Tracing the making of the painted stone portal of Ryning Palace, Stockholm

Anna Henningsson and Alexandru Babos

Abstract The potential knowledge that can be obtained from the remaining traces of paint found on stone façades has often been underestimated and far from investigated to a desirable extent. In 2010 the National Property Board of Sweden applied a new investigative approach to examine two stone portals built in 1644 at Ryning Palace with the aim of understanding the painter's application process and the materials that were used. This study was novel in a Swedish context because it utilised a six-step approach which focused on the evaluation of the findings from the *in situ* examination. This allowed tracing of the paint application process and a more precise material identification. The results are interesting because they reveal two different painting techniques. The findings from the sandstone of the east portal show that the binding medium did not consist solely of oil. The discovery of binding media such as oil tempera paint and lime-casein contradicts the common belief that sandstone in Sweden was painted mainly with linseed oil. The results highlight that different stone types were sometimes painted with different materials in the 17th century.

Keywords architectural paint, painted stone, technical art history, *in situ* examination, ultraviolet illumination, *in situ* microscopy, investigation strategy, paint layer stratigraphy, working process, painter's execution process

Introduction

Historically, outdoor painted stone was very common in Sweden just as in other European countries. Today, however, only very small traces of such work remain. In Sweden, these small fragments of decorations on portals and façades have been an overlooked and underestimated area of the Swedish cultural heritage. During the maintenance of façades, the millimetre-sized paint traces that today appear black or grey have usually been misinterpreted and considered to be dirt or secondary paint without any research value (Figs 1 and 2). As a result of this, the remains of original paint in Sweden were often removed during regular building maintenance.

Although painted outdoor architectural stone details are carriers of valuable historic information as well as vital stories for enriching the cultural heritage, research into such artefacts has been sparse. A survey undertaken as part of a research project at the Swedish National Heritage Board in 2005 revealed that in the last 30 years only short written reports of the appearance of paint traces on historic outdoor painted stone have been produced. Sampling for pigment identification was carried out in only a few cases. Stratigraphic examination of paint layers complemented with analyses of binding media and pigments is very rare (Claesson and Henningsson 2011: 11–12). A change in the methods for investigating painted stone was requested during the late 1970s, when the Swedish National Heritage Board highlighted the need for tracing the application process[1] used by the painters on different types of integrated architectural stone in Swedish buildings (Claesson and Henningsson 2011: 9). Inspired by the results of international research projects (Drewello and Herkner 2009; Hartleitner 2011), the National Property Board developed a new approach to examining outdoor painted stone in 2010. Using Ryning Palace and its stone portals from around 1640 as a case study,[2] the aim of the project was to gain insights into the painter's application process and the materials used in order to achieve the intended visual impression.

This paper presents the new investigative approach adopted by the National Property Board, and describes its application in a study of the stone portals of Ryning Palace in Stockholm.

The case study

Ryning Palace, located next to a canal in the old town of Stockholm, was built between 1640 and 1644 by Admiral Erik Ryning and consists of a main building facing the main street with wings around a courtyard (Fig. 3). The palace still has its four stone portals from that period, two of which are located in the main building and two belonging to the former gatehouse. These are some of the most valuable and well-preserved portals in the old town and are important examples of the Swedish Renaissance art of North German and Dutch origins. The portal on the main street at the entrance of the main building is the most elaborate with raised ornaments

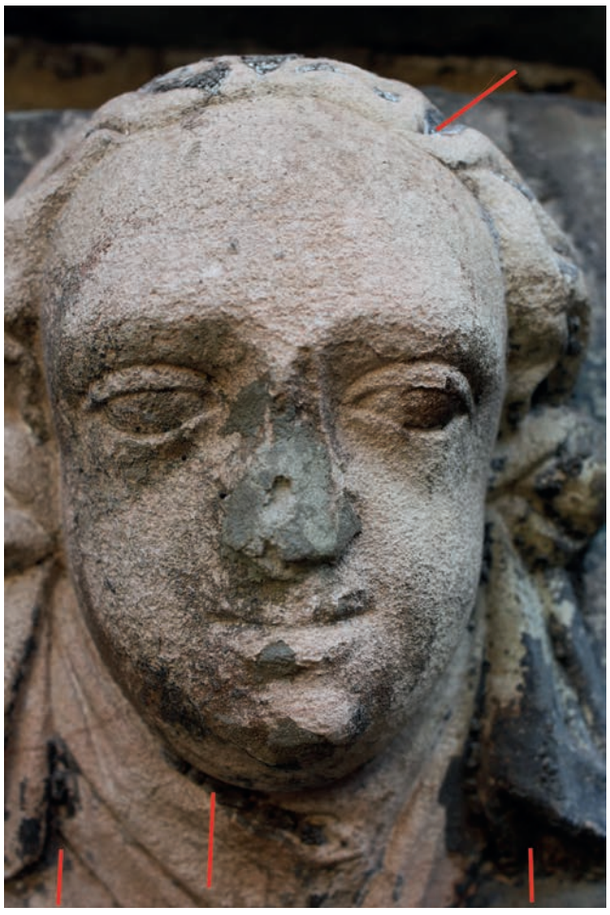

Figure 1 The millimetre-sized paint traces on stone (red marking) that today appear black or grey have been misinterpreted and considered to be dirt or secondary paint without any value. (Photo: Anna Henningsson)

Figure 2 Upper part of the east port of Ryning Palace. The historic paint traces on the stone appear black or grey and are often not investigated prior to maintenance of the façade. (Photo: Anna Henningsson)

and is attributed to a Dutch stonemason from Haarlem, named Aris Claezon (Axel-Nilsson 1950: 228–9) (Fig. 4). Of the two portals of the gatehouse, one faces the courtyard and the other faces the street along the canal.

All four portals are made of a combination of limestone and sandstone, and the extent of the paint layers became obvious during the conservation treatments in 2010. Only the two portals facing the courtyard – the east portal at the main building and the west portal at the former gatehouse – were part of the investigation described in this paper (Fig. 5). The locations of the different stone materials in both of the portals were visualised through mapping of the stone varieties. Historic paint layers were available on all of the different stone types found in the portals.

Investigation strategy

The common goal of architectural paint research is to understand the relationships between paint layers and building alterations and to match these with archival data. The owners or managers of historic buildings usually commission architectural paint studies in order to obtain information for maintenance purposes or for the reconstruction of a colour scheme from a certain period in the building's history. The potential to narrate the history of the painting process and the historical materials that had been applied is seldom highlighted in such investigations.

This investigation focused on gaining insights into the painter's process and acquiring knowledge of the materials used to achieve the intended visual impression. This focus can be useful for making conservation decisions, for international studies comparing craftsmen's working methods, and for presenting long-lost knowledge to a new audience.

The very small paint fragments on outdoor stone are most valuable while they remain attached to the original stone so they should, therefore, be left in this context as much as possible during the analysis to enable interpretation of the original application process. Thus, sampling for laboratory analyses should be kept to a minimum. The investigation strategy used here was based on a systematic procedure consisting of six steps with clear decision points. Each step involved different activities and outcomes.

1 In situ *visual examination*

The first step was to collect as much available information on the object as possible followed by on-site assessment of the paint layers in their original context. In this case, available written records and other sources of information on the original methods and materials used by 17th-century painters were very limited. To gain insight into the working process used almost 400 years ago at Ryning Palace, the investigation first focused on a systematic examination of the surface of the stone before any samples or laboratory analyses were undertaken. The paint layers were thoroughly examined *in situ* at magnifications up to ×190. In addition, ultraviolet (UV) illumination with the aid of digital microscopy provided initial information about the type of pigments and binders used in the different layers. The layers were documented using microphotographs, macrophotographs and graphical mapping. The aim was to collect information on the stratigraphy of the layers *in situ* before any sampling was undertaken. The expectation was that this *in situ* examination could provide more contextual information on the interaction between the stone and the first paint layer. This

Figure 3 Ryning Palace, located next to a canal in the old town of Stockholm, was built between 1640 and 1644 by Admiral Erik Ryning and consists of a main building facing the main street and wings around a courtyard. (Photo: Alexandru Babos)

Figure 4 Ornament from the portal at the main street entrance of the main building that is attributed to a Dutch stonemason from Haarlem named Aris Claezon. (Photo: Anna Henningsson)

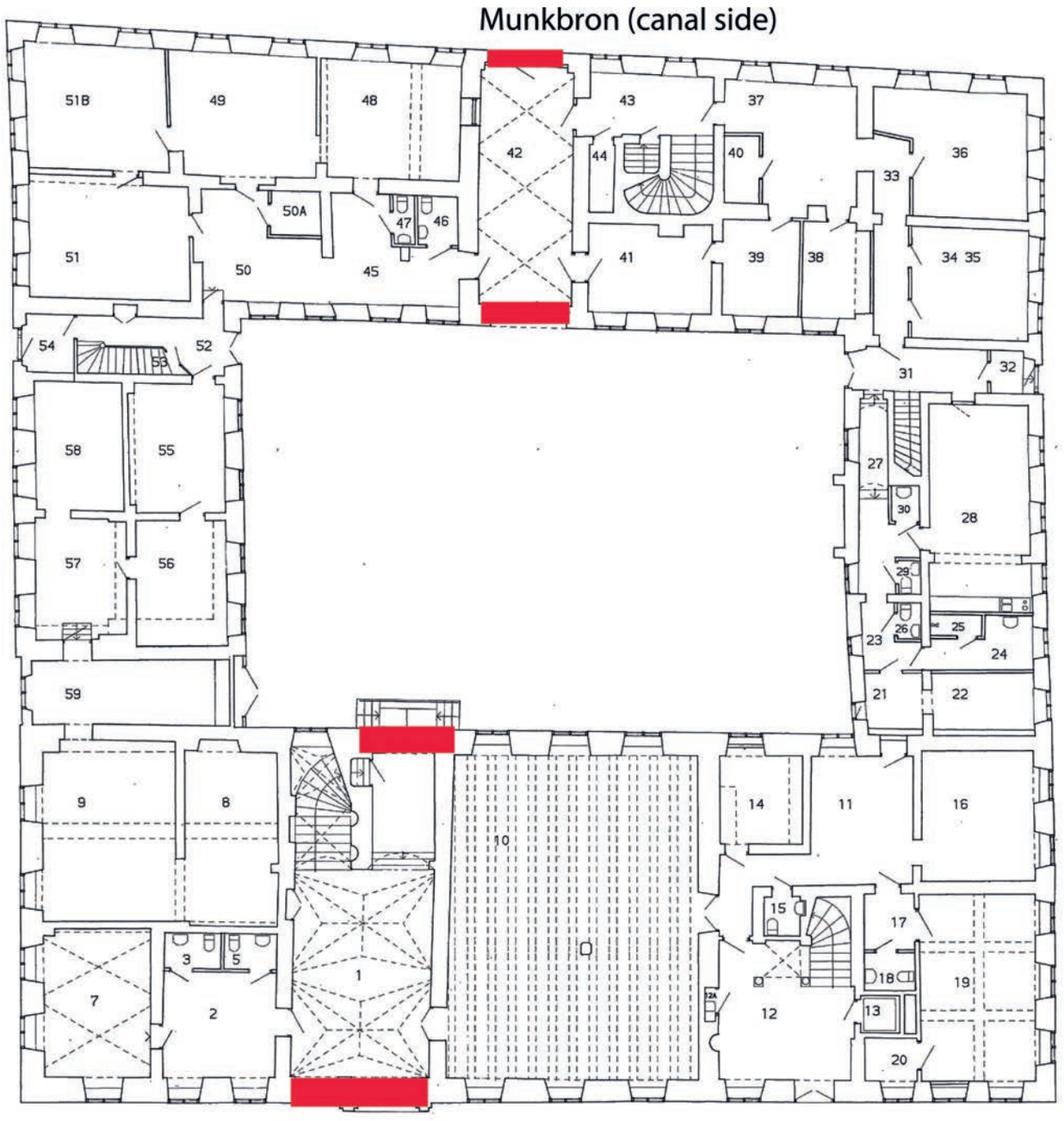

Figure 5 Red markings show the location of the four stone portals at Ryning Palace. The two portals facing the courtyard were investigated between 2010 and 2012. (Drawing: Swedish Property Board Archives)

step is often not performed and, as a consequence, information on the interaction between the stone and the first preparatory layer might be overlooked during the removal of samples.

2 Interpretation of the in situ *examination*

The stratigraphic documentation of the examined areas was carefully evaluated using advanced digital image analysis before deciding where and what to sample for further analysis.[3] In addition, an evaluation of the location of the findings and their distribution on the portal architecture was an important part of this step. The locations of the findings had to be correlated to the different stone types in the portal. During this step in the process, it was also important to evaluate the degree of weathering in the examined areas. Based on this evaluation, a scenario was established regarding the possibilities of laboratory material identification.

3 Visual questionnaire for material identification

The result of this step was a basic visual questionnaire with precise questions supported by photos, drawings, and mappings (Fig. 6). It made it possible to specify and prioritise

the materials that were relevant for laboratory analyses in relation to the project's aim of clarifying the painter's process. The initial *in situ* stratigraphic examination and subsequent interpretation (steps 1 and 2) were the basis for communicating the observations more precisely within the working group, and allowed specific questions to be addressed regarding the identification of the materials in the different layers observed in the *in situ* examination under magnification and UV illumination. The visual questionnaire also served as a first initial report to the different parties involved and as a teaching tool for communicating the results during the ongoing investigation.

4 Sampling

Based on the assessment of steps 1–3, a limited number of samples were taken for laboratory material identification. Because the microscopic studies in steps 1 and 2 provided good insight into the stratigraphy of the layers, the need for sampling for cross-section studies was reduced. Sampling could thus focus on investigating the materials used in the first original layers dating back to 1640, which was the primary aim of this investigation.

5 Material identification of samples

The composition of the first layers in the samples was analysed using microchemical spot testing, Fourier transform infrared (FTIR) spectroscopy and, in some cases, scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDX). Each sample taken for analysis had a clear and specific set of questions to address, which had been developed in step 3. The aim was to confirm the layer stratigraphy collected *in situ* and to obtain information on the material composition of the ground layers and the original paint layers. The main questions to address in this step were which binding medium was used for the ground layer and the appearance of the first paint layer.

6 Interpretation of results from steps 1–5

By comparing the results of the *in situ* evaluation with the technical and chemical identification of the materials in the samples, the original painting process could be reconstructed as far as possible. At this point it became evident that the interpretation step of the *in situ* examination (step 2) was essential for the outcome of step 4 (the sampling) and the interpretation of the material analyses (step 5) of the specific layers in the samples.

Results of the investigation

The visual site examinations as well as the chemical and physical material identification using FTIR and SEM-EDX revealed that the two portals were painted using different processes and materials.

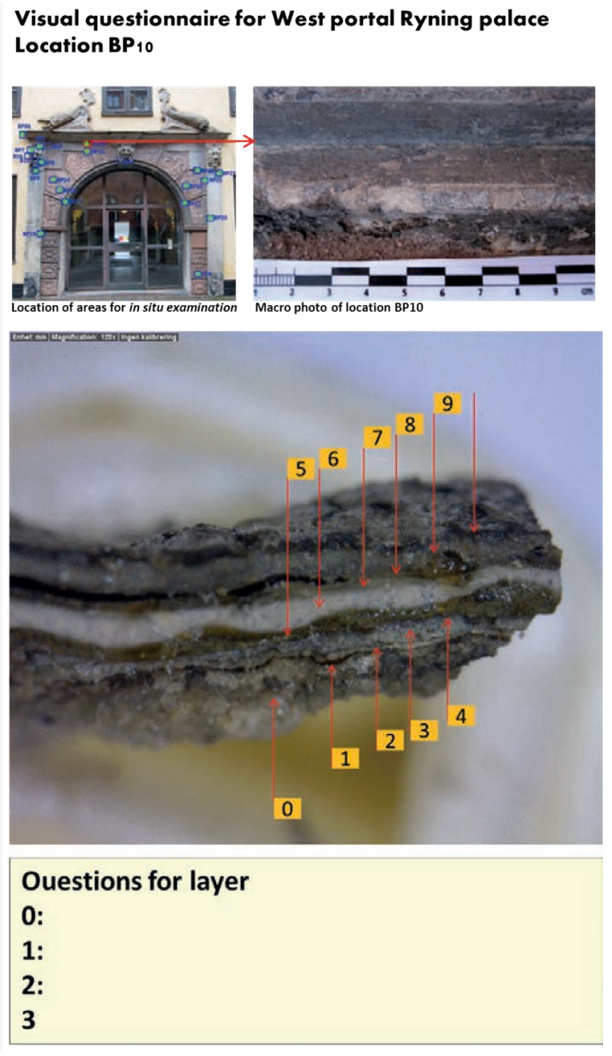

Figure 6 The form for the visual questionnaire showing the microphotographs from the *in situ* examination. This form was used for pinpointing the specific questions to be addressed during the identification of the material in the different layers. The visual questionnaire was an important communication tool. (Photo: Anna Henningsson)

West portal

The site examination, with the aid of magnification under both normal and UV light, showed that the sandstone on the west portal was prepared before the first layer of paint was applied (Fig. 7). UV illumination revealed the presence of a preparatory layer of an oil medium, and it appears that the sandstone had been treated with oil before the application of the first layer of white ground followed by a white paint layer. FTIR showed that the first layer that was applied to the oil-treated sandstone contained calcium carbonate, silica and a small amount of lead white pigment in an oil-based binding medium. This first layer constituted the ground layer on the sandstone. The silica that was identified was in the form of fine aggregates for the lime ground. The low amount of lead white is an indication that this served as a siccative in this layer. In the following layer, lead white occurs as the only pigment in an oil medium.[4] The strong interaction between the ground layer and the first paint layer as well as the absence

Figure 7 The west portal of Ryning Palace. (Photo: Anna Henningsson)

of a layer of dirt between these layers confirm that the first white layer can be dated to the 1640s. These findings strongly suggest that the sandstone on the west portal was intended to have a smooth, bright and shiny surface at the time it was built between 1640 and 1644. The appearance of a smooth surface is achieved by saturation of the sandstone with oil in combination with the application of a ground layer based on fine filler material such as calcium carbonate and silica. The use of a pure oil medium for the first paint layer (in combination with the preparation layers described above) would have created a glossy appearance.

The process of applying the ground layer onto the limestone on the west portal is still under investigation and has not yet been fully clarified.

East portal

The findings from the sandstone of the east portal show that the binding medium did not consist solely of oil, as was the case for the west portal. Optical microscopy in combination with microchemical testing indicated the presence of oil tempera and lime-casein in the binding medium. The conservation materials applied during earlier conservation treatments complicated the laboratory analysis of the sandstone parts of the east portal. The upper parts of the east portal (see the blue box in Figure 8) had been treated using an acrylic-based mortar and an acrylic-based glaze. The addition of these materials made it very difficult to produce any useful laboratory results because the acrylic material had consolidated the paint layer as well as the stone surface. Therefore, the investigation of the east portal focused on the stone in the central part of the portal (see green box in Figure 8). It was not possible to determine a complete colour scheme on this portal.

The results from the east portal gave us only a vague impression of a possible original polychrome appearance of the lower part. Signs of a preparatory layer of oil or lime ground similar to the sandstone on the west portal could not be established. The first paint layer appeared to be red or white depending on the location on the arch or the ornamental decoration in the lower part of the portal. Paint from

the limestone of the arch in the central part of the portal contained mainly lead white and a very small addition of red ochre in oil tempera to achieve a creamy white appearance. One sample from the sandstone relief just above the arch confirmed the use of red ochre as a pigment for a paint layer based on lime-casein.[5] These findings have to be further investigated before any clear conclusion regarding a possible polychrome appearance can be confirmed.

For the east portal, the finding of a lime-casein binding medium is important because it contradicts the common belief that sandstone in Sweden was painted with paints based on linseed oil.

The sandstone and limestone in the two portals appear to have been painted in different ways. In Sweden, it is often assumed that sandstone constructions from the 16th and 17th centuries were treated with linseed oil or painted with a linseed oil-based binding system. However, only a few scientific analyses have been conducted to try to verify this assumption (Claesson and Henningsson 2011:12), which is based on a written source by Nicodemus Tessin the Younger, the architect of the Royal Court. In a manuscript from 1714, he suggested that linseed oil was recommended to protect both limestone and sandstone: sandstone should be either impregnated or painted with two layers of oil or both (Tessin the Younger 2002 [1714]). The study of Ryning Palace shows a more complex picture regarding the use of binding media and the process for preparing the stones for the first paint layer. The evidence for a lime-casein binding medium in the east portal shows that not just oil was used as a preparation for the painting of stone.

Unfortunately, during the last maintenance of the façades no investigation regarding the original plaster was carried out. That, in combination with the current findings of the portals, could have provided highly interesting knowledge about the façades in their entirety.

Figure 8. The east portal of Ryning Palace. The blue outline in the picture shows the area where it is extremely difficult to obtain valuable information from the paint traces due to conservation treatments based on acrylic. Therefore, the investigation of the east portal focused on the stone in the central part of the portal (green outline in the figure). (Photo: Anna Henningsson)

Discussion

An important part of the investigative approach described in this paper is the focus on *in situ* optical methods as an aid to reflect and formulate relevant questions and predict their outcome before any paint layers are removed from the stone. Too often the investigation of painted objects focuses primarily on samples taken from the object and sent to a laboratory for scientific analysis. By removing paint samples from the object, hidden facts that are only readable in their context are lost. An example of this is a preparatory layer that is tightly bonded within the stone pores and very difficult to investigate on removed samples. It is important to note that the small traces of paint still present at Ryning Palace will, unfortunately, not be available much longer due to maintenance and weathering. Thus it is important to be aware of the potential information that will be lost during ongoing maintenance or by sampling without performing an *in situ* examination as described in step 1. As the experience from the east portal shows, conservation treatments can make it extremely difficult to obtain valuable information from these remaining traces of paint. This raises the question of whether more extensive examination (steps 1–4) and sampling should be carried out and the results stored centrally under governmental supervision to be used in future investigations. This is not the case in Sweden today.

Most of the time spent on this project involved reflecting upon and evaluating the *in situ* findings before deciding what needed to be investigated further in order to gain insight into the painter's working procedure. The visual questionnaire was an important tool for understanding, communicating and pinpointing the findings and made it possible to formulate more precise and visualised questions for the layers.

The emphasis on spending quality time on steps 1–3 is often overlooked or underestimated by monument owners and managers as well as by conservators. The initial time invested *in situ* with proper lighting and microscopy was invaluable in the interpretation of the results from the laboratory analysis. Without these steps, the insights gained into the painting process of these artefacts would not have been possible.

Because this project had only a small budget, expending most of the effort on step 1 and step 2 in this investigative strategy helped us to get the most out of the laboratory analysis by allowing us to select the most suitable laboratory methods and samples. Ultimately, this brought us closer to our aim of tracing the painting process for the different types of stone

used in the two portals. This approach provides a first basis for understanding the original stone-painting process, and more information on the materials used could be obtained using complementary analyses. Extended investigations of other stone objects from the same period would make it possible to conduct a comparison with research from other countries.

The study of Ryning Palace has raised awareness of new types of architectural and historical values by increasing our understanding of the craftsmen's processes and the materials they used 370 years ago. The result, showing how different stone types were painted in the 17th century, is a story that is attractive to a broader audience. In technical art history, it is common to exhibit the results of scientific investigations in the form of reconstructions that allow the viewer to follow the original working processes. The same can also be done for the painted stone at Ryning Palace. Using teaching materials such as pedagogical reconstructions,[6] it is possible to show all of the steps involved in reaching the original visual appearance of the stone portals.

Conclusions

Outdoor painted stone is a very demanding area in paint research. The very limited amount of well-preserved original paint requires a combination of *in situ* examination and laboratory studies to gain an understanding of the application process and the materials used. In the case of Ryning Palace, the absence of written sources regarding the original process forced us to collect all the evidence from the portal itself.

The investigative approach used in this work has revealed that the stone in the two portals was painted in different ways. This allowed us to obtain an impression of the original visual appearance of the west portal in the courtyard of Ryning Palace and to obtain insights into the painter's application process and the materials that were used.

This approach has provided very good practical experience for investigating the original techniques used for working with outdoor stone. The systematic procedure consisting of six steps focused on the evaluation of the findings from the *in situ* examination. This allowed tracing of the paint application process and a more precise material identification.

Another important element of the investigative approach presented here is that if it is continually used and optimised in other projects it will improve the comparability of studies with similar objects in Sweden and abroad with respect to the original processes for painting different types of stone.

Notes

1. In this paper the word 'process' is used to describe the painter's applications steps (for example, the use of different layers and their functions) as well as the composition of materials used.
2. The National Property Board acquired responsibility for Ryning Palace in 2008. Since then a careful process of maintenance has been adopted.
3. The digital analysis of microphotographs from the stratigraphic site examination was undertaken in Adobe Photoshop Lightroom. This allowed for spot magnification and adjustments of contrast as well as switching between colour and greyscale.
4. The type and character of the oil used have not been further investigated in this study because this would require a more specific analysis. More conclusive results concerning the organic binders used can be obtained by pyrolysis-gas chromatography-mass spectrometry (Py-GC-MS).
5. The described material was identified by a microchemical spot test and examination of the cross-section.
6. Teaching materials for the demonstration and explanation of the details of the making of architectural integrated art in churches have been produced in Fornåsa Church (Henningsson 2012: 129).

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