima Taro and a coffered ceiling representing musicians (Kozyreff, 2001). It was furnished for the King’s comfort and equipped with a hidden toilet and an extra heater. The second floor is now referred to as the green floor, but it could more accurately be described as the golden floor owing to the extensive application of aventurine to the large lacquered wall panels. In comparison to
the smaller flakes used for the nashiji decoration, comparatively, large flakes were used to achieve this decorative effect. This floor also has representations of mythical figures such as dragons. Originally, it had a painted vellum canopy ceiling, attributed to Jac Galand, showing a group of women in a landscape, which was probably inspired by a Japanese woodblock print by Utagawa Kunisada (Kozyreff, 2001). The painted textile is stored at the Museum of Art and History in Brussels.

The third floor incorporates the most Japanese nashiji decoration. This type of decoration is found throughout the tower, for example on the French window frames (Fig. 3), some sliding doors and on the frames of the carved panels. Nashiji is a type of decoration created by sprinkling small metal flakes on thinly coated lacquer — in this case, analysis revealed tin flakes sprinkled on a layer of red lacquer (Fenikx, 2013). When cured, the surface is coated with lacquer, cured, then smoothed and polished so that the sparkling effect of the flakes is seen through a layer of urushi. The technique is named for the Japanese pear (nashi) and powder may be sprinkled densely or sparsely. There is a magnificent ceiling similar to the first floor soffit but evoking animals, including remarkable openwork reliefs representing rising and diving dragons.

The fourth floor (Fig. 4) is known as the red floor owing to its red lacquered wooden panels and the high-quality carved columns. A large, matt Japanese painting on wood (1427 × 72.5 cm) depicting musicians covers the room’s upper walls, surrounding the viewer. The ceiling is decorated with a large 20 m² marouflaged painted canvas produced in 1904 by the French decorator Willemsen (Fenikx, 2013). This painting is influenced by a painting from Nikko temple and by a Japanese woodblock print of Utagawa Hiroshige (Kozyreff, 2001).

One of the tower’s main attractions is the exceptional panoramic view from the fifth floor, although the floor itself has suffered from construction imperfections over the years. Numerous elements are now missing or very damaged. The large wooden panels, comparable with the others in the tower, are finished
with black lacquer and, as on the second floor, the iconography focuses on animals, such as lions or monkeys. European craftsmen decorated the ceiling with marouflaged canvas paintings in the art nouveau style, which was very fashionable in the late nineteenth and early twentieth centuries.

Decorative components imported from Japan were installed in 1904. The construction process was slowed by structural defects and damage to the Japanese woodwork as a result of poor storage and significant water damage. Nevertheless, the tower was completed the same year, and the official inauguration took place on 6 May 1905 during the King’s annual garden party.

Despite its beauty and exoticism, on 26 March 1909, only four years after its inauguration, King Leopold II donated the tower to the Belgian state to be used as a commercial museum. Access was limited during the Second World War and in 1947 it was closed due to financial constraints. The first restoration campaign was undertaken in the early 1990s and mostly focused the entry hall and the main staircase leading to the ground floor of the tower.

Study methodology: a multidisciplinary approach
A study of the upper floors was carried out by Fenikx bvba between September 2010 and November 2013. The research methodology focused on comparisons between archival research, architectural, and material research in situ, and the results of scientific analysis. It led to the identification of the techniques used in each of the decorative elements, which were then mapped for future reference. A detailed record of damage to the decoration was compiled. This information was used to prioritize decorative elements for conservation and to help define treatment parameters.

In 2011, to ensure the problems of this delicate and highly unusual building were addressed with care, international experts were consulted to exchange views and discuss the various methodological, technical, and ethical issues. The visit of Professor William Coaldrake and Shigeru Kubodera in September 2012 was of major importance to understanding the tower’s history and style. They confirmed that the tower is an important cultural object that poses complex conservation challenges, stating:

Only a few places in Japan have a similar combination of decoration and architecture. The interior includes elements from the late Edo and Meiji periods. The latter was the culmination of decorative arts in Japan. The tower reflects this in the sophistication of crafts and technologies employed to decorate its interior, as the apparent extensive use of ikkei saishiki for the doors, pillars and panels will suffice to illustrate. (Coaldrake & Kubodera, 2012)

In addition, Yoshihiko Yamashita offered an overview of the materials and techniques used in lacquer conservation in Japan and contributed to the preservation plan for the interior decoration.
Lacquer decoration and results of analysis

The tower incorporates a wide range of decorative techniques, including a significant variety of Japanese lacquer, which was found on bas-relief, framework, sliding doors, ceilings, French windows, carved columns, and porticos. Several lacquer techniques were used, including monochrome lacquer (black, red, green, and yellow), with and without relief, metal powder and leaf (nashiji, maki-e and takamaki-e), and the architectural technique ikkei saishiki. Most of the monochrome lacquers in the tower are composed of two grey-brown ground layers, followed by the lacquer layers.

The ikkei saishiki technique was extensively used for the doors, pillars, and large panels (Fig. 5). It is a technique of extraordinary virtuosity and technical rigour that was developed in the first half of the seventeenth century and brought an important innovation to architectural decoration (Coaldrake & Kubodera, 2012). Traditionally, gold leaf was applied on the surface with Japanese animal glue (nikawa) or lacquer. Coloured layers, using pigments and nikawa, were then applied to create the polychrome parts of the design, leaving gold leaf exposed where required for contrast and decorative detail. Even though no gold leaf was identified, the tower contains an adaptation of this technique: a layer of lacquer on which coloured pigment mixed with nikawa was applied followed by the use of metallic powder to create the highlights of the design.

Scientific analysis — optical microscopy, scanning electron microscopy with energy-dispersive X-ray analysis, Fourier transform infra-red spectroscopy, high-performance liquid chromatography with diode-array detection, and pyrolysis gas chromatography-mass spectrometry — identified the use of urushi along with additives including plant juice and perilla oil in the upper coloured layers. A mixture of proteinaceous binder mixed with urushi lacquer was identified in the ground layers (Sanyova, 2013). The uppermost layers of the red lacquer (Fig. 6) were pigmented with mercury sulphide (HgS), whereas transparent black lacquer was used for the black finishing layers. Several types of smooth monochrome lacquer were observed on the frames of the sliding doors: red and black as described earlier, as well as transparent lacquer (on the fifth floor) and green seishitsu urushi (on the second floor: Fig. 7). Analysis revealed that the green lacquer was pigmented with a mixture of Prussian blue and artificial orpiment (Vermeulen et al., 2015).

Lacquer degradation in the tower

The lacquer in the tower exhibits extensive damage of varying degrees as a result of the history of the building and the passage of time. The damage is a complex matter and has different causes. The most frequently encountered damage is that caused by environmental factors, resulting in: severe flaking of the polychromy; salt contamination; insect and mould contamination; cracks in the wooden supports; fading, whitening, and other colour changes in the lacquer; oxidation; and surface dirt. The degree and type of damage depends on the storey, as exposure to sunlight, pollution, temperature changes, and relative humidity varies accordingly. Damage specific to the lacquer

Figure 5  The technique of seishitsu urushi on the carved column of the second floor. Image: courtesy of Fenikx bvba.

Figure 6  Red lacquer on the carved column of the third floor. Image: courtesy of Fenikx bvba.
includes fading and colour changes (Fig. 8), micro-cracking, flaking and lifting, powdering, and many types of loss, ranging from superficial losses to those that extend to and through the ground layers and substrate.

Some previous European interventions on the Japanese elements have resulted in degradation. Prior to assembly in the tower, certain elements were stored on the Styvenberg farm (Laeken) in poor conditions, resulting in a whitish appearance on some elements. As a result, some restoration was undertaken during their installation. Because the deterioration differs between decorative elements and their associated techniques, one of the major challenges is to achieve an overall aesthetic balance in the final result. Some damage is irreversible and this must be taken into account as conservation strategies are formulated.

Lacquer conservation challenges

The conservation of this building is a challenge because of its nature — a wooden structure that cannot be altered, which incorporates many types of decoration. This situation is further complicated by the need to conform to modern fire regulations and address security issues before the tower can be opened to the public.

The ethical and technical issues are complicated by ownership, location, and financial constraints. The tower is the property of the Belgian Buildings Agency, but located within the Royal Domain of Laeken, which is subject to stringent security requirements. The Museum of Art and History occupies the building but lacked financial means. Belgium’s political situation complicated matters further: following elections in 2010, it took more than 500 days to form a government. During this period most political decision-making was suspended, including that related to the Japanese Tower conservation project.

The general approach to the conservation of this building was determined after preliminary studies by a multidisciplinary team combined with consulting a range of international experts including architects, curators, scientists, and specialists in lacquer, lacquer
conservation, and preventive conservation. The objective is to conserve those parts of the building that are in good condition in their current state, to slow future degradation using preventive conservation and maintain homogeneity with limited and sympathetic conservation treatment where necessary.

It is known that photodegraded lacquer is very fragile and that the choice of methods and conservation approach is crucial to ensure optimal preservation. European and Japanese methods differ in ethics and material choices, and both present advantages and disadvantages. The conservation approach in Japan is to use the same material as the original, thereby preserving the object’s essence (Webb, 2000). This, however, can pose a problem to the reversibility and visibility that is valued in the West and emphasized in resulting conservation practice.

Research and exchange between Western and Japanese lacquer specialists convinced us that (when possible) the use of the Japanese technique will offer the best way to conserve the tower’s photodegraded lacquer (Yamashita & Rivers, 2011). However, this will still require study, because the use of lacquer-based material depends on the state of degradation, previous European interventions, the materials used in the original manufacture and the feasibility of such methods on architectural elements on this scale.

First conservation measures
During the winter of 2013, the Belgian Buildings Agency allocated funds for urgent conservation work. Much of the budget was used to address damage to the polychromy (securing the first- and third-floor ceilings, and treatment of mould on the entrance pillars of the first and third floor), while part was used to fund the installation of ultraviolet-blocking blinds, which were crucial for lacquer preservation. At the beginning of March 2016 the dusting of the staircase was undertaken by an interdisciplinary team including specialists in metal, paper, polychrome, and Asian lacquer conservation.

Conclusion
The Japanese Tower is of genuine historical interest in both Belgium and Japan. As a result, the Belgian Buildings Agency decided to take measures to preserve it. Preliminary studies highlighted the exchanges between Belgium and Japan before, during and after its construction. The cross-cultural exchange continued in the consideration of the conservation treatment and influenced the conservation–restoration approach that will be taken to preserve this exceptional example of Belgian–Japanese cultural heritage.

Cross-cultural exchange convinced the team to pursue Japanese approaches for some treatments and Western approaches for others. This will require collaboration between Japanese and Belgian specialists, as occurred during the building’s creation.

Preliminary research on the interior identified a large, varied, and unique collection of both European artefacts and Japanese lacquerwork and architectural ornaments from the Edo and Meiji periods. Research has demonstrated the exceptional character of the building although the Tower still holds, and may always hold, secrets.

Glossary
Nashiji
A type of decoration created by sprinkling small metal flakes on thinly coated lacquer. When cured, the surface is coated with lacquer, cured again then smoothed and polished so that the sparkling effect of the flakes is seen through a layer of urushi. The technique is named for the Japanese pear (nashi) and powder may be sprinkled densely or sparsely.

Kinkarakawa-gami/ kinkarakawakami
Japanese paper that imitates the European gilt leather (kinkarakawa) imported to Japan by the Dutch in the seventeenth and eighteenth centuries. Embossed paper with metal foil (tin, brass, etc.).

Makie
A type of decoration (sprinkled picture) created by drawing designs in lacquer on a surface, then sprinkling metal powder on top.

Seishitsu urushi
A Japanese term that indicates green lacquer. Absorbent yellow pigments, such as orpiment were immersed in an ai (indigo) dye solution to give a green colour that was then bound in transparent lacquer (suki-urushi) (Kato, 2005, p. 182).

Ikkei saishiki
A technique of extraordinary virtuosity and technical rigour. It was developed in the first- half of the seventeenth century and brought an important innovation to architectural decoration (Coaldrake & Kubodera, 2012). Traditionally, gold leaf was applied on the surface with Japanese animal glue (nikawa) or lacquer. Coloured layers, using pigments and nikawa, were then applied to create the polychrome parts of the design, leaving gold leaf exposed where required for contrast and decorative detail.

Takamakie
Raised makie decoration.

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References

Bure, P. 1902. Letter to the Baron Goffinet, June 27. Archives of the Royal Palace, Brussels, Documentary Collection No. 586.

Coaldrake, W. & Kubordera, S. 2012. Report on the Survey and Consultation Conducted at the Japanese Tower, Royal Castle Domain, Laeken, Brussels (unpublished).

Deceuninck, M., Decroly, M., Mesmaeker, D., Sanyova, J., Urban, F. & Verdonck, A. 2014. La tour japonaise dans le domaine royal de Laeken, brillance perdue de la décoration intérieure/De Japanse toren in het koninklijk domein van Laken, verloren glans van de interieurdecoratie in les actes du colloque. In: M. Buyle, ed. Lustré et brillance en conservation-restauration. Brussels: APROA-BRK, pp. 166–77.

Fenikx, 2013. Laeken Japanse toren materiaaltechnisch onderzoek. Ghent: Fenikx bvba (unpublished).

Kato, H. ed. 2005. Urushi 2005 International Course on Conservation of Japanese Lacquer. Tokyo: Tokyo National Research Institute for Cultural Properties.

Kozyreff, C. 2001. Songes d’Extrême-Asie. La Tour japonaise et le Pavillon chinois à Laeken Bruxelles. Anvers: Fonds Mercator.

Marcel, A. 1911. Tour japonaise de Laeken. Brussels: Archives of the Royal Palace.

Sanyova, J. 2013. Rapport d’analyse: Etude des matériaux et techniques des couches picturales. Brussels: Institut Royal du Patrimoine Artistique (unpublished).

Vermeulen, M., Sanyova, J. & Janssens, K. 2015. Identification of Artificial Orpiment in the Interior Decorations of the Japanese Tower in Laeken, Brussels, Belgium. Heritage Science, 3: 9.

Waillez, W. 2005. Les papiers peints japonais en Europe occidentale autour de 1900. In: J. Bridgland, ed. ICOM Committee for Conservation 14th Triennial Meeting the Hague Preprints. Los Angeles: Getty Conservation Institute, pp. 869–74.

Webb, M. 2000. Lacquer Technology and Conservation: A Comprehensive Guide to the Technology and Conservation of Asian and European Lacquer. Oxford: Butterworth-Heinemann.

Yamashita, Y. & Rivers, S. 2011. Conservation of the Photodegraded Surface of the Mazarin Chest. In: S. Rivers, R. Faulkner & B. Pretzel, eds. East Asian Lacquer: Material Culture, Science and Conservation. London: Archetype, pp. 208–16.