Conservational Case Studies from the Patan Royal Palace, Nepal
An International and Interdisciplinary Story

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Abstract

The Durbar square of Patan, together with its temples and the Royal Palace is one of seven monument zones that are part of the Kathmandu Valley World Heritage Property. The ongoing project of the conservation of facades and courtyards of the palace had already been in operation for a considerable time as the team of conservators from the Institute of Conservation of the University of Applied Art Vienna arrived for the first time in 2010.Three working campaigns were organized after this initial visit. Two stone portals, four stone lions, two fire gilded deities and a doorway, one stone pavilion base and a ritual bath are the combined total conservation output of these campaigns. The cooperation of the senior conservators (staff) and students of the institute with architects from the KVPT (Kathmandu Valley Preservation Trust) and local craftsmen was and is very productive.

The exchange of knowledge is an integrative part of the practical work on the conservation site. This is very important, since our team can only be present for a limited time, mostly through the summer months. Treatment processes are often started together, all the necessary varying steps are shown and practiced and after our team leaves, the locals finish the treatment. At the beginning of the next campaign, the results of the previous one are evaluated and, if necessary, corrections are made. In this way, both the objects, as well as the Nepalese colleagues profit

from our stay. In return, we can learn a lot about the crafts and architecture of Nepal. This information helps us understand the production and the condition of the treated monuments. Not only do the manufacturing techniques differ from those that we are used to dealing with, but also the availability of tools and materials for the treatment processes is more restricted than in Austria. The differing climate results in different weathering; this completes the picture and makes this project as interesting as it is demanding.

Keywords: conservation, stone, Kathmandu Valley, earthquakes, bio-colonization

Klíčová slova: konzervace, kámen, údolí Káthmándů, zemětřesení, bio-kolonizace

Introduction

The bilateral relation between Nepal and Austria, especially in the field of heritage preservation, has a long tradition. When Prof. Eduard Sekler first visited Kathmandu Valley in 1962, the country had been open to the outside world for a mere decade. He soon saw the troubles approaching through industrialization and capitalism.1 Ten years later, he made multiple return trips to the valley in association with UNESCO. These visits resulted in the "Master Plan for the Preservation of Cultural Heritage of the Kathmandu Valley" and the nomination for the World Heritage List. Today the Durbar (Royal) Square of Patan, together with its temples and the Royal Palace, is one of seven monument zones that are part of the Kathmandu Valley World Heritage Property. In 1990 Eduard Sekler founded the Kathmandu Valley Preservation Trust (KVPT), which is the leading partner of the project. The KVPT´s main mission is to safeguard the extraordinary and threatened architectural heritage of Kathmandu Valley.2 But E. Sekler was not the only Austrian architect to be enchanted by the vernacular architecture of the Kathmandu Valley. Carl Pruscha, a student of Sekler's, first visited the Valley in 1964. In his books "Himalayan Vernacular"3 and "Pruscha Inventories",4 he describes the architecture and the monuments of the Valley. Götz Hagmüller was the architect of the Patan Museum, which is situated in the Durbar Palace itself, and is still very involved in the preservation of Bhaktapur, where he has also lived since 1979.5 Thomas Schrom who worked on the Patan Museum project is one of the leading forces in KVPT at present. An invitation from E. Sekler and T. Schrom was the catalyst for the first visit of Prof. Gabriela Krist[6] and Mag. Manfred Trummer[7] of the

1 GERWETZ, Ken. Sekler leaves mark on Nepal, *Harvard University Gazette* 2004, accessed on 18.02.2013, http://www.news.harvard.edu/gazette/2004/06.03/05-sekler.html.

2 Kathmandu Valley Preservation Trust (KVPT), 2013, Kathmandu/New York, accessed 20.02.2013, http://www.kvptnepal.org.

3 PRUSCHA, Carl. *Himalayan Vernacular*. Vienna : Schlebrügge.Editor, 2004. ISBN 3-85160-038-X.

4 PRUSCHA, Carl. *Kathmandu Valley: Preservation of the Physical Environment and Cultural Heritage, a Protective Inventory*. Schroll 1975. ISBN 978-3703104022.

5 PRADHAN, R., Hagmüller of Bhaktapur, ECS Nepal, accessed on 18.02.2013, http://www.ecs.com.np/feature_detail.php?f_id=120.

6 Prof. Gabriela Krist, Head of Institute, Institute of Conservation, University of Applied Arts Vienna.

7 Mag. Manfred Trummer, Chief Conservator, Museum of Applied Arts Vienna.

Institute of Conservation, University of Applied Arts Vienna in 2010. Three working campaigns have been organized since this first trip. Two stone portals, four stone lions, two fire gilded deities and a doorway, one stone pavilion base and a ritual bath are the combined total conservation output of these campaigns. The following report discusses the challenges of the project and specifically the conservational problems of the sandstone monuments and the solutions found.

1. The Challenges

The main problems of the monuments in Patan's Durbar Palace are very easy to recognize and define. The extreme biological colonization and the distortion of the structures are striking at first glance. The latter is explained by cycles of demolition (partial or total) through frequent earthquakes and the efforts to repair, rebuild or restore (the damaged objects). The repairs were always undertaken in the spirit of the specific period, a factor that also influenced the materials and methods used.

The other problem, already mentioned, is the extreme bio-colonization on almost all surfaces. The excess of water in the monsoon period in combination with a very porous stone substrate results in surfaces that are covered not only with algae and bacteria, but also with moss. Even higher plants are growing from and in joints and cracks where earth and dust has accumulated. Insects are nesting in every recess and crack.

In order to restore, or in other words, to find answers to these problems, we needed to understand much more than this initial idea. We had to know more about the material and the climate. We had to learn how these monuments function and how they were made. This is why the collaboration with the local architects and craftsmen was so important. The following paragraphs focus on this essential information before moving on to the treatment of the monuments and objects made from fine sandstone. Three case studies round up the report.

Fig. 1 (right) Patan, bio-colonization on one of the Mul Chowk lions. (Institute of Conservation, University of Applied Arts Vienna, 2011)

Figure 2 (bottom) Patan, insect nest in one of the joints of the Bhandarkhal Tank Pavilion. (Institute of Conservation, University of Applied Arts Vienna, 2010)

1.1 The Material

The stone that was predominately used in the Durbar Palace of Patan is a very porous and capillary active type of siliceous sandstone. The grain is fine and the color can vary from whitish to ochre. The stone is in general very homogenous, although some of the blocks show distinct bedding. The working marks on the blocks indicate a very fine workmanship, which can only be explained through tools and methods similar to woodcarving. This kind of craftsmanship was only possible due to the homogeneity and "softness" of the stone.

Analyses on original samples and fresh samples from the same stone material[8] were done[9] back in Vienna. These included thin section microscopy, both in polarized and unpolarized light as well as SEM investigations. Porosity measurements and petrographic characterization were also carried out. In addition, prisms were used to measure the water absorption in 24-hour immersion, water absorption coefficient and the drying rate. The results show water absorption of 10% to 18% and a drying rate of 31 to 48 hours respectively.[10] The water absorption coefficient was measured on two stone varieties in three directions. The results varied from 5,25 all the way up to 30,2 kg/m2h0,5.[11] These high values show that even though there are big differences in the water uptake, the stone is very absorptive in all directions. The extreme value of 30,2 kg/m2h0,5 was achieved in a measurement taken where the bedding was positioned vertically.[12]

1.2 The Structures

As previously mentioned, earthquakes demolish the structures in regular cycles. This fact is directly linked to the way in which the structures are built. They mostly consist of small blocks that can be carried by a single worker. These were originally only adhering to each other through an occasional dash of natural resin in the joints. No pointing mortar and no metal pins were used. The joints/gaps are so fine that the carving on the front extends over more blocks regardless of their dimensions. A question that we often asked ourselves is: Why are the blocks so small? The "European" idea of monolithic monuments seems out of place in Nepal. Even the blocks that are being worked on today, are not much bigger. One possible explanation is the problem of transportation. Watching the craftsmen and workers on the site we noticed that there is a big difference in the organization of the site compared to sites we are used to. No carts or wheelbarrows are used in Nepal. Most of the material is transported in baskets that are carried on the back of workers – women and men – and have a strap going over the forehead. Everything that is too big for the basket is carried by hand. This could be the reason for the small sized blocks. Looking at the stone structures in Patan, there are some very fine carved reliefs on architectural surfaces and some less detailed sculptures mostly depicting mythological animals. Both present an extremely dense network of joints. The surfaces seem to have been roughly hewn in the studio, then assembled and finished in-situ.

8 Which is also still used for substitutions in the Patan Durbar Palace.

9 By Katharina Fuchs (student of the Institute of Conservation) and Prof. Johannes Weber from the Institute of Sciences in the Conservation, University of Applied Arts Vienna, 2012–2013.

10 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

11 Every material with a water coefficient over 2 kg/m2h0,5 is classified as absorptive.

12 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

Fig. 3 Patan, Bhandarkhal Tank Pavilion, carving spreads regardless of the joint net. (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 4 Patan, organization of the building site, material is carried in baskets or by hand. (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 5 Patan, Bhandarkhal Tank Pavilion, detachment of the surface and flaking due to a hydrophobic surface coating, (Institute of Conservation. University of Applied Arts Vienna, 2010)

1.3 The Climate

The climate in Kathmandu Valley differs very much from the European one. Since the natural deterioration of stone is very closely related to the climate in which it stands, we needed to understand the weather in Kathmandu Valley better. Through our Nepalese colleagues and a pre-thesis done by one of our students[13] we could define the most important differences to our climate and try to understand the deterioration processes that are relevant in Nepal. The most important difference is probably the absence or very rare occurrence of frost. This is, of course, an advantage for the stone monuments in Kathmandu Valley compared to the ones in central Europe. As has been previously described, the stone that was used for most of the monuments is a very porous type of active sandstone with strong capillary characteristics. We suppose that this material would not be capable of standing repeated frost-dew cycles (Vienna has approximately 50 per year). Further tests are being conducted at present at our University.

But there are not merely advantages compared to the continental climate. The rainfall in the monsoon period is very strong, and the sandstone is slow drying, therefore the surfaces remain mostly wet throughout the rain season.[14] This is one of the reasons for the extreme bio-colonization. It is also possible that the absence of frost is favors the biological growth.[15] In addition, this stone is extremely soft when wet. Therefore, the monuments accessible to the public show typical mechanical damage (scratches, surface erosion etc.).

1.4 The Recent History of the Monuments

The last disastrous earthquake was in 1934. Not only were large parts of the Palace destroyed during the earthquake, but also much of the damage that we find today is directly connected with the materials and methods used over the next 20 years to rebuild, restore and reconstruct what was previously damaged or destroyed. Some of the structures were rebuilt incorrectly; the positions of the blocks were altered, or the blocks were not used at all. Furthermore, pointing mortar was used for the joints, where only natural resin was originally used. In these cases, the joints became wider and the relief was subsequently stretched. However, the resulting visual defects were not as great a problem as the ensuing structural damage. The mortar that was mainly used was almost a pure portland cement paste with very little aggregate.[16] This was a new material in Nepal in the 1950s, and as is often the case, it was thought to be the perfect building material without any disadvantages. The mortars turned out to be too hard, dense and stiff and damaged the surrounding stone. In combination with the excess of water, the capillary inactive joints caused the blocks to remain wet for a longer period of time and accelerate the deterioration through bio-colonization and salts.[17]

13 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*; Palastkomplex Patan, Nepal, 2011.

14 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

15 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

16 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

17 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

Over time, we found two very different coatings on the stone surfaces. Both of them were possibly applied as a surface treatment to minimize the water intake and both seem to have been counter-productive. The first one, most likely the older coating, was analyzed and found to be a bitumen or bituminous substance.[18] It was applied on the two stone gates in front of the Mul Chowk that were treated in summer 2012 and were the topic of a pre-thesis of one of our students.[19] The material was already on the surface before the last reassembling, after the great earthquake of 1934. Not only did the coating influence the appearance of the gates negatively, but it also sealed the surface of the blocks. This not only minimized the water uptake through the surface, but also slowed down the drying of the wet stones. Salts were destroying the material through subflorescences. The other coating was found on the base of the Bhandarkhal Pavilion. It was a hydrophobic transparent film that was easily soluble in acetone. The overall properties of the film resembled those of an acrylate based coating. The hydrophobic surface and good durability in the monsoon rain exposure had to be explained by another component though. The "bologna cocktail"[20] or a similar mixture was possibly the material used for this coating.[21] Although no written documents were found in the archives of the KVPT, an Italian team treated the Bhandarkhal Tank in the 1990s. However, this is the only (oral) information we were given and no details of materials and methods used are known,[22] but it would not be surprising if an "Italian" team used the "Bologna Cocktail" in the 1990´s as a consolidation treatment and a water repellent, because this was very common in Italy at that time. Unfortunately, only the fronts of the blocks were treated, so the water could infiltrate the structure via damaged joints as well as through the foundation that could transport water from the ground into the structure above. The water was then trapped and could not evaporate rapidly enough from the substrate. The result was similar to that of the gates: evidence of flaking and detachment from the surface is present on almost every block.

The situation before the recent treatments can be summarized as follows:

Due to repeated earthquakes of varying intensities, the structures that are made of stone as well as other materials, show signs of distortion today. Different damage, such as cracks and breakages or missing parts, can be directly linked to the seismic activity. Furthermore, the repair phases themselves induced many damages. Different materials and methods were used over time, some more efficient than others. Due to the different climate, mild winters but an abundance of rain in the monsoon season, bio-colonization plays a much bigger role in the overall deterioration process than in central Europe. Along with inappropriate pointing mortars, two different coatings have exacerbated the problems of the stone surfaces up to the present day.

18 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.. FTIR analyses, by Prof. Karol Bayer, University Pardubice, Faculty of Art Restoration, Litomyšl.

19 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, The Conservation of Two Stone Relief Gates at the Nasal Chowk, Patan Royal Palace, 2013.

20 Bologna Cocktail is a mixture of a acrylic resin (Paraloid B72) and a silicone based water repellent (Dri-Film).

21 University of Applied Arts Vienna, Institute of Conservation, 2010, *Patan 2010 – Conservation Report*, Vienna.

22 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

2. The Treatments

The concept for the treatment had to be applicable in the extreme climatic situation in Kathmandu Valley and take into account the fact that not all materials could be organized in or for Nepal. In addition, the appearance of the other previously treated surfaces and structures (brick and stone walls, wood constructions and roofs) had to be considered. The aesthetic expectations that Nepalese people have differ from those we are used to in central Europe. It was very important to involve the local architects, craftsman and workers in as many different steps of the treatment as possible. In this manner they can broaden their competences in the field of preservation of "their own" heritage. It is only in this way that it is possible to contribute to sustainable heritage preservation.

The treatment mainly consisted of several simple steps that were undertaken ideally in cooperation with the local colleagues. The first step is a simple but very important one: the graphic documentation of the blocks and their respective positions in the structure.

Fig. 6 (left) Patan, Bhandarkhal Tank Pavilion, graphic documentation of the blocks, their relative positions in the structure and the joint net, (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 7 (right) Patan, organization of the building site, the blocks of the Bhandarkhal Tank Pavilion after dismantling (Institute of Conservation, University of Applied Arts Vienna, 2010)

All elements were labeled and a plan was made with the positions marked. The next step was the dismantling. This was a very important part of the treatment. The joints that were still in their "original" state were very easy to open, since they did not have more than a couple of dashes of a natural resin. The portland cement paste, which was used mostly in the 1950s for repairs and reassembling, is where the problem usually starts. These joints are much harder than the surrounding stone and at the same time adhere very well to it. Therefore, it was very difficult to remove the mortar from the joints and leave the stone undamaged. In fact, it can be very complicated to crack the joint mortar whilst preventing the crack from spreading to the stone.[23]

After the whole structure was dismantled, each block was cleaned. This was undertaken with water and brushes or, in case of the two coatings, also chemically, mostly using acetone. The

23 University of Applied Arts Vienna, Institute of Conservation, 2010, Patan 2010 – Conservation Report, Vienna. LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

solvents were sometimes also applied with cotton poultices covered with aluminum foil in order to postpone evaporation. Mortar remains, paint spots and thick biological films were reduced with a scalpel. The remains of the joint mortar was removed by hammer and chisel.

The biocide treatment is necessary and has to be repeated on a regular basis. In the first campaign we used formaldehyde. It was possible to arrange for concentrated formaldehyde in Kathmandu which had been diluted to 4% and then applied with brushes on the surfaces.[24] After twenty hours, the blocks were washed in the monsoon rain. The cycle was repeated for a second time. In the next campaigns, we used quats (quaternary ammonium salts). They were also applied twice, but in a concentration of 1%.[25] They can be purchased pure and can therefore be easily transported to Nepal and diluted there. Another advantage of quats compared to formaldehyde is their low toxicity for humans, as well as plants and animals.

Blocks with obvious salt damage or those where strong salination was/is determined[26] are desalinated in a water bath. For this purpose we used ordinary plastic buckets. As tap water as well as the water from the Bhandarkhal Tank showed high anion concentrations (nitrates and chloride respectively), rain water (very low nitrate concentration) was collected and used for the desalination.[27]

24 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

25 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

26 Salt test stripes Merckoquand: nitrate, chloride and sulfate.

27 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

Fig. 8 (left) Patan, cleaning and water bath desalination, (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 9 (right) Patan, missing parts are being reconstructed by local stone masons/carvers, (Institute of Conservation, University of Applied Arts Vienna, 2012)

After the drying of the blocks, the broken parts can be glued together. This was done with a locally purchasable two-part epoxy resin. Reproductions of the missing parts were made by the Nepalese stone masons.[28] This proved to be a good solution, since the craftsmanship is still vividly present and of high quality in Nepal! It is not only important for the objects and this specific palace to make these reproductions. Projects such as this one also contribute to the preservation of traditional crafts, in the sense of intangible heritage. We in Europe know the problem of disappearing crafts as a consequence of industrialization only too well, so we were very happy to see that this was still not the case in Nepal. Minimal conservation without reproduction of missing parts would not only be ignorant of the different aesthetical expectations of the locals, but would also ignore the chance to contribute to the preservation of the immaterial heritage at the same time.

Fig. 10 Patan, reassembling of the stone gates. (Institute of Conservation, University of Applied Arts Vienna, 2012)

As a final step of the treatment, the elements were reassembled. This was done in a way that involved innovative steps that should repel water and give the structures greater stability against earthquakes. Where possible, the foundations were dried out,[29] the gates were reassembled without direct contact with the brick wall[30] and everywhere pins and clamps were used to stabilize the structures. For the joint pointing, we used a lime-brick dust mortar. This mortar seems to have some tradition in Kathmandu Valley. Even if it was not used for the original joints of the treated objects, the local craftsmen and workers seem to have experience with this recipe.[31] The mortar also seems to have good properties as regards the climate and the stone material.

It is important to say that, due to the short time that our team works in Patan, most of the treatment steps can only be shown and practiced, but then have to be finished by the local

28 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

29 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

30 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

31 The mortar used, consists of: silicate river sand, brick dust and slaked lime.

craftsmen, workers and architects. In the following campaign, the work is evaluated and changes or corrections are done if necessary.

Regular maintenance must be initiated and the locals instructed. The program should consist mainly of a biocide treatment that is ideally applied after the monsoon season and an inspection of the network of joints and possible corrections in terms of refills. In the forthcoming working campaign (summer 2013), a maintenance check list should be established and the frequency of the treatment processes defined. At the same time, Nepalese colleagues should be instructed in the treatment procedures.

In the following section, some of the monuments consisting of fine sandstone will be presented briefly and the individual steps of the treatment processes discussed. A gate complex made of gilded copper sheets and a ritual bath (Tusha Hiti) made out of soapstone were treated in the campaigns 2012 and 2010 respectively, but will not be in the focus of this paper, since they are outliers and not representative of the bulk of monuments treated.

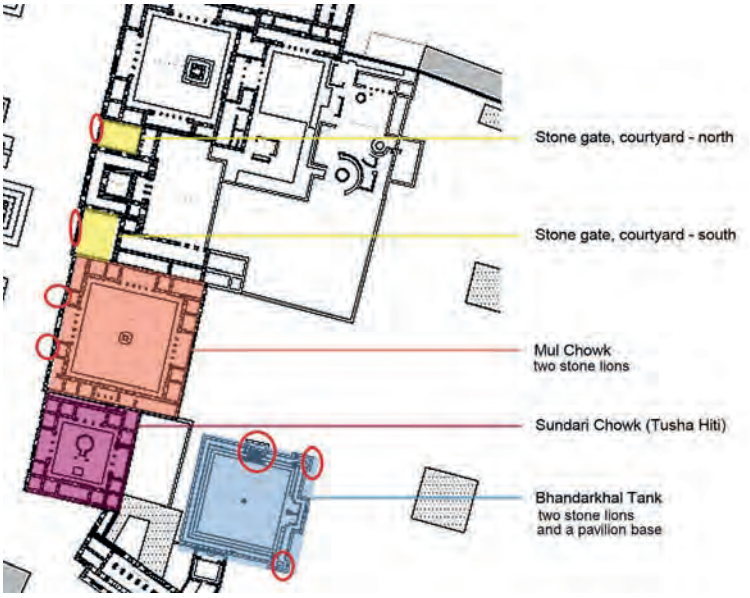

Fig. 11 Patan, plan of the Royal Palace Complex, the treated monuments are marked red, (by KVPT, adapted by the Institute of Conservation, University of Applied Arts Vienna, 2012)

2.1 The Pavilion Base at Bhandarkhal Tank

The first campaign, in which the University of Applied Arts Vienna, Institute of Conservation took part, was in the summer of 2010. The aim of this campaign was to offer support for work on the base of the Bhandarkhal Tank Pavilion. This pavilion originally consisted of the stone base and a wooden baldachin. The original baldachin, which was depicted in early drawings and aquarelles, was destroyed and had to be reproduced in 2010. The base was extremely distorted and leaning towards the water surface, so it had to be supported with beams.

Figure 12. Patan, Bhandarkhal Tank Pavilion before the treatment, (Institute of Conservation, University of Applied Arts Vienna, 2010)

The base of the pavilion was partially reassembled after the great earthquake in 1934. The reconstruction happened sometime in the 1950s, but definitely before 1956. This was documented on the bricks used, on which "His Majesty King Mahendra 2013" (1956)[32] was stamped before firing. The pavilion (its base) was therefore reassembled for the enthronement ceremony of King Mahendra which took place in 1956.[33] According to the Nepalese colleagues, portland cement first came to Nepal around 1950. This explains the rather inexperienced use of the material. The joints in the reassembled parts of the base were pointed with a portland cement paste with almost no aggregate. As mentioned earlier, there are good reasons to believe that an Italian team restored the base in the 1990s. The surface coating identified was probably applied as part of that treatment. The dense and hard joint filling in combination with the sealed and hydrophobic surface and the missing baldachin caused moisture to get trapped inside the stone. The water could penetrate through the foundation, as well as through cracks and the joints that remained without cement pointing (parts with original joints). This increased the damage due to salination and/or bio-colonization. The treatment of the base included documentation of the structure, mapping of the block borders, as well as marking of the single blocks. The dismantling process was the first practical cooperation between the Austrian and Nepalese teams. The next steps consisted of mechanical and chemical (acetone) cleaning, as well as biocide treatment and desalination. All of these conservation treatment procedures were carried out together with architects, craftsmen and workers from the Nepalese team. Finally, a brick dust-lime mortar and stainless steel pins were used to reassemble the base.[34] The concept for reassembling was determined cooperatively. The implementation of the practical work was done by the Nepalese team. The wooden baldachin was reconstructed by a local woodcarver. In addition, a new foundation was made and a pool foil was used to separate it from the rest of the structure. At present,

32 2013 According to the Nepalese calendar (Vikram Samvat) is the year 1956 after the Gregorian calendar.

33 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

34 LEINER, Susanne. *Der Pavillon am Bhandarkhal-Tank*, Pre-thesis, University of Applied Arts Vienna 2011.

the capillary rise from the ground is interrupted by the foil and the stone base is protected against rain by the baldachin. The water that still manages to get into the structure, mostly in the monsoon season, can evaporate through the stone surfaces, but more importantly through the capillary active and hydrophilic joint mortar. Along with regular monitoring, a biocide treatment, especially for the lower portions that are dealing with splash water, has to be carried out after each monsoon.

Fig. 13 (above left) Patan, dismantling the Bhandarkhal Tank Pavilion. (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 14 (above right) Patan, teamwork at the Bhandarkhal Tank Pavilion. (Institute of Conservation, University of Applied Arts Vienna, 2010)

Fig. 15 Patan, the Bhandarkhal Tank Pavilion after the treatment and reconstruction of the baldachin, (Institute of Conservation, University of Applied Arts Vienna, 2011)

2.2 Stone Lions

In total, four stone lions have been treated in the past three years by our team. Two of them are positioned on the face of the Bhandarkhal Tank; the other two are standing in front of the Mul Chowk. All of them underwent similar treatment. After the primary documentation, the dismantling took place. The blocks were cleaned mechanically and/or with moisture. Biocide treatment and/or desalination in a water bath were carried out. Similar to the treatment of the Bhandarkhal Tank Pavilion, the reassembling involved stainless steel pins and brick dust-lime mortar. Furthermore, a regular monitoring and maintenance cycle is essential here. (Institute of Conservation, University of Applied Arts Vienna 2011 and 2012)

Fig. 16 Patan, a lion at the Bhandarkhal Tank before treatment. (Institute of Conservation, University of Applied Arts Vienna, 2011)

Fig. 17 Patan, a lion at the Bhandarkhal Tank after treatment. (Institute of Conservation, University of Applied Arts Vienna, 2011)

2.3 The Shakti Goddesses Gates

The gates showing Shakti goddesses on the front (square) façade of the Durbar Palace Complex were treated in the last campaign in 2012. Similar to the previously described objects, these ones were also reassembled after the earthquake of 1934 using portland cement paste with very little aggregate.[35] The only real difference to the other treated elements is a surface coating consisting of a bituminous substance. Alongside the sealing effect, which is comparable to the one caused on the pavilion base by the surface coating, the bituminous coating also affects the appearance of the gates.

Once more the treatment included documentation, followed by dismantling, cleaning (mechanical and chemical with acetone), biocide and water bath for the desalination. Along with the stainless steel pins and the brick dust-lime mortar a gap between the stone blocks and the bricks behind them was established in the process of reassembling. After the summer campaign 2012, the gates were stabilized in their existing condition, but the appearance was not yet satisfactory.[36] The new parts, substitutions and joints were very light colored and the original blocks

35 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?,* Pre-thesis, University of Applied Arts Vienna 2013.

36 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

Fig. 18 Patan, a fragment of the Stone Gates, the surface is covered with a coating consisting of bitumen. (Institute of Conservation, University of Applied Arts Vienna, 2012)

from which the bitumen could only be partially removed still looked very dark. In order to find a solution to this problem a pre-thesis[37] was initiated. The results of the research demonstrated that there are two basic possibilities: to try to brighten up the appearance of the original stone, or to retouch – introduce a patina – to the new parts and joints. Due to the overall appearance of the previously restored parts of the palace, the second possibility was rejected. To brighten up the old parts further means to find a better solution for cleaning or to use color to paint over the surfaces.[38] There is objective reason to believe that the bitumen would creep through most colors and penetrate the new surface. We also wanted to leave the surface as permeable as possible. Therefore, further cleaning seemed to be the best possible solution. For this purpose trials with different solvents, with and without different light exposures (IR and UV) were done as part of the pre-thesis. All tests showed very similar results, and all of them were not much better than the results already achieved by the acetone cleaning in-situ.[39] In addition to the trials mentioned, laser cleaning was also undertaken. This gave very good results and was additionally

37 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, The Conservation of Two Stone Relief Gates at the Nasal Chowk, Patan Royal Palace, 2013

38 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

39 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

tested on the original surface[40] with great success.[41] Since there is no laser available in Nepal, we are trying and hope to be able to arrange for this equipment for the project. The trials in retouching the surfaces also gave good results. Silicate based paint seems to meet the special needs (good adhesion and the bitumen does not creep through) in this situation.[42] At the moment, small trial areas are applied in-situ in order to be able to evaluate these in the course of the summer campaign 2013.

Fig. 19 Patan, Stone Gates after the treatment in 2012, new and old parts are very different in color. (Institute of Conservation, University of Applied Arts Vienna, 2013)

3. Conclusions

A conservation project on another continent, in another cultural context, always results in some difficulties. Apart from the customary complex logistics and the organization of the campaigns, basic knowledge about the region, its climate, crafts, traditions and religion have to be gained in order to understand the site and its condition.

40 Sample from the gates.

41 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

42 FUCHS, Katharina. *Bitumen Coating on Stone, a Nepalese Problem?*, Pre-thesis, University of Applied Arts Vienna 2013.

In the case of the Durbar (Royal) Palace of Patan, the conservational treatment of the stone objects is successfully done with the cooperation of architects, conservators, craftsmen and workers on site, with input from scientists back in Vienna. The project fulfils many different aspects: quality conservational treatments of the monuments as well as esthetical improvement of their appearance. It is also offers knowledge exchange: the Nepalese colleagues learn how to preserve "their" heritage, the Austrian conservators learn about Nepal's crafts and arts, three students have written their pre-thesis as part of the project and hopefully many others are to come. In total, 13 students and staff members of the Institute of Conservation have already taken part in one or more working campaigns.

An important practical aspect of this project will be the monument maintenance plan. It has to be developed and practiced with the craftsmen and workers on the site. Our aim is, after all relevant objects have been treated once, to leave a team of Nepalese colleagues who will be able to practice the maintenance plan as well as do minor repairs themselves.

Most importantly, the project should help in the understanding of the importance of cultural heritage and the role each one of us plays in its preservation. We are all responsible not only for the national heritage of the country we are from, but for cultural heritage in general. Or in the words of UNESCO: "World Heritage sites belong to all the peoples of the world, irrespective of the territory on which they are located".[43]

Resumé

Marija Milchin, Gabriela Krist, Lisa Gräber, Příkladová studie restaurování Královského paláce v Patanu v Nepálu – mezinárodní a mezioborový příběh

Bilaterální vztah mezi Nepálem a Rakouskem má v oblasti ochrany památek dlouhou tradici. Výsledkem této spolupráce je mj. "Dlouhodobý plán na ochranu kulturního dědictví v Kathmandu Valley" a nominace této oblasti na zápis do Seznamu světového dědictví UNESCO. Dnes patří náměstí Durbar v Patanu společně se svými chrámy a s Královským palácem k celkem sedmi památkovým zónám, které jsou součástí the Kathmandu Valley World Heritage Property (Světového dědictví Kathmandu Valley). Když sem v roce 2010 poprvé přijel tým konzervátorů z vídeňské Vysoké školy uměleckoprůmyslové, již tu nějakou dobu probíhal projekt restaurování-konzervování fasád a nádvoří paláce.

Od první návštěvy Gabriely Krist a Manfreda Trummera tu byly zorganizovány tři restaurátorské akce. Jejich výsledkem je obnova dvou kamenných portálů, čtyř kamenných lvů, dvou božstev z mědi zlacené v ohni a brány, jednoho kamenného základu pavilónu a rituální lázně. Spolupráce vedoucích konzervátorů-restaurátorů (zaměstnanců) a studentů Institutu s architekty z KVPT (Kathmandu Valley Preservation Trust) s místními řemeslníky byla a je velmi přínosná.

Hlavní problémy památek v paláci Durbar v Patanu lze velmi snadno rozpoznat a definovat. Extrémní biologické napadení a deformace stavebních konstrukcí jsou zřejmé na první pohled. Deformace konstrukcí může být vysvětlena opakujícími se cykly zemětřesení (částečné nebo úplné poškození) a také snahou tyto poškozené objekty opravit, přestavět nebo zrestaurovat, vždy v závislosti na vkusu určitého slohového období, což lze vztáhnout i na použité materiály

43 http://whc.unesco.org/en/about/ accessed on 18.02.2013.

a metody. Dalším již zmíněným problémem je extrémní biologické napadení na téměř všech površích. Přítomnost vody během monzunových období v kombinaci s velmi porézním kamenným substrátem má za následek, že povrch kamene je pokryt nejen řasami a bakteriemi, ale i mechem. Ze spár a prasklin, ve kterých je nahromaděná zemina a prach, vyrůstají navíc i vyšší rostliny. Ve štěrbinách a prasklinách je patrný výskyt hmyzu. Na povrchu kamene byly v průběhu času objeveny dva velmi odlišné nátěry. Oba na něj byly naneseny nejspíše za účelem minimalizovat průnik vody do hmoty kamene. První byl identifikován jako živičná látka, druhý obsahoval akrylát.

Koncept zásahu musel reflektovat extrémní klimatickou situaci v Kathmandu Valley a brát v úvahu omezenou dostupnost některých materiálů v Nepálu. Také se muselo dbát na vzhled dalších, již ošetřených povrchů a stavebních konstrukcí (cihlových a kamenných zdí, dřevěných konstrukcí a střech), protože obyvatelé Nepálu mají jiná estetická kritéria, než na která jsme ve střední Evropě zvyklí. Velmi důležité bylo co nejvíce zainteresovat do projektu v jednotlivých jeho fázích místní architekty, řemeslníky a dělníky. Tímto způsobem si mohli rozšířit své schopnosti v oboru ochrany "svých vlastních" památek. Jedině takto je možné přispět k udržitelné ochraně kulturního dědictví.

Zásah v podstatě tvořila řada několika jednoduchých kroků, které byly v ideálním případě prováděny ve spolupráci s místními kolegy. První z kroků je sice jednoduchý, ale velmi důležitý – jedná se o pořízení grafické dokumentace bloků a jejich umístění ve stavbě. Poté se mohlo přistoupit k jejich rozebrání. Spoje, které byly stále v „původním" stavu, nebylo těžké uvolnit, protože v nich bylo pouze nepatrné množství příměsí přírodních pryskyřic. Problém obvykle nastal, pokud byl pojivem portlandský cement, který se na opravy a rekompletaci používal hlavně v 50. letech 20. století. Takové spoje jsou mnohem tvrdší než okolní kámen a zároveň k němu mají dobrou přilnavost.

Proto může být velmi složité způsobit v maltovém spoji prasklinu tak, aby se nerozšířila i do kamene. Poté co byla celá stavba rozebrána, byl každý blok očištěn vodou a kartáči. Pokud se na nich nacházely povrchové nátěry, byl ošetřen chemicky, většinou s použitím acetonu. Zbytky malty, stopy barvy a biologické povlaky byly odstraněny skalpelem nebo majzlíkem a kladivem. Nutné bylo také ošetření biocidy, jež musí být pravidelně opakováno. Pro tento účel byly použity kvartérní aminy (kvartérní amoniové soli), které byly aplikovány dvakrát v 1% koncentraci. Lze je snadno zakoupit jako čisté látky a mohou se tedy snadno převézt do Nepálu a ředit až na místě. Další jejich výhodou je nízká toxicita pro člověka, stejně jako pro zvířata a rostliny. Bloky s vysokým stupněm zasolení a bloky solemi poškozené byly odsolovány ve vodní lázni.

Chybějící části byly zhotoveny nepálskými kameníky (Fuchs 2013), což se prokázalo jako dobré řešení, protože řemeslná výroba je v Nepálu stále živá a dosahuje vysokých kvalit. Takové rekonstrukce nemají význam jen pro objekty samotné nebo pro tento konkrétní palác, ale přispívají také k uchovávání tradičních řemesel coby součásti nehmotného dědictví. My Evropané, kteří známe až příliš dobře fenomén tradičních řemesel mizejících v důsledku industrializace, jsme opravdu rádi, že v Nepálu tomu tak není.

Posledním krokem zásahu bylo znovu sestavení jednotlivých prvků do celku, a to s využitím nových úprav, jež by měly odvádět vodu od objektu nebo zabezpečit větší stabilitu stavby při zemětřesení. Tam, kde to bylo možné, byly vysušeny základy, brány byly přestavěny tak, aby nebyly v přímém kontaktu s cihlovou zdí a pro stabilizaci stavby byly všude použity kolíky a svorky. Na spárování spojů byla použita vápenná malta s obsahem cihlové drti. Tato malta má v Kathmandu Valley jistou tradici. I když však nebyla použita v původních spojích ošetřovaných objektů, je parné, že místní řemeslníci a dělníci mají s maltou tohoto složení zkušenosti.

Je důležité se zmínit o tom, že náš tým pracuje v Patanu vždy jen krátkou dobu, proto je možné většinu jednotlivých kroků zásahu pouze ukázat a procvičit. Potom je musí místní řemeslníci, dělníci a architekti dokončit sami. Na začátku příští pracovní sezóny (v létě 2013) by měl být sestaven kontrolní seznam údržbových prací a mělo by být stanoveno, jak často mají být objekty ošetřovány. Ve stejné době budou nepálští kolegové instruováni o pracovních postupech zásahu. Až budou jednou všechny práce na příslušných objektech ukončeny, je naším cílem ponechat další péči na nepálských kolezích, kteří již budou schopni provádět údržbu i menší opravy samostatně.

V Durbanském (Královském) paláci v Patanu byly úspěšně provedeny konzervační zásahy na kamenných objektech, a to ve spolupráci s architekty, konzervátory, řemeslníky a dělníky na místě i za přispění vědců pracujících ve Vídni. Přínos projektu spočívá ve výměně poznatků: nepálští kolegové se učí, jak chránit "jejich" kulturní dědictví, zatímco rakouští restaurátoři získávají informace o nepálských řemeslech a umění. Ze všeho nejdůležitější je ovšem skutečnost, že tento projekt by měl pomoci porozumět tomu, jak důležité je kulturní dědictví a jakou roli v jeho ochraně hraje každý z nás. Všichni jsme zodpovědni nejen za národní kulturní dědictví země, v níž žijeme, ale i za kulturní dědictví celé planety. Slovy organizace UNESCO: „Památky světového dědictví patří všem národům celého světa, nehledě na území, na němž se nacházejí" (UNESCO 1992).

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