Measure for Measure: Researching and Documenting Early Buddhist Architecture in Spiti

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Introduction

The architectural research presented in this article offers insights for other scientific disciplines such as Art History and Buddhist Studies. Since literary descriptions and visual documentation are often rare, the buildings themselves remain the most reliable sources of information. Edifices dating to the early stage of Buddhist architecture are, however, increasingly exposed to alterations, or, in the worst case, are under threat from factors such as tourism, social changes, improper restoration work, natural disasters, and climate change. Due to these pressing forces, the architectural study of sacred buildings must take place in situ during extensive fieldwork. Once in the field, it is crucial to collect sufficient empirical data about different types of buildings. Developing a typology of Buddhist monuments requires taking into account the greatest number of examples, using the most accurate measuring methods and techniques. Ultimately, an exhaustive documentation allows an analysis of these edifices as well as their evolution over time.

For the last 15 years, Holger Neuwirth has conducted several research projects on the Buddhist Architecture of the Western Himalayas with different teams from the Graz University of Technology, thanks to the financial support of the Austrian Science Fund. These projects focused on edifices belonging to the Kingdom of Purang-Guge, which once extended over much of West Tibet, Ladakh, and parts of today's Himachal Pradesh, between the tenth and seventeenth centuries. The number of buildings that have so far been documented exceeds fifty-seven at eighteen different locations. The documentation collected includes detailed photographs,

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sketches, architectural drawings, as well as 3D digital models.[1]

A successful field research presupposes the three following stages. The first stage consists in recording the various buildings in their entirety by means of sketches and drawings, which will be essential for later measurements. Geographical and topographical particularities, such as landscape and village structures, are an essential part of the survey. Measurement is the second step. Using a laser tachymeter allows to secure a high level of precision in the digital measurements of distances; particularly in very rugged terrains and spacious areas. Measures taken by hand make it possible to complement the former; especially for the measurements of architectural details and areas out of reach. The third stage aims to take stock of the interior spaces of these buildings. It consists in detailing and locating the geometry of the sculptures, wall paintings, and inscriptions within the architectural context. A large number of photographs completes this last stage.

The collected data are put together and processed to generate the detailed plans of the site, floors, ceilings, sections, and elevations. Two-dimensional plans are retained for further analysis and spatial representations. In turn, it makes it possible to evaluate the stability of the building, and to identify potential tensile forces and deformation. This aspect is crucial in order to develop custom-made methods and solutions in view of maintenance and restoration work.

Finally, a holistic documentation is achieved by combining the plans with scaled representations of artistic features located inside and outside the edifice. This final assembly is important as Buddhist artwork is often the only means we can use to date these buildings and reflect upon their historical context.

What building technologies were employed? What construction materials were used? Answering these questions is crucial for assessing the state of any historical monument. The architectural style found in the Western Himalayas is determined by climatic conditions and locally available materials; essentially stone, rammed earth, mud bricks, and wood. All bearing walls are built solidly using stones, rammed earth or mud bricks. The wall plaster is made of different layers of clay and mortar made of clay and straw. Wood is used mostly for beams, pillars, corbels, capitals, as well as for framework, and flooring. In view of the climate, roofs are flat and a

[1] http://www.archresearch.tugraz.at

thick layer of clay protects them against occasional showers. Since there is no need for slanted roofs, the construction pattern of these buildings was based on simple cubic shapes. It was thus easy to transfer these shapes into the geometry of sacred architecture, a process inspired by the philosophy of Tibetan Buddhism.[2]

In Spiti, we documented significant and unique buildings, *i.e.* the temple complex of Tabo, the ancient monastery of Dangkhar, and the temple of Lhalung. They are characteristics of architectural concepts initiated in the Kingdom of Guge, which were developed and implemented in the Western Himalayas over several centuries.

Geographically, the villages of Tabo, Dangkhar, and Lhalung are quite close to each other. The linear distance from Tabo to Dangkhar is merely 16 kilometres, while it is about 6.6 kilometres from Dangkhar to Lhalung. Nevertheless, the three sites display quite diverse architectural concepts, both in terms of size and topographical setting, and belonged to different periods.

The Temple Complex of Tabo

The village of Tabo is located on the northern bank of the Spiti River. The area lies in a wide plain partly cultivated, and flanked by mountain ranges. The extensive temple complex is situated in the south-west of the village. To this day, the monastic complex comprises nine chapels and several stupas built between the tenth and the nineteenth century as part of the sacred compound. They are surrounded by a high enclosing wall determining an almost rectangular area of about 6700 square meters. Tabo is the oldest Buddhist monastery in India still in use. Established during the later diffusion of Buddhism, the Main temple at Tabo, which was founded in 996 and renovated in 1042, is uniquely the most prestigious monument still preserved in the western Himalaya.[3]

Due to geo political circumstances, the Spiti Valley became part of British India after 1846. As a result, Western travellers and British civil servants managed to travel to Spiti and collected the first descriptions of its landscape, its people and its cultural heritage as early as the second half of the nineteenth century. In the course of that traveling activities, Tabo was one of the first monastery in the

2 See Neuwirth and Auer 2015: 9-13, 125-147.
3 See Klimburg-Salter 1997: 45-63.

Western Himalayas to catch the attention of extensive scholarly research. In the 19th century Tabo had already been visited and its artwork described by both Hutton and Jacquemont.[4] The latter also produced drawings of some of the clay statues. August Hermann Franke visited Tabo in 1909. His contribution included sketches of the architectural arrangement.[5] The photographs taken by Eugenio Ghersi, who accompanied Giuseppe Tucci in 1933 and 1935, show the whole compound as well as single buildings.[6] Romi Khosla was the first to publish detailed plans corresponding to the state of site the 1970s.[7] Fortunately for us, Laxman S. Thakur documented the temple complex in 1988, before the 1991 restoration. This restoration was executed by the Archaeological Survey of India (ASI) and altered the outer walls of most temples.[8] In recent years, it has become possible again for international scientific teams to conduct research in that area. In 1997, Deborah E. Klimburg-Salter published a study of the Main Temple at Tabo that discusses the artistic significance as the result of a trans-Himalayan cultural meeting between the rulers of West Tibet and Indian Buddhism.[9] All these publications help understanding the monastic complex and the changes some of the edifices underwent. In this respect, early documentation is particularly helpful for replicating the structural changes that affected the monastic complex over the last century.

However, previous architectural drawings were basically schematic in nature, giving the impression that the buildings possess clear orthogonal shapes. To get a more detailed documentation of the site, our fieldwork at Tabo was completed within seven weeks from April 28 to June 21, 2002.[10] It covered all temples and twenty-three stupas within the monastery, as well as the cave temples located on the mountain slope to the north of the site. Due to the progress made in metrology, it was possible to obtain digitalized results by means of a laser tachymeter. We collected approximately 40,000 digital points, which we supplemented by manual measurements, and additional

4 See Hutton 1840: 494 and Jacquemont 1841, 2: 346-50.
5 See Franke 1914: 37-42 and Fig. 2 on page 39.
6 See Tucci 1988: 21-115. Museo Nazionale d'Arte Orientale "G. Tucci", Roma.
7 See Khosla, 1979: 37-48.
8 See Thakur 2001.
9 See Klimburg-Salter 1997..
10 Researchers involved were Holger Neuwirth, Marianne Pecnik, and Anton Reithofer.

2,000 colour slides.

In the following years, we evaluated the collected data during ongoing projects that were funded by the Austrian Science Fund. The field research provided us with a set of architectural plans of all temples, including ground plans, longitudinal and cross sections, elevations, wall projections, and ceiling plans. Based on this material we generated three-dimensional models of all buildings alongside photomontages of the murals and painted ceilings.[11] We were able to present the results of our work to the Venerable Geshe Sonam Wangdui, the then abbot of the monastery, in 2010. During the interim years, more visits to Tabo allowed us to witness the development of the site. In a short period of time, the construction of new buildings and restoration work had considerably changed the face of its architectural layout.

When comparing our general plan of Tabo with earlier site maps, it becomes strikingly apparent how much the buildings deviate from a hypothetical grid determined by the enclosing wall of the compound, which turned out to be more of a parallelogram than a rectangle (Fig. 1).

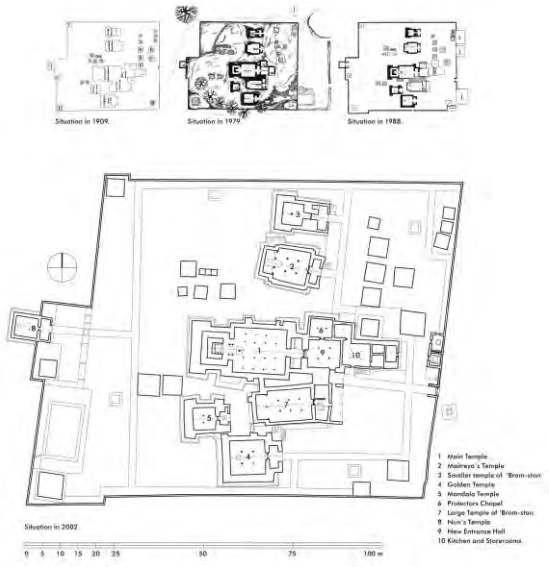

Fig. 1 — Site plan of Tabo's monastic complex. TU Graz 2010.

[11] Unfortunately, we were not able to obtain full permission for taking photographs of all of the paintings.

Regarding the orientation of each temple, the site plan shows that their alignment is not parallel as their longitudinal axis differs from one another.

The Main Temple (#1) located in the centre of the complex is the earliest building. The main axis and the original entrance are almost precisely oriented east-west. They deviate southward by 3° only. The central axis of the Maitreya Temple (#2) deviates considerably from the orientation of the Main Temple by 7° to the south, as does the axis of the White Temple (#8). The axis of the Smal 'Brom-ston Temple (#3) deviates a mere 5° from the orientation of the Main Temple. The axis of the Golden Temple (#4) and the Mandala Temple (#5) diverge by 6° to the north. Finally, the Large 'Brom-ston Temple shows a deviation of 8° to the north. The raisons for these deviations have yet to be explained. It is important to report these observations as the alignment of religious edifices in the Buddhist Himalayas are often strictly regulated. The orientation of the buildings within a particular site, especially for those containing mandalic representations, follow prescriptions, which play a vital role during the foundation ceremony of sacred buildings.[12] This is all the more important as the Main Temple at Tabo was never meant to be a three-dimensional representation of a mandala before its renovation in 1042. Thus, the initial orientation of the sacred compound and the Main Temple could have followed a general Buddhist conception, rather than being dictated by a specific praxis (*i.e.* Sarvavid Vairocana mandala).

Plans enable us to represent the significant aspects of monuments, such as their spatial organisation, size, and construction phases. For example, what does the ground plan of the central edifice tell us? It shows that the Main Temple (#1) used to be isolated, whereas nowadays it is connected with the Protector's Chapel (#6), the New Entrance Hall (#9), the ad-joining rooms in the east (#10), and with the Large 'Brom-ston Temple (#7) in the south. Apart from the room layout, plans also reveal how much the thickness of the walls differs from one another. The walls of the oldest parts of the building, for instance, are 115 centimetres thick, while later structures, like the walls of the Protector's Chapel and the Large 'Brom-ston, range from 50 to 80 centimetres. Likewise, the renovation work conducted by the ASI in 1991 consisted in reinforcing parts of the outer walls like, for

[12] See Gyatsho and Jackson (trs.) 1979, specifically, the chapters on 'establishing temples' and 'construction festivals' pp. 29-53.

example, that of the corners of the western wall of the Main Temple. Furthermore, the longitudinal and cross section views of the Main Temple show the complexity of the rooms with their different heights, ranging from 4.40 metres to 5.10 metres. The sections also depict how the different sectors of the Main Temple are top-lit through lanterns in the ceilings. The Main Temple is a one storey-edifice. The rooms that were added to the east later on developed in two levels instead: the Protector's Chapel (#6), the New Entrance Hall (#9), and the ad-joining rooms in the East (#10), with heights between 2.10 and 2.40 meters. Briefly summarized, plans constitute an essential and effective documentation to understand the construction phases, enlargements, and alterations underwent by religious edifices.

Another important issue in the context of the religious architecture of Spiti is the integration of murals into the architectural documentation. Thanks to scaled reproductions of the wall paintings, it is easier to assign iconographic details and to study them within their context without having to travel to the site. In Tabo, we were able to generate scaled reproductions for the murals of the Mandala Temple,[13] the Small 'Brom-ston Temple, the New Entrance Hall, and for the Golden Temple (Fig. 2). The visual reconstruction of decorative wall paintings is an essential prerequisite for future restoration work, particularly in view of a comprehensive damage assessment of the interior walls. Similarly, and following the same method, we also generated scaled reproductions of the ceilings for three of the buildings; namely, the Mandala Temple, the Golden Temple, and the Large 'Brom-ston Temple (Fig. 3).

Based on two-dimensional plans we were able to generate 3D models that further our understanding of these edifices. For example, views of spatial elevations and sections clearly show the different configurations and proportions of the buildings. Returning to the Main Temple, internal views of a 3D model make it possible for specialists and amateurs alike to appreciate the complexity of the layout and the volume of the rooms of this edifice (Fig. 4).

[13] For a discussion and review of these murals; see Heller 2017 in the present volume.

Fig. 2 — Scaled photomontages of the wall paintings on the Western side of the Mandala Temple, the New Entrance Hall, the Golden Temple, and the Smaller Temple of 'Brom-ston (clockwise). TU Graz 2010.

Fig. 3 — Scaled photomontages of the painted ceilings in the Mandala Temple, the Golden Temple and the Large Temple of 'Brom-ston (clockwise). TU Graz 2010.

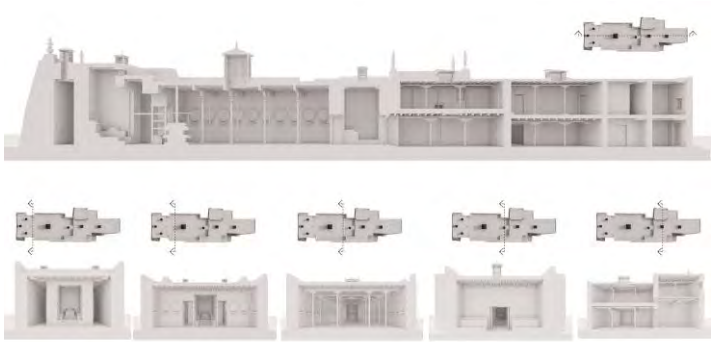

Fig. 4 — Longitudinal and cross sections of Tabo's Main Temple, the New Entrance Hall, and the store rooms next to it. TU Graz 2010.

Spatial models like those generated for the buildings at Tabo improve scientific exchange with fellow researchers who may not be able to visit the original site.

Eventually, 3D representations of the monastic compound at Tabo put the finishing touches to a holistic understanding of the site (Fig. 5).

Fig. 5 — Spatial model of Tabo's monastic complex in the 1930s and in its state in 2002, seen from the North-West. TU Graz 2010.

They illustrate how the various buildings interact and relate within the space. Judging from Ghersi's 1933 photographs, it is plainly visible that the surroundings of the monastery have changed dramatically. But thanks to digital visualisation of architectural heritage, it is possible to remove modern features from spatial representations; or, as in this case, to ignore the changes caused by the ASI restoration work.

The Golden Temple of Lhalung

The village of Lhalung is located in the side valley of Lingti, about 14 kilometres off the main road that runs along the banks of the Spiti River. Lhalung used to be a small monastery with monks quarters, located in the south of the village on the crest of a hill. It was also a branch monastery of Dangkhar (*i.e.* Lag sgo dpe Monastery). The only remaining buildings of the original ensemble are the Golden Temple, also known as Serkhang, and the so-called Vairocana chapel or White Temple *(lha khang dkar po)*. The complex also included a number of residential buildings, which are now partly in ruins. The whole monastic complex had a size of about 2600 square metres.

The original Serkhang had only one room with a small annex, and an ambulatory corridor running around it. The Serkhang ranks among the earliest buildings from "the time of the religious and artistic activities inspired by Rin-chen bzang-po".[14] According to the founding inscription recorded inside the temple, and based on stylistic criteria, the Serkhang has been dated to the 11th-12th century.[15]

Our team conducted a first architectural survey of the Serkhang and the Vairocana chapel in 2002. The documentation was complemented by a 3D laser scanning (LiDAR) of the Serkhang's interior in 2011.[16] All in all, the documentation includes a site map, ground plans, and sections of both the Serkhang and the Vairocana chapel, as well as scaled reproductions of the elaborate artistic interior of the Serkhang, comprising of murals, statues, painted ceiling, and clay sculptures on the walls (Fig. 6). The ground plan makes it possible to trace the development of the edifice over the last

14 See Snellgrove and Skorupski 1980: 41.
15 See Luczanits 2004: 89-106 and Tropper 2008.
16 See animation of the 3D laser scanning at: https://www.youtube.com/watch?v=HXvF9H895O8

centuries. Previous studies were conducted by Shuttleworth and Khosla.[17] Shuttleworth's 1924 sketch shows the main shrine of the Serkhang, a narrow storeroom, and the room of the so-called New Temple room in the left front corner, next to a veranda.[18] The ambulatory runs around these three rooms from the north-western corner to the south-western corner. Khoslas's 1969 ground plan, however, shows that a spacious entrance hall was added in front of the main room in place of the veranda. Judging from the 2002 documentation, it becomes apparent that the entrance hall was enlarged and a small corridor was built into the hall after 1969.

The ground plan (Fig. 6) shows that the main axis of the temple is orientated east-west with the entrance facing west. At Present the temple consists of four rooms, with a new veranda built on the western side. Although the old ambulatory still exists, only fragments of its impressing murals can be admired today. A small room on the north-western corner was obviously used as a stable. The Serkhang was originally flat-roofed, yet, between 2008 and 2010, the old roof was covered with a sloping corrugated roofing.

The main room of the Serkhang is slightly trapeze in shape. The western wall is 5.0 metres wide, the northern wall is 5.6 metres, the eastern wall with the altar is 5.5 metres wide, and the southern wall is 5.6 metres. The ceiling is 4.6 metres high. A column in the centre of the room was not part of the original layout. It was added later in order to support the ceiling. Based on our plan and detailed pictures, we generated a complete and scaled overview of the panelled ceiling (Fig. 6). The wooden blanks and crossed beams divide the ceiling into 36 squares. All these panels show multi-coloured geometrical designs with foliage. The beams are painted green and red, with some floral elements. Each of the 20 consoles displays a slightly different design, with multi-coloured stripes underneath.

The artistic programme of the Serkhang is well preserved. Rich groups of sculptures cover three of the interior walls. Two gatekeepers flank the entrance on the western wall. The surrounding walls are covered with murals. Due to the lack of natural lighting and space in this room, it was initially impossible to satisfactorily document the artwork in its entirety with regular cameras. The 3D

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17 See Shuttleworth 1929: 1-7 and Khosla 1979: 48-53.

18 On Shuttleworth's description of his visit to the Serkhang in 1924; see Laurent 2017 in the present volume.

scan (LiDAR), however, enabled us to create a scaled drawing of the room, thereby reproducing the complete artistic decoration (Fig. 6).[19]

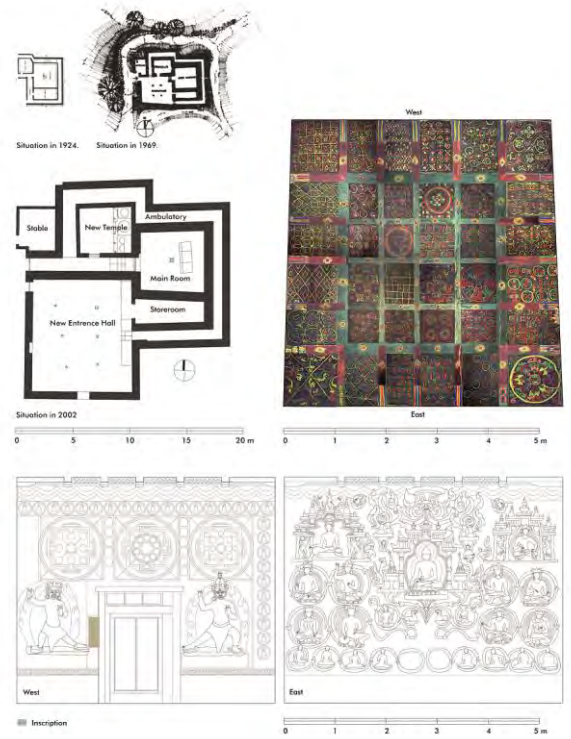

Fig. 6 — Ground plan, photomontage of the ceiling, and scaled drawings of the Western and Eastern wall in the main room of Lhalung's Serkhang. TU Graz 2013.

The Ancient Monastery of Dangkhar

Dangkhar is situated to the east of the Spiti River between Tabo and Kaza. This ancient monastery is a multi-storey building, standing on a 300-metre high spur, overlooking the confluence of the Spiti River and the Pin River. The religious buildings around the ancient monastery includes a gateway stupa at the foot of the cliff, the monastery building on the western side of the old village, the tower above the monasteries roof, and the Upper Temple on the terrace above. The whole area has a size of about 680 square metres.

19 See Neuwirth and Auer 2013: 294-297.

Nineteenth-century drawings, lithographs, watercolour, and photographs show how the whole site has dramatically changed over the last two hundred years due to seismic activity and erosion.[20] In 2009, art historian and Tibetologist Christian Luczanits invited our team of architects from the Graz University of Technology to come up with a proposal. The project officially started in 2010 after Markus Weisskopf, a Swiss entrepreneur and philanthropist from Basel, had secured funding. Drawing from experience and techniques developed for other sites, the main objective was to produce a comprehensive documentation of the monastery for future restoration.

After a relatively short but intensive planning phase, a first fieldwork took place in the summer 2010.[21] Between July 17 and August 2, we used a laser tachymeter to gather the digital measurements of the whole complex. Due to the dramatically topography of the site this was a possibility to secure a high precision of the measurements for the different levels and distances. Again, we completed these digital data with manual measurements, in particular for small-scale indoor structures. At the same time, we established a list of damage for each room in order to create a precise catalogue for future repair intervention. Back in Graz, we evaluated the collected data. The second fieldwork took place in the following year from June 21 to July 31. It involved different teams of experts in the field of geology, archaeology and Tibetology, painting restoration, and architecture.[22] The results of this interdisciplinary work were published in an edited volume in 2013.[23]

The main building consists of various rooms whose structure has changed over time. A tower situated above the roof of the main building possesses a staircase leading upwards thereby granting access to the Upper Temple at the terrace above the monastery. An access road made of concrete has been laid out to reach the temple from the north in recent times.

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20 See Photographs by Francis Frith and Samuel Bourne, Victoria and Albert Museum, London.

21 The participating scientists of the first field research were Dieter Bauer, Yannick Laurent, Holger Neuwirth, and the present author.

22 The participating scientists of the second fieldwork were Maria Gruber, Scott Kieffer, Yannick Laurent, Holger Neuwirth, Kathrin Schmidt, Christoph Steinbauer, Jitender Yadav, and the author.

23 Neuwirth and Auer 2013.

The documentation includes all necessary ground plans, sections, and elevations as well as spatial models of the complex room structures. Additionally to the site plan, we also generated a map of the settlement (Fig. 7). The ground plans and sections show how strongly the surrounding topography determines the architecture of the buildings (Fig. 8). The main building consists of a cluster of 31 rooms on four different levels, including an inner courtyard on the upper floor. The assembly hall is located on the first floor, at the rear of the building. Three chapels are located in the southeast of the building. We find another sacred room on the north of the third floor while the so-called meditation cave lying in the northwest of the third floor.

The complexity of the building led us to consider different construction phases along with different planning methods. The plans eventually prove that the main building was built in different phases (Fig. 9).

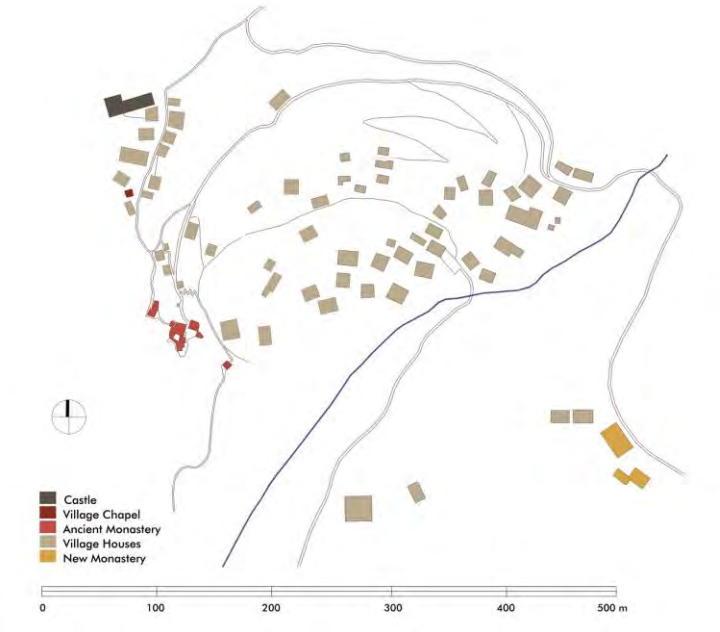

Fig. 7 — Map of Dangkhar village. TU Graz 2013.

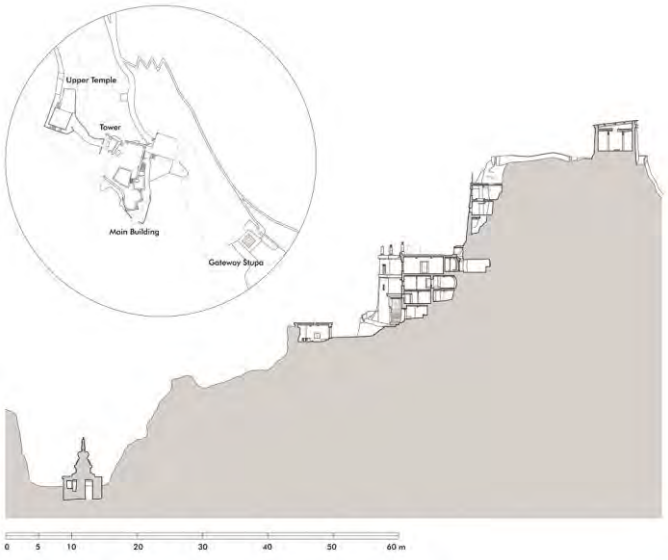

Fig. 8 — Site plan and cross section of Dangkhar's ancient monastery. TU Graz 2013.

Fig. 9 — Building phases of Dangkhar's main building. TU Graz 2013.

On the basis of these plans, we can observe that the entire complex consists of three buildings that were originally separated. In the centre, we find a single-storey assembly hall, with its typical skylight, plus a group of stupas leaning against the rock on top the roof. This configuration was maintained and incorporated in later phases up until today. The fact that the building was not erected all at once is also responsible for the several structural problems with respect to stability. Largely ignoring load transfer, the addition of rooms and storeys created extra weight, presumably in the absence of technical know-how (Fig. 10). These observations, combined with a detailed analysis of all damage, are fundamental for an effective and encompassing restoration work.

Fig. 10 — The four storeys of Dangkhar's main building, illustrating the statically problems. TU Graz 2013.

Views of 3D models make it a lot easier to understand the complexity of the building. In particular, the numerous spatial sections give us a deeper insight into the structures (Fig. 11).

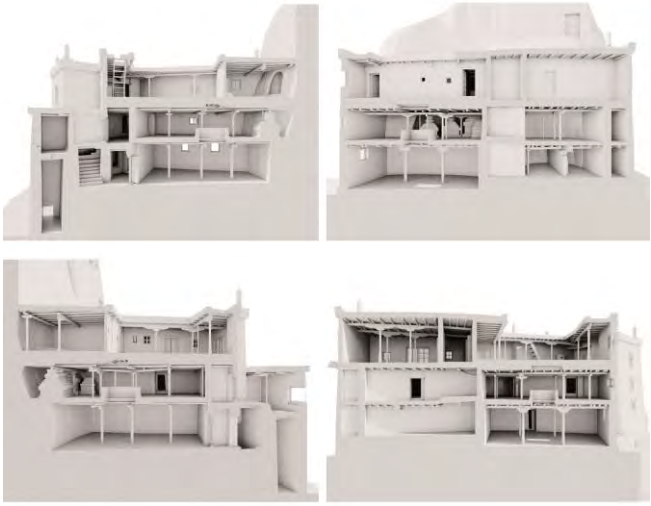

Fig. 11 — Spatial sections of Dangkhar's main building. TU Graz 2013.

These models also allow us to create a digital animation that illustrates the different construction phases over the centuries. In order to complete the documentation, we again compiled scaled representations of the interior wall paintings by using photomontages and drawings (Fig. 12).

Fig. 12 — Scaled photomontages and drawings of the wall paintings in Dangkhar's Upper Temple. TU Graz 2013.

This proved effective in terms of both iconographic research and painting restoration. In terms of iconographic research, scaled reproductions and outlines of the murals allowed fellow researcher Yannick Laurent to precisely assign the iconographic programme of the Upper Temple, and to locate the construction of this edifice within the religious and historical context of Spiti in the eighteenth century.[24] For conservators Kathrin Schmidt and Maria Gruber from the Vienna University of Applied Arts, these montages were a prerequisite for their analyses and preparation work in view of a possible renovation.[25]

It is crucial and fruitful to co-operate in an interdisciplinary way, when it comes to restorations. The report by the Institute of Applied Geosciences at Graz University defines the actions necessary concerning the foundation and soil conditions, which are both in a critical state. With their special geological equipment, Scott Kiefer and his team documented not only the surrounding topography, but also the current state of the facades and of some rooms. This information enriches our analyses of deformations and displacements.[26]

Conclusion

The study a religious sites and buildings rests on a comprehensive topographical and architectural documentation. A temple or monastery is not a complete unit itself. It is part of a conception of religious space demarked by votive structures. Therefore, it is important how the sacred buildings are integrated in the natural environment and in the village structures. In this respect it is also necessary following the historical development of the sites in form of historical-layer-plans since the surrounding and the buildings may have changed considerably over time.

An extensive architectural documentation is the first step to addressing open questions like the choice of the site, the orientation, the typology, the proportional principles and last but not least the

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24 See Laurent 2014.

25 See Neuwirth and Auer 2013: 247-271.

26 Animations based on the 3D laser scanning of Dangkhar village and monastery at https://www.youtube.com/watch?v=54wMOWWRVAI, https://www.youtube.com/watch?v=NhsIOkbLQLI and https://www.youtube.com/watch?v=WIUcsjaBnmM.

chronology. A further aspect concerns the question of whether there is any proportional concordance between the architecture of a temple and its decoration, in particular the dimensions of the images, and the spatial division of the paintings (showing a general or special Buddhist conception of space?).

Based on solid data, the architectural documentation allows the planning of consolidation or restoration work. Therefore, we have to focus on examining the present condition of the respective buildings. Based on the assessment, various methods of historic preservation can be discussed which also have to take into account regional, social, and cultural circumstances.

The architectural documentation about the temple complex of Tabo, the ancient monastery of Dangkhar, and the temple of Lhalung display quite diverse architectural concepts regarding form, size, orientation and artistic equipment. The used material and construction technique are more or less the same, they just differs regarding their quality of execution and workmanship, and therefore reflects the economic potentials and (changing) religious importance of the buildings/sites.

The setting of Tabo, which lies on a plain and open terrace, is not determinate by the topography. So here it was easy to extend the compound with further free standing buildings around to the Main Temple through the centuries, which show the typical cubic shape and room organisation on ground level due to their function (as assembly halls or chapels). The main axis of the earliest temple is orientated east-west with the entrance facing east.

The site of Lhalung lies on a slope and is therefore more determinate by its topography. The original Serkhang that consists of only one room with a small annex, and an ambulatory corridor running around it, had been enlarged through three rooms, which were directly attached to the original structure. The main axis of the temple is also orientated east-west, but the entrance facing west, towards the river valley.

Finally the setting of Dangkhar demonstrates how strongly the building concept can be dominated by the topography and the conception of space between the old settlement and the sacred buildings. The originally complex consists of three buildings that were separated with a single-storey assembly hall in the centre. The only possibility to get more space on this narrow spur was, to close every gap and build on top of each other. Today the building consists

of a cluster of 31 rooms on four different levels, including an inner courtyard on the upper floor. The assembly hall is now located on the first floor, at the rear of the building. The entrance of the multi-storied building and also of the former free standing assembly hall facing southeast towards the open valley, while the entrance of the Upper Temple above the monasteries building facing northeast towards the old village.

There are still a lot of open questions. Due to the imminent threat to these monuments, the architectural research has to continue with the fieldwork and the analysis. The elaborated material will allow the analysis of various aspects of the buildings, and hopefully will show how different kinds of building types have evolved in that region.

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