Presentation of participation on wall painting conservation projects in Ladakh in 2015, 2017 under the direction of Tibet Heritage Fund

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1. Introduction

The text presents the Tibet Heritage Fund (THF) Conservation Projects of the early Buddhist wall paintings in Ladakh, in which I participated in 2015 and 2017. Projects were coordinated by the architect and manager Yutaka Hirako and conservator Anca Nicolaescu.

Ladakh, an ancient Tibetan kingdom, with its capital city Leh is a dry area in the north western part of the Himalayan mountain range\(^1\), in the north of India with periods of monsoon rain. Vegetation depends on water sources and irrigation systems. There are only poplars and willows grown by the streams.\(^2\) Basic agriculture, growing vegetable and wheat, is the common village's people activity.

In general the sites landscape geology and the geomorphology determinate the building's character and composition of masonry. The wall painting is closely linked to architecture which adapts to the landscape. In Ladakh historical tradition of building houses, temples consists of the wooden construction, the walls are made of mud bricks with mud plaster. Usually the temples are entirely painted. There is a historically practised roof making process as well.\(^3\) Characteristic way of building houses from mud bricks on stone foundation is often replaced by reinforced concrete

\(^1\) Himalayas are young mountains which has been created by folding, the process which is still unfinished.

\(^2\) Their branches are continually cutting of and are using in the building's construction, for example for the ceilings

\(^3\) Roof consists of a layer of wooden beams. On that layer there are other layers of different materials posed: wooden boards or round branches, straw mat, grass, coarse mortar, mud and markalak, layer of stones around, coarse mortar. Finalized by pouring of donkey dung diluted in water and applied to the surface as a roof impregnation.
structures. There can be also seen even the combination of both. Concrete buildings are usually not made very well; they have no functional value – no heat insulation and any aesthetic quality. Because of the atmosphere condition change in the inhabitant's point of view neither mud houses nor the reinforced concrete houses seems to be suitable for the periods of very heavy rains or for the long winter time.

Although the transience is characteristic for the Buddhism, the interest to keep the historical buildings, houses and unique wall paintings in the temples for an aesthetic either the economic reason, is present. The need to repair houses to restore temples as well as the efforts to learn to take care and to restore the culture monuments in a way which is suitable for that area is wide spread between the local inhabitants.

There are several organisations taking part in these activities, producing even the literature for children or the monks\(^4\). Tibet Heritage Fund (THF) is one of them. It is a non-profit organisation\(^5\) which takes care of the conservation, restoration of local buildings, temples and which tries to spread principles of an authentic urbanism and house making in general. In Ladakh, THF has also helped to set up a local non-governmental organization (NGO) the Leh Old Town Initiative (L.O.T.I.), so that the Ladakh projects can eventually be handed over to local management. Next important THF’s project was to build The Central Asia Museum in Leh by using traditional way of building. One of the reasons for that was to show that the historic method of building can still be applied in the right functional way. The THF focus on cooperation of the local common people and craftsmen with foreign professionals, so that international team can provide a good platform to share the experience, to exchange the professional skills and thoughts. The THF managed also the Restoration Project of the Lotsawa Lhakang in Alchi and Guru Lhakang in Phyang.

\(^4\) PIMPIM DE AZEVEDO: *The House of Tashi Tsering*  
http://www.tibetheritagefund.org/pages/publications.php on 24th April 2018

\(^5\) COTTE, Sabine; NOCK, David: *Handbook of Preventive Conservation for Dzongs and Lhakangs*, 1998

http://www.tibetheritagefund.org/pages/about-thf.php on 24th April 2018
2. Wall painting conservation projects: Lotsawa Lhakang and Guru Lhakang

2.1. Degradation causes

The main reasons of clay-based plaster and wall paintings degradation are water (leaking, rising, and moisture), natural and weather conditions (rain, wind erosion) and natural disasters (earthquakes, floods, fires). The human activity (lightening butter lamps, touching), tourism and the lack of maintenance are also the reasons. Next causes of damage are the natural degradation and water sensitivity of original material used. Organic material, straw or animal hairs, which are often added in the mortar, can cause damage if used excessively or applied under a thin layer of base used for the paint surface or by its different water absorption. (fig. 1)

![Figure 1. Lotsawa Lhakang, the state of the South wall before treatment (THF, 2014)](image)

2.2. Painting technique

The painting technique observed in both temples is very common for that area and due to its quality it belongs to the group of temples with exceptional quality wall

6NICOLAESCU, Anca; HIRAKO, Yutaka: Progress report 2014 Lotsawa Lhakang conservation project
paintings. They are both secco painting using the pigments with animal glue medium on the gypsum fine layer. The painting in general is very fine, detailed, with brilliant brush work, using a several layers of different colours superimposed to reach the required hue. (fig. 2)

![Image of wall paintings](image)

*Figure 2. Lotsawa Lhakang, Thousand Buddha images on the eastern wall: white Buddha of the Centre Vairocana, blue Buddha of the East Aksobhia, yellow Buddha of the South Ratnasambhava, red Buddha of the West Amitabha, green Buddha of the North Amoghasiddhi. In the painting technique several layers superimposed of different colours are used to reach the hue (Klára Kolářová, 2015)*

There was a sketch scheme with brush underdrawing found on the walls with designation for different colours. Further step was to paint all the garments. The paint layer is different in thickness depending on colour and nature of the used pigment. The incarnates were done last. Finishing step were the very fine black lines which were painted to outline the figures, accentuate the folds of the draperies as well as the eyes and mouths.⁷

In both temples the colour palette is very rich. Red, orange and blue are dominant colours utilized. The red is made from vermilion; the blue colour was obtained from azurite, and the black lines were made out of charcoal black, other pigments identified are natural earth, orpiment.⁸

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⁷NICOLAESCU, Anca; HIRAKO, Yutaka: *Progress report 2014 Lotsawa Lhakang conservation project*

⁸NICOLAESCU, Anca; HIRAKO, Yutaka; THORN, Andrew: *Guru Lhakang mural paintings: Conservation report Progress in 2016*
The gilding was observed in different uses only in Guru Lhakang either as gold leaves applied for the larger areas (fig.3) or as a gold metal powder mixed with animal glue and used for the jewellery. (fig.4)

Generally we can find two different painting styles; there is a western Tibetan art style which used big figures of gods on the simple coloured uniform background (Ridzong dukhang in Tsa tsa Puri). The other example is Kashmir painting style, the one which is influenced by the artists who were brought by Rinchen Zangpo. There are geometric details characteristic for this style. The figures are situated in the coloured fields. The Gods are wearing very decorative clothes; their jewellery is painted in great detail. The Kashmir painting style is common for three temples in that area (Alchi, Sumda Chun and Mangyu).9

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9Charlotte Martin de Fonjaudran, Sreekumar Menon, Maninder Singh Gill, „Sumda Chun and other early Buddhist wall paintings in Ladakh: practical and ethical konservativní issues from failing structures to obscuring surface layers“, in Arts of Merit, ed. David Park, Kuenga Wangmo, Sharon Cather – London 2013, s. 203 – 218
2.3. Research Methods

The wall paintings were observed in the day light and in raking light. Portable microscope was used in situ for micro examination and study of the painting techniques, and technology visible on the surface. Several pigment and support samples were collected from the wall paintings (fig. 5). They were analysed by different and complementary analytical techniques in order to obtain as much information as possible about the materials – which pigments and binders were used and to analyse the painting technique. Microscopic investigation of cross section, Fourier-transform infrared spectroscopy (FTIR), X-ray fluorescence (XRF), and X-ray diffraction were performed in Lotsawa Lhakang. For Guru Lhakang the environmental study was done by A. Thorn.

Figure 5. Lotsawa Lhakang, Stratigraphy shows the composition of the paint layer and the coarse mortar: heterogeneous layer of mud mortar contains aluminium silicates, quartz grains, fragments of ferruginous rocks, organic particles, wood chips and organic fibres, surface is free of dirt. Preparatory base layer consists of a plaster coating, which contains fine particles of clay and protein binder (glue), its surface is free from noticeable impurities. The paint layer at this point is pigmented by charcoal and bonded by protein; the surface has no appreciable impurities. Photos done in: daylight, ultraviolet luminescence (Ing. Lenka Zamrazilová, 2016)

2.4. Restoration process in the temple Lotsawa Lhakang

2.4.1. Description of the site Lotsawa Lhakang

Lotsawa Lhakang is a mid 14th century temple, the name means the temple of Translator, translator Rinchen Zangpo (958 – 1055), who is also connected with the other monasteries in Alchi.11 Shangrong village’s temples are very preserved

10Analysis (FTIR, XRF) were done by The National Research Laboratory for Conservation and Restoration of National Cultural Heritage (LNC) Romania; polarized microscopy and environmental studies (humidity, temp, light) – report unpublished by Andrew Thorn; Laboratory stratigraphy of few samples was realized by Ing. Lenka Zamrazilová in Academy of Fine Arts in Prague.

11NICAESCU, Anca; HIRAKO, Yutaka: Progress report 2014 Lotsawa Lhakang conservation project. Rinchen Zangpo also influenced the temples in Chos – khor and Tsa tsa puri
in the buildings structure and the wall paintings are really unique. Because of this the place in general is a really an exceptional example of the Buddhist art (fig. 6).

Figure 6. Shangrong village, Alchi, where Lotsawa Lhakang is located and also other temples: Tsa Tsa Puri and Chos – Khor complex are situated here (Klára Kolářová, 2015)

The building of Lotsawa Lhakang is a simple single storey one, with a square floor plan 5 x 5 metres. There is a small door on the south and no windows. The walls are made of mud bricks with mud mortar and plaster. The wall are entirely painted and wall paintings are unvarnished. The ceiling is made with beams; there are also two wooden brackets on the both sites and main wooden pillar in the centre. The wooden elements are decorated with very fine carvings (fig. 7).

Figure 7. Lotsawa Lhakang, view from the South (Klára Kolářová, 2015)

2.4.2. State before the restoration Lotsawa Lhakang\textsuperscript{12}

In Lotsawa Lhakang main causes of the wall painting degradation were due to the lack of maintenance and human actions. The temple was not used for ceremonies in a long time and it was in a very poor condition. Children were playing stone games on the walls and cattle stayed inside the temple in the rainy days. Beside this, the lack of maintenance or improper maintenance led to structure damages (roof and floor)\textsuperscript{13} and part of the western wall collapsed and was rebuilt in recent years; there was no more painting on that part of the wall. Grave cracks

\textsuperscript{12}NICOLAESCU, Anca; HIRAKO, Yutaka: Progress report 2014 Lotsawa Lhakang conservation project

\textsuperscript{13}All the repairs of building structure were done by THF in previous year and before the wall painting conservation starts
were visible in all the building's corners. On the other walls the deep cracks have been filled up protecting the interior wall paintings from the rainwater seepage but in the process more than actual cracks damaging the paint layer in the adjacent areas on surface around the cracks was covered. Despite all damages mentioned above, the support layer was quite stable; there were no big or dangerous detachments, only in few areas in the top of the wall due to the roof weight and the rafter's movements or near the cracks. The thickness of the coarse support and its composition might have provided sufficient mechanical strength (in this case more resistant to all the stoning). On the other hand the same rough composition with the big amount of straws, stone fragments and the lack of a secondary finer layer under the preparation layer, produced damages to the paint layer. Straw pierced the preparation layer producing serious detachments at this level, especially on the north and east walls. These two walls were damaged the most. Also all the paintings at the bottom, at approximately 1 m high, have been lost mainly because animals found shelter inside the temple (fig. 8).

Figure 8. Detail of damage on the north wall in day light and in raking light (Klára Kolářová, 2015)

The surface of the paintings was physically disturbed by the holes and covered by dust and mud leaked out of the plaster due to rain so it was not possible to identify the scenes very well. Big cracks, many lacunas, local areas with a craquelures could be observed on the painted surface.
2.4.3. *Restoration process Lotsawa Lhakang*

The project was implemented under "Tibet Heritage Fund's Lotsawa Lhakang Conservation Project 2014-2015". The deconsecrating ceremony of the temple took place before the restoration process had started so the restorers could approach the paintings. When the restoration process was finished another ceremony to consecrate the place was done by the monks in the temple. The restoration was realized in several phases, first of all the basic and very important static repairs as well as the tests of all materials which were supposed to be used for consolidation and for the fillings was done in previous year. Decisions to use the local natural materials which are compatible with the original authentic materials in the temple were determined. The roof and the floor were repaired in the traditional technique, using locally available materials with the cooperation with skilled craftsmen coordinated by arch. Yutaka Hirako. During the restoration process it was necessary to repeat many of the phases, because of the poor condition of the paintings due to flaking paint layer, high sensibility to water, and dirt on the painted surface.

First of all it was necessary to consolidate the support. There were tests of the different mixture of markalak, fine yellow soil, sand and water made for the grout injection the detached parts of the painting in previous years. On that base these parts were injected. For the mixture, in general, different fractions are very important to provide good adhesion to the original mortar. Besides good adhesion, other mechanical qualities were also observed: hardness, porosity, mechanical resistance, adhesive power, workability, linear shrinkage.

For consolidation of the friable support, in the parts of the lost paint layer, mixture of water and Syton X 30 (dispersion of acid silicate diluted in water) was used.

On the other hand for the fixation of the paint layer 2% gelatine sprayed on the painted surface was used. When the solution penetrated the surface was pressed over the japanease paper and melinex to put the craquelures back to the flat surface of the painting.

For cleaning, mechanical way was chosen because of the high sensitivity of the paint layer. Use of different kind of brushes, cotton swabs and wishab sponges allowed the removal of clay, markalak from the previous treatment which was covering the painting. Mechanical way was safe and satisfactory because there was no soot from the butter lamps. Only in local parts mixture of the isopropanol and water for removing the hard layer of markalak was used. The compresses which were used made overlapping tache of markalak softer and easier to remove. If the mixture of solvents is not used carefully, it can be dangerous, because of possible penetration of solvents into delicate painted layer or in case of glazes from natural colorants, it can even affect them.

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14 NICOLAESCU, Anca: “Conservation of Buddhist paintings with traditional materials” XIIth World Congress on Earthen Architecture – TERRA Lyon 2016

15 Charlotte Martin de Fonjaudran, Sreekumar Menon, Maninder Singh Gill, „Sumda Chun and other early Buddhist wall paintings in Ladakh: practical and ethical conservation issues from failing structures to obscuring surface layers“, in Arts of Merit, ed. David Park, Kuenga Wangmo, Sharon Cather – London 2013, s. 203 – 218
When the surface was consolidated and cleaned but before the filling took place it was necessary to consolidate the edges of the lacunas and to protect painting on that parts, this part is called „edge pointing“, for this a mixture of markalak and yellow soil sieved very fine with 2% warm gelatine was used and carefully applied by brush (fig. 9).

Figure 9. Lotsawa Lhakang, detail of the northern wall in restoration process, edge pointing (Klara Kolarova, 2015)

Test of the mortars for filling were done the previous year to choose the mixture with suitable physic and visual qualities. Mortars were using the local materials (soil, markalak) from near localities. Filling was made in three phases. The big cracks in the corners and the very deep lacunas’ were filled with coarse mortar with small stones wetted before at first. This layer was followed by the layer of medium mortar and finalised by fine mortar. Clay- based mortars, although strong and stable, are easy to work with because they can be reactivated all the time. On the downside, there is limited time to work on one place to achieve a surface which is pressed enough but has suitable texture and it is not shiny or blackish. For the final surface the homogeneous sponge was used (fig. 10).
For the decision of final presentation of the painting it was important the fact, that local people were occasionally visiting the temple during the restoration process (fig. 11).

Temples are not museums and even there were many restorers from the western world working on them, the humility and respect to the thoughts and opinions of the local Buddhist people must be present on the working site. Some of the temples were repaired or even repainted by local masters as a common part
of local life. In the Buddhist meaning the temple can be functional only if it is complete, so there are still large reconstructions of the lost painted parts being done to iconographically complete the important scenes and to satisfy the local Buddhist practitioners. In Lotsawa Lhakang the international team consists also from Ladakh restorers so there could be a discussion with locals about the interpretation and final phase of the restoration. Even the filling was acceptable as a kind of aesthetic presentation. Because the damage was not consistent in the upper and bottom parts (fig. 12), it was decided to present the layer with just fillings in the local tone. Finally even by fillings, the scenes started to seem complete and became visually more compact.

Figure 12. Lotsawa Lhakang, unevenly damage on the part of the eastern wall (Klára Kolářová, 2015)
2.5. Restoration process in the temple Guru Lhakang

2.5.1. Description of the site Guru Lhakang

Guru Lhakang comparing to Lotsawa Lhakang is privately owned, well-kept mid 14th century temple, situated in Phyang valley. The temple is located on a cliff and it is part of ruins of fortress. The building of Guru Lhakang is a one storey temple, with a square floor plan 6,18 x 6,3 metres. There is a small door on the south and no windows, only a lantern is present on the ceiling (fig. 13).

![Figure 13. Guru Lhakang, view from the South (Klára Kolářová, 2017)](image)

The walls are made of rough stones in the lower and by mud bricks with mud mortar and plaster in upper part. The ceiling is made with beams; there are also two wooden brackets on the both sites and main wooden pillar in the centre. The interior is entirely painted, not varnished and the wall paintings are unique in the quality.

2.5.2. State before the restoration Guru Lhakang

The main reasons of the degradation in Guru Lhakang were caused by different water actions and improper human activity. Water leaks caused by roof defects affected the upper parts of the wall paintings, where paint losses were striking. Wall paintings being water – soluble suffered greatly by the leakage which washed out the colours and produced white traces along the drips. There were areas where the support seemed to have slid together with the paint layer and created hard wrinkles. The paint layer was cracked, delaminated and in some areas it seemed it was flaking. Rising moisture mostly destroyed the lower part of the east and south wall. Deposits of soil were found adhered to painted surface in the water leaks. Also the brownish stains affected the paint layer in some areas.

The temple's structure was sound; there were only few deep cracks, probably due to heavy weight of the roofing soil settling over the years due to inadequate maintenance. Dust and dirt deposits were found all over the painted surface. The north wall was also affected by the adhered soot from the butter lamps.

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16NICOLAESCU, Anca; HIRAKO, Yutaka; THORN, Andrew: Guru Lhakang mural paintings: Conservation report Progress in 2016
The different previous treatment could be observed in the building. There were three previous treatments known from the temple keeper's documentation (fig. 14).

2.5.2. Restoration process Guru Lhakang

The restoration was made in two phases. Primarily, all the basic and very important static repairs as well as the tests of materials supposed to be used for consolidation and for the fillings were implemented in 2016. Then, the wall painting conservation took place in 2017. Decision to use the local natural materials which are compatible with the original authentic materials in the temple was made. The roof was in a good state and the floor will be repaired in the traditional technique, using locally available materials by the carpenter's family coordinated by arch. Yutaka Hirako.

The conservation in 2017 started with the process of consolidation. This activity was necessary to repeat many times – in the level of the paint layer as well as in the support level. The deep consolidation was carried out on the base of the test made in previous phase in 2016. Detached parts were injected by the mixture of markalak, fine yellow soil, sand and water. Sometimes there was Japanese paper applied by using Klucel G on surface before injection (fig. 15).
For consolidation of the friable support, in the parts of the lost paint layer, mixture of water and Syton X 30 was used (fig. 16).

In the crack's zones 2% gelatine was injected in the cracks. When the solution penetrated, the surface was pressed over the Japanese paper and melinex to put the craquelures back to the flat surface of the painting.

The phenomenon of using menthol was employed to protect the paint layer during the fixation process. Solution of menthol in isopropyl alcohol was softly brushed along the cracks, and then when it started getting white, the gelatine was injected and than surface was pressed (fig. 17). After that the menthol sublimed without leaving residues. For some problematic places higher concentration of gelatine was applied or low concentration of acrylic emulsion Primal was used. Generally the fixation of the paint layer was the tricky phase of this conservation project, because of the high instability of the paint layer in local areas.
Cleaning was done in a mechanical way using different tools as mentioned above, compress of isopropyl alcohol were locally applied, which made tache of markalak softer and easier to remove. For the silicon residues from old treatment there were compresses of acetone applied to make it easier to be removed. Removal
of stains (water stains from old roof leakage, dirty patches) was done by the physical phenomenon of evaporation and drying after the wet japanese paper was applied on the stain.

When the surface was fixated, clean but before the filling took place edge pointing was implemented to protect the edges of the lacunas using a mixture described above.

For choosing the adequate filling mixture, the tests of mortars were done in 2016 to choose the mixture with suitable physical and visual qualities. Mortars were done by use of the local materials (sand, soil, markalak) from nearby localities. Filling was made in three phases following same methodology as was used in Lotsawa Lhakang: filling the cracks from deeper-with more coarse granulated fillings, up to the finer layers of mortar.

In Guru Lhakang due to complex and not very damaged wall paintings stabilization of the paint layer, removal of impurities (surface dirt deposits) and filling were the phases which were done as the conservation process in 2017. The environmental study was done by A. Thorn to protect the interior painting in the future (fig. 18).

*Figure 18. Guru Lhakang, detail of the western wall after the treatment (Klára Kolářová, 2017)*
3. Conclusion

Lotsawa Lhakang and Guru Lhakang are both very interesting temples in both artistic and iconographic way and in their placement in general. The research methods and the scientific analysis supported historical and artistic studies to clarify all the aspects of these wall paintings. The conservation technique using local natural materials seems like a very adaptable method with good qualities and no problems were observed during the restoration process. In Lotsawa Lhakang the aim was to find a good solution for the final presentation of very damaged unique wall paintings, which was accompanied by discussions with monks and local inhabitants. And that to make the instant realization of all of the fillings. Guru Lhakang conservation project contained mainly a consolidation of all levels of the wall painting and its support, because of the fragility of the paint layer. It was necessary to vary the concentration of the adhesive solution used as well as a methodology which was applied. The participation in the projects of Tibet Heritage Fund as a volunteer was a really unique experience. It was great to be a part of a team, where skilled craftsmen cooperated with experienced professional restorers to save the Buddhist culture heritage.

4. Bibliography

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NICOLAESCU, Anca: “Conservation of Buddhist paintings with traditional materials” XIIth World Congress on Earthen Architecture – TERRA Lyon 2016


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17 Round trip travel ticket to Leh in 2015 was a donation of Libor Malý. In 2017 round trip travel ticket to Leh was funded by a grant for University Research of Academy of Fine Arts in Prague