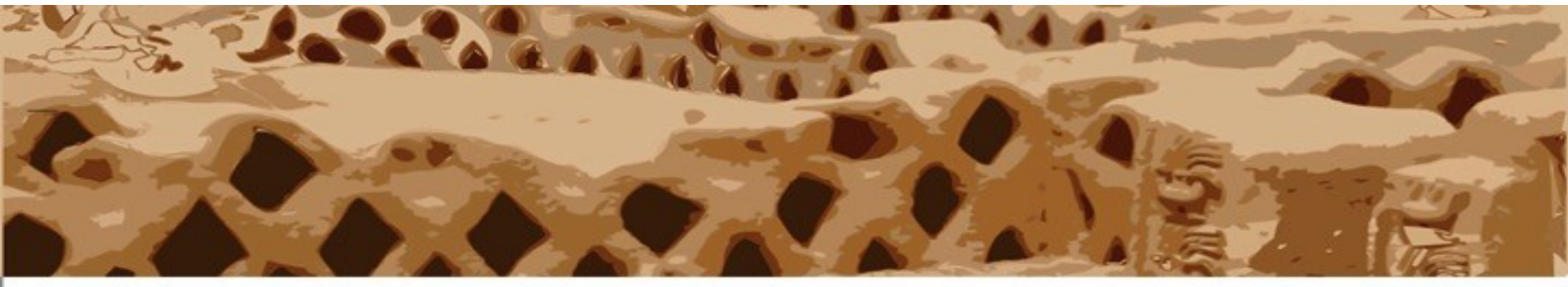

Wall Paintings on Earthen Support: Technological Characteristics and Challenges for Conservation. Research and Experiences from the Western Himalayas

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We would like to present our paper which talks about our experiences in the region of Ladakh in the Indian part of the Western Himalayas.
The high mountain desert, shaped by wind and sun, has broad arid valleys surrounded by peaks that rise to over 6,500 meters. These climatic and geographic conditions have formed the outstanding earthen architecture.

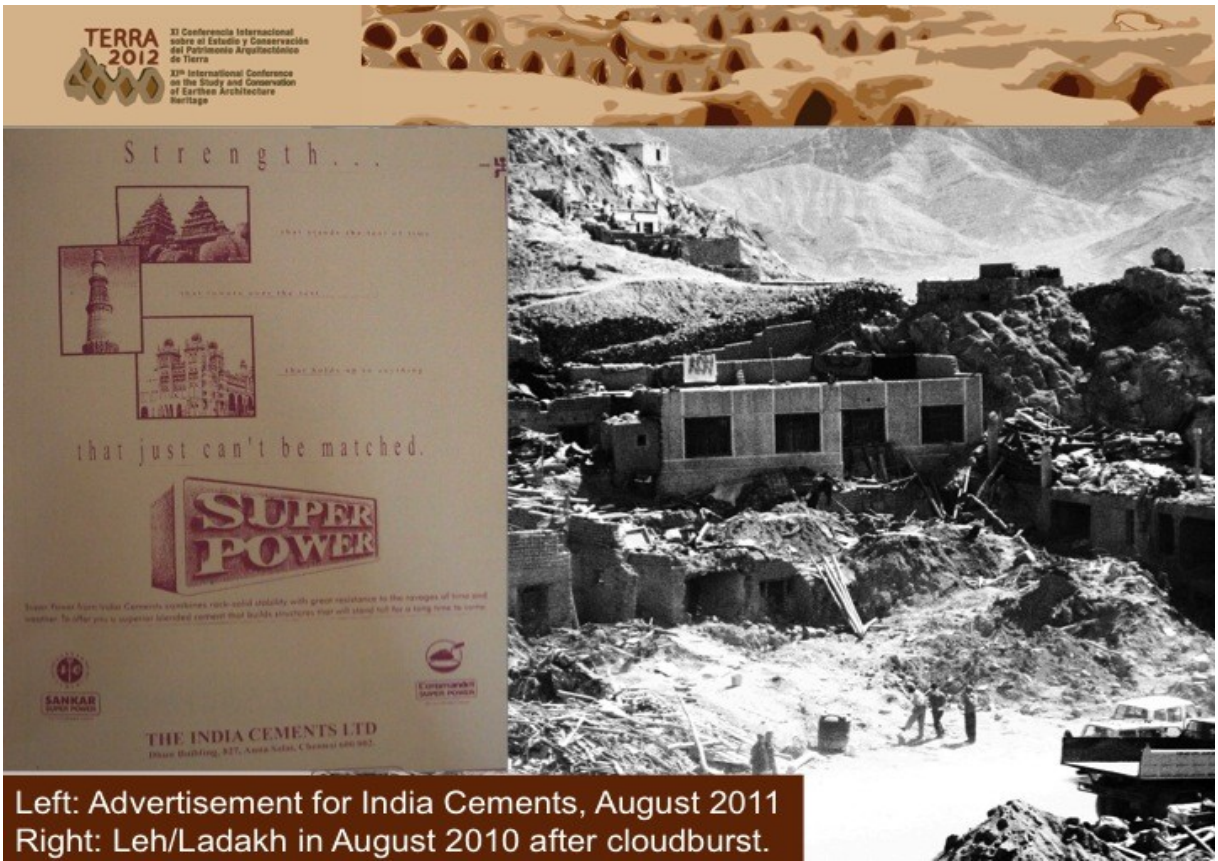
In modern times Ladakh was isolated up until the mid-1970s, because it was a prohibited military area and no foreigners were allowed to enter this region. With the opening up it is again exposed to the influence of other cultures.

The historic settlements are not only severely challenged by the fact that the Western Himalayas lie in one of the most vulnerable seismic zones in the world. Moreover, they are also endangered by the rapidly changing Ladakhi lifestyle in the present times, and by a possible climate change.

Left: Ladakh (arrow)

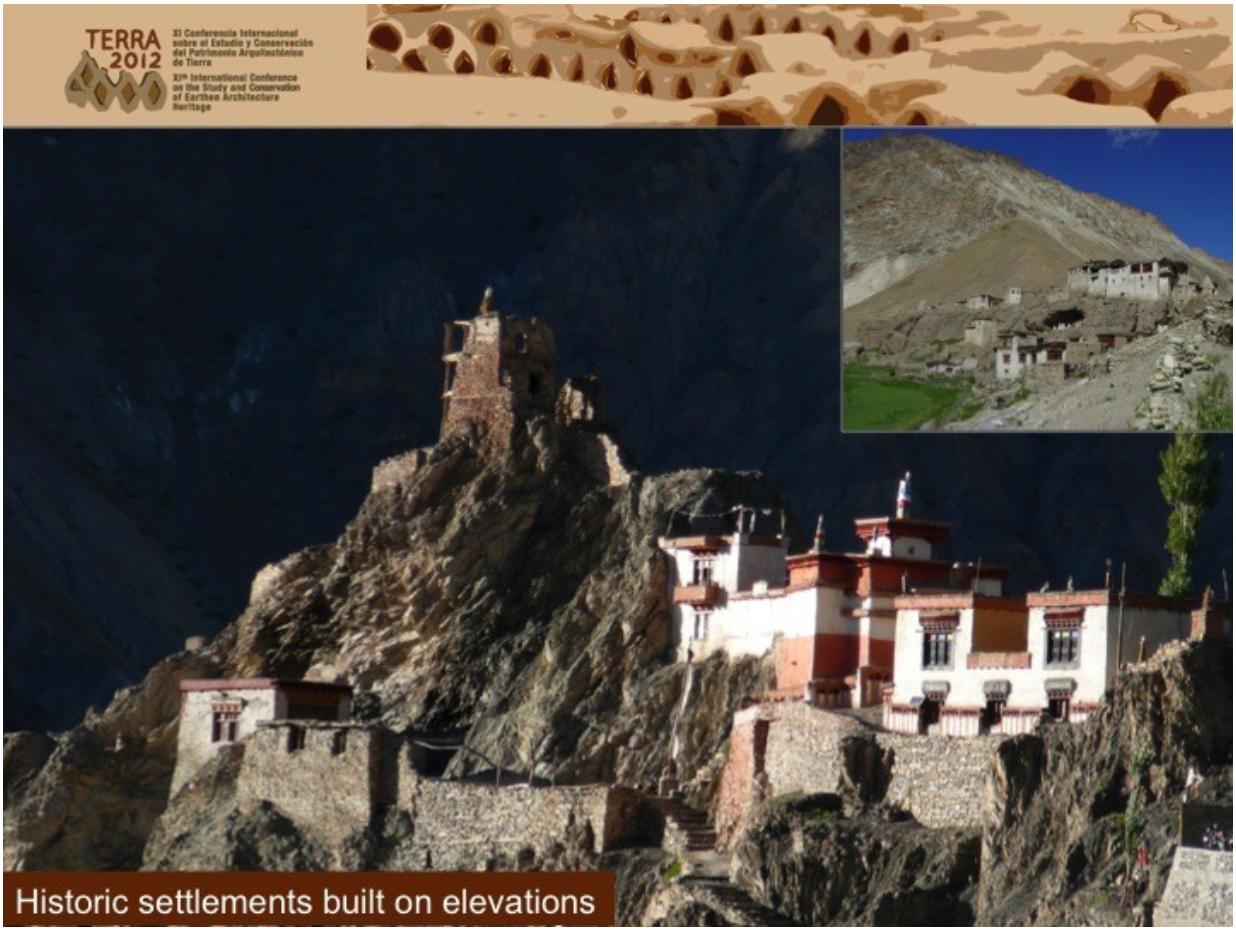
Right: Historic village Kanji

Even if the meteorological data demonstrate that there is no significant change in summer precipitation, people have observed that rainfall in summer has become unpredictable. At the beginning of August 2010 disastrous rainfalls affected Ladakh and Pakistan. Torrential downpours caused mud avalanches to destroy houses. Hundreds of people were killed alone in Ladakh and thousands were left homeless.



Left: Advertisement for India Cements, August 2011
Right: Leh/Ladakh in August 2010 after cloudburst.

Many people believe that the only chance for endurable housing in the future is to abandon the earth building technology and to construct buildings in cement instead.



But the catastrophe in 2010 demonstrated the strength of Ladakh's traditional building knowledge: most of the flat roofed earthen historic buildings survived the disaster, above all because they had been built on elevations far from the rivers and in areas where most likely no avalanches would occur. However, many of the destroyed buildings were built in dangerous areas. A considerable number of them were reinforced with cement and steel.

The irony of this situation is, that the traditional earth building technology after the catastrophe is now even more discredited in people's perception as not being adaptable to the changing climate.

Left: Religious buildings in Ladakh
Right: Detail of a wall painting

The exterior of Ladakh's architecture, many of them Buddhist religious structures, is kept simple and functional with minimal decorative elements.
Most historic buildings have masonry foundations, and the walls are built with adobe bricks. Roofs are flat and made of local tree trunks padded with local dry grass and plastered with re-enforced mud slurry. What makes the Buddhist religious buildings so extraordinary are their lavish interior decorations, like polychrome sculptures and elaborate wall paintings.

For more than ten years, the Achi Association, an NGO based in India and Switzerland, has contributed to preserve the cultural heritage in Ladakh, and to foster awareness-raising measures for the revaluation of the built earthen heritage. The association encourages interdisciplinary collaboration between conservators, architects, art historians and conservation scientists on the one hand and, on the other hand strives to increase the participation and involvement of the local communities.

The Achi Association's team of wall painting conservators and conservation scientists has been carrying out technological studies in temples, the earliest dating from the 13th century. We would like to present now our results of the research conducted on the wall paintings in different Buddhist temples.

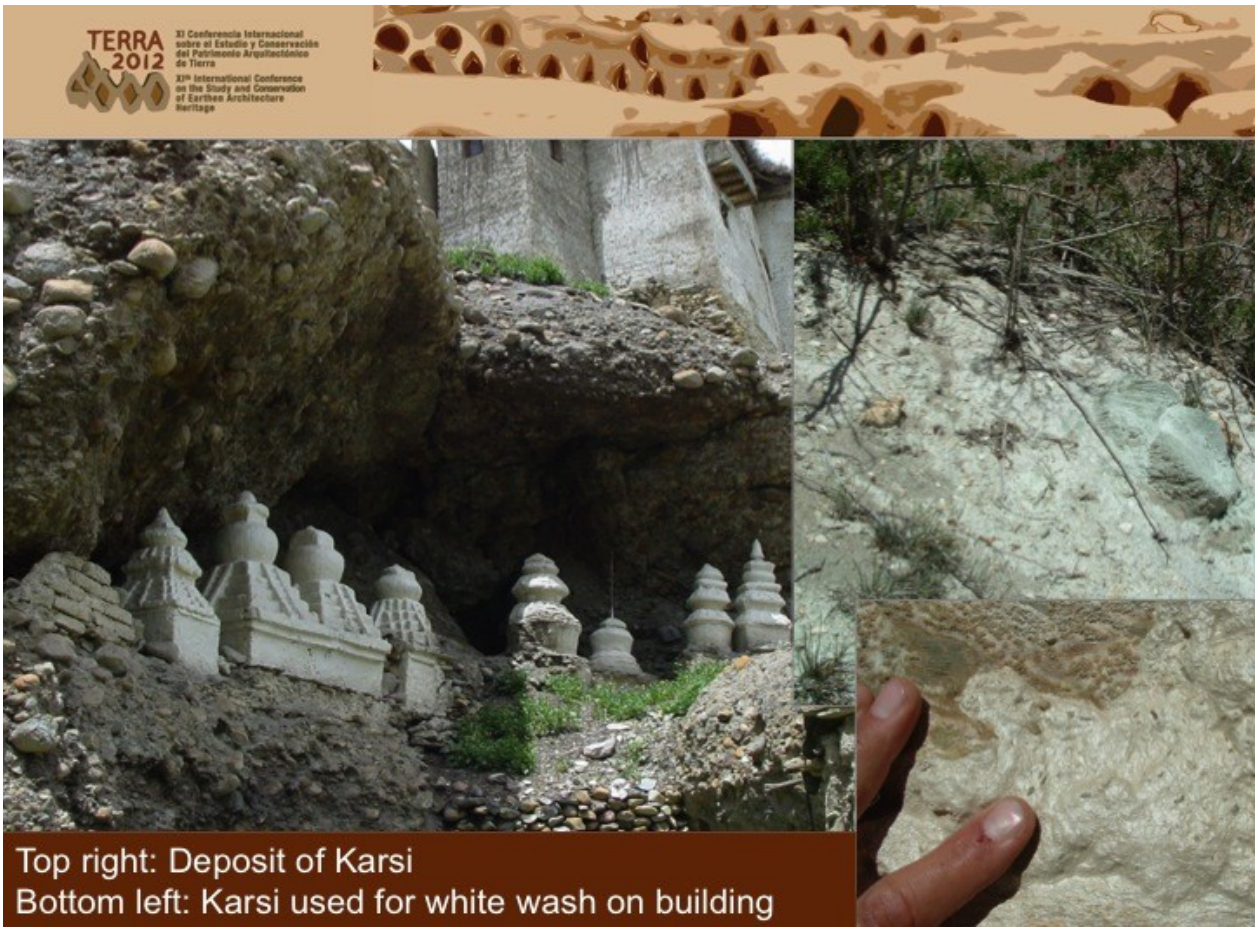
In the interior of these buildings the stone and adobe brick walls are covered with several layers of earthen plaster, which are finished to an even and smooth surface.
To modify the material characteristics of the plaster, different fillers like stone splinters and plant fibres were added.

The last layer consists of a very fine clay material, which is known by the name *markalak* , which translates to something like “butter-mud”. This material can be quarried all over Ladakh. Two major sources can be found at “Moonland” near Lamayuru, and near Spituk, which are both paleolake deposits.

Left: Paleolake deposit near Lamayuru (Moonland)
Right: Paleolake deposit at Spituk

The plaster is covered by a white burnished primer.
In Ladakh, this material is called *Karsi („dkar rtsi“* means something like “white wash”*).*
We investigated white painting materials from various places. Their composition and consistency differ considerably.
The whitewash materials employed for the building exteriors presumably depended on the characteristics of the available materials and thus reflect the local geology. These white coloured materials are in fact decomposed stone materials.
For example, at one of the investigated temples the whitewash is composed of some very fine-grained carbonate minerals and fibrous serpentine minerals. On diverse smaller religious structures near another temple the whitewash is made of a fibrous hydromagnesite.

The white primers of the investigated wall paintings in the different temples, however, are composed of gypsum or nearly gypsum-free calcium carbonates, containing calcite and aragonite.



Top right: Deposit of Karsi
Bottom left: Karsi used for white wash on building

The question is why different materials were used for the whitewash of the exterior and for the priming of paintings. We assume that the materials for the primer, as well as the pigments, were brought to the sites by the artists, as they provided the necessary characteristics for high quality paintings.

Loss of colour reveals the white primer

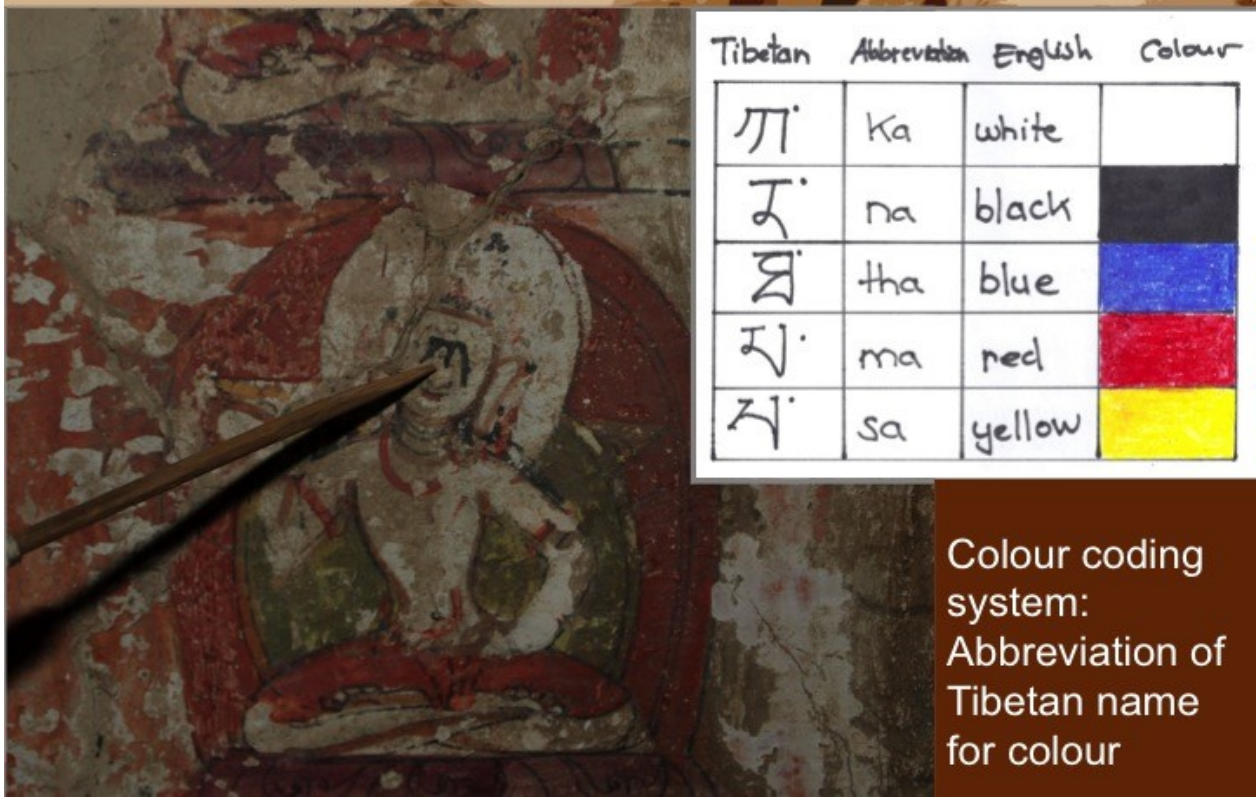
Top left: Incision lines for mandala
Right: Painted lines to section painting

Prior to the actual painting process the surface was divided into different sections. In many temples snapped or painted lines, either in red or yellow, have been detected. A further technique to section the paintings, is the incision of lines with a sharp tool into the plaster, above all used for the *Mandala* circles.

The paintings, as all religiously motivated images, were carried out in concordance with the iconographic and iconometric rules, as these were of primary significance for the consecration and value of the depiction.

Preparatory sketches, colouring and contour lines were the important steps of the painting process.

Prior to the colouring, every painting detail was assigned a number or an abbreviation of the scheduled colour. This colour coding system is still today in use in Tibetan painting.



Colour coding system: Abbreviation of Tibetan name for colour

Generally, paintings were carried out in many superimposed paint layers, and several colours have their respective under-painting colours. For example, light green lies below a dark green. And orpiment, which is a bright yellow, can be found underneath an ochre-coloured area.

Mostly, these colours were applied as semi-transparent washes, so as to give the image a certain kind of plasticity.

Which kind of representation was embellished with contour lines followed traditional guidelines and is one of the most important characteristics of these paintings. With this system important images could be clearly defined and accentuated. Minuscule details such as eyelashes, eyes and jewellery could be added.

Several additional decoration techniques like metal and pastiglia applications can be found in the temples.

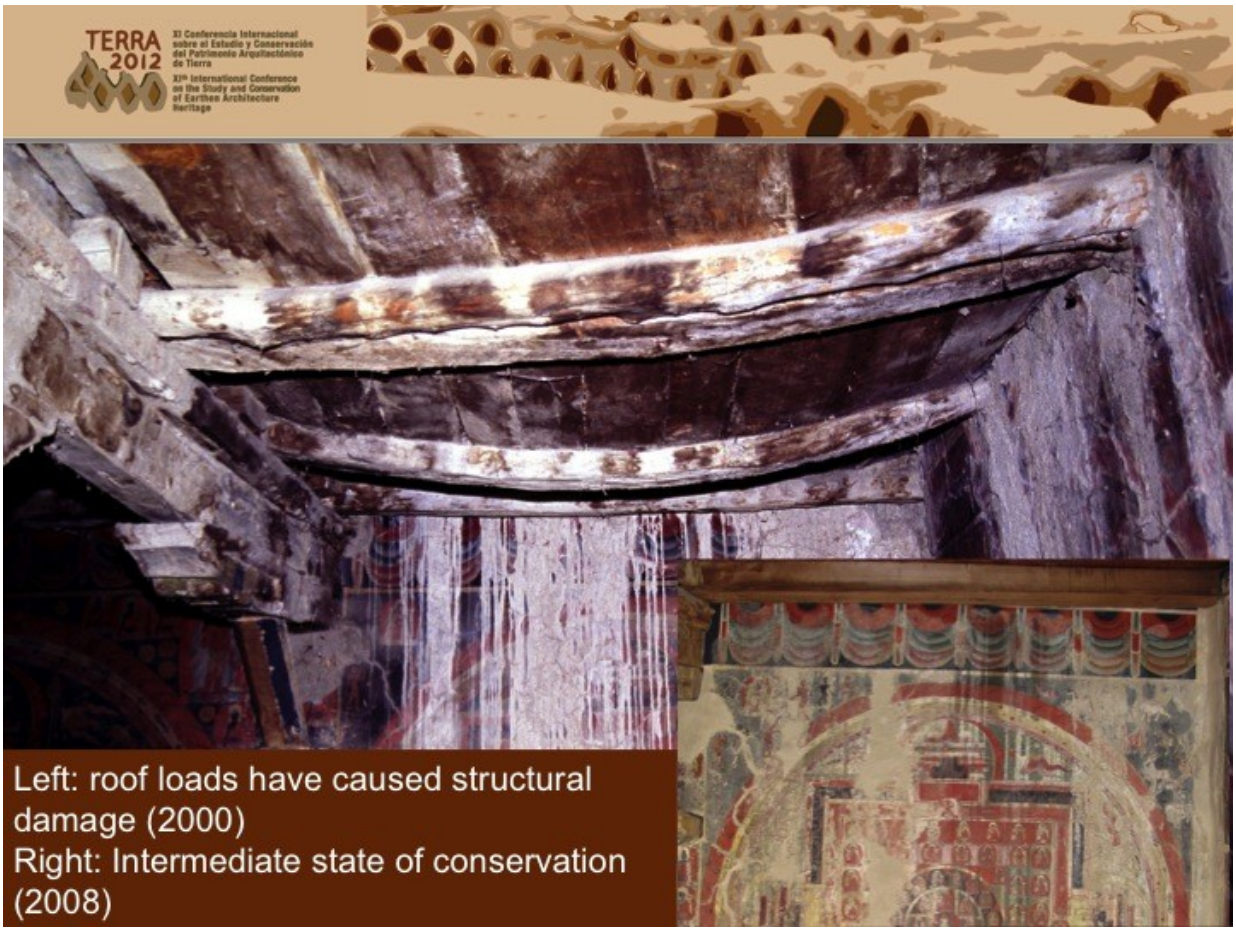
Gold was considered as having a particularly high merit which in turn augmented the religious power of the image.

All of these wall paintings are bound in a watery binding medium, such as plant gum, starch, animal glue or egg. These allow for the use of a relatively wide range of pigments.

It is possible that within one painting several binders were used. This is due to the fact that some painters believe only certain divinities should be created with animal glue. “Compassionate ” divinities are painted with plant glue/sap, the fierce ones however with animal glue.

Typical for this region is the use of azurite, red and yellow ochres, orpiment, indigo, red lacquer, carbon black and cinnabar. It is interesting to see that in earlier periods, a mixture of indigo blue and orpiment yellow was used as green. At a later period, from approximately the 15th century onwards, the green pigment malachite was then used for the green areas.

On various levels, the painting process is influenced by religion, as is demonstrated with the choice of materials, the figurative representations with their iconometric and iconographic rules, as well as with the sanctification. Also the position of a temple, a cloister or a sacred place is strongly linked to the position within the landscape bearing a religious significance. For example, one of the temples, together with other neighbouring structures form a religious powerful unity. These structures, so goes the legend, keep the different body parts of a dangerous and fierce female goddess literally tied to the mountains.



Left: roof loads have caused structural damage (2000)
Right: Intermediate state of conservation (2008)

In history the buildings have been maintained regularly. Well-meant maintenance work, such as the permanent additions of earth onto the roofs might have kept water leakage at bay, but resulted in too heavy roof loads. It has thus led to many structural problems, and in a near collapse of many buildings. The numerous additions of earthen material onto the roofs are possibly also an indication that throughout times the region had to face more or less heavy rainfalls.

One of the main conservation goals of most of these structures is to reduce the roof load and to render the roof more water-resistant. As important as the conservation is however regular maintenance, like clearing water-spouts and closing cracks after heavy rainfalls.

The conservation of the wall paintings and their earthen support depends on the one hand on the historic materials and techniques. Nevertheless, we also need to consider the religious significance of these materials and techniques, as well as the on-going religious acts which take place in the temples.

The religious act with its yearly white washing ceremony of the temple should become again a significant and conscious maintenance measure.

Left: Consecration ceremony of a religious structure
Right: Splashes of white wash on painting