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The Twenty-first Regular Report

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ACCU Nara International Correspondent

The ACCU correspondents periodically send reports on cultural heritage protection activities in which they have been recently involved. This is a collection of eight reports submitted by international correspondents in the Asia-Pacific region.

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Bhutan

Archaeological Study on *Dzongs* - Comparative Analysis of Plan Form Typologies of a Different Era

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Introduction

Fortresses in Bhutan are locally known as *dzongs*. According to the history and era of the construction, fortresses in Bhutan can be categorized according to three phases: (1) Pre-Zhabdrung *dzongs* (2) Zhabdrung-era *dzongs* (3) Post-Zhabdrung *dzongs*. Most of the principal surviving *dzongs* that are still in use are attributed to the great historical and religious ruler Zhabdrung Ngawang Namgyel (1594-1651) and his successors (MoWHS 2014). Zhabdrung Ngawang Namgyel is regarded as the unifier of the country as a nation state. In the process of unifying and gaining control over the different regions, which were at that time ruled by local chieftains and clerics of different Buddhist sects, he had constructed chain of *dzongs* in the country (Hasrat 1980, also see Fig. 1). He established a dual system of governance in which the secular and spiritual affairs of the state functioned from the dzong (Phuntsho K 2011 p.232).

However, the practice of building *dzongs* in Bhutan pre-dates the introduction of *dzongs* by Zhabdrung Ngawang Namgyel in the 17th century, and can be traced back to as early as the 12th century (Dept. of Works 1993, p.52). Presently, very little is known about the form and function of the pre-Zhabdrung *dzongs*. Therefore, this report aims to compare and analyze the plan form typologies from the results of the archaeological survey and documentation of pre-Zhabdrung fortress ruins implemented under the Bhutan-Swiss Archaeology Project with the Zhabdrung era and contemporary *dzongs* to gain a better understanding of the *dzongs* of the country.

Comparison will be made with recent archaeological studies by Meyer W. (2010) in "Bhutan-Swiss Archaeological Project 2008-2010 Drapham Dzong, Bhutan 2010, Excavation Result from Stage 3 (Autumn 2010)" on Drapham Dzong ruin; and Bader et al. (2012) in *The Obtsho Dzong Ruin — Inventory and Documentation of a Pre-Zhabdrung Dzong under Gasa Dzongkhag in Northern Bhutan* along with inventory and documentation; and Bader C., Tobgay S., Kinga S. and Tenzin K. (2013) in *Chubjakha Dzong Ruin, Paro Dzongkhag, Kingdom of Bhutan* implemented under Phases I and II of the Bhutan-Swiss Archaeology Project. These sites are relevant for the present comparative analysis, not only because these two *dzongs* were built before the Zhabdrung-era *dzongs*, but also because their ruined state has prevented them from undergoing later interventions. Furthermore, comparison will be carried out with the "Assessment Report, Wangduephodrang Dzong Structures Post-June 24, 2012 Fire", regarding a *dzong* built by Zhambdrung Ngawang Namgyel. References to the available historical pictorial records and the present preserved state of other historical *dzongs* of different eras will also be considered where relevant, to further supplement understanding of the *dzongs* of different eras. Moreover, the sketches of Samuel Davis drawn in 1783, photographs taken by John Claude White in 1905, and the state of Wangduephodrang Dzong before the fire in June 24, 2012 provide a general overview of the state of the *dzongs* at different times to discern how they have changed and evolved over time.

Basic information on the sites

a) Drapham Dzong ruins

The Drapham Dzong Archaeology Project was the first ever archaeology project executed in Bhutan under the Bhutan-Swiss Archaeology Project, which spanned over three years from 2008-2010. The Drapham Dzong (fortress) ruins complex is situated in the Bumthang district in Central Bhutan (Fig. 1). The scientific excavation of the ruins resulted in a better understanding of the layout of the main fortress, which runs approximately 200 m long in a north-south direction (Figs. 2 and 3). The main fortress is supplemented with two fore fortresses built on lower platforms. Oral accounts indicate that the fortress was the winter residence of Choekhor Deb (leader of the community) and is said to have been built in the 15th century.

b) Chubjakha Dzong ruins

Chubjakha Dzong ruins are located on top of a hill overlooking Paro Valley, a few kilometres above the Paro National Museum (Figs. 1, 4, and 5). It falls within the Hungrel gewog (block), Paro Dzongkhag district, Bhutan. The site is at present connected with a farm road located some 20 to 30 minutes' drive from the Paro National Museum.

Exact Location (Site Coordinates, Drukref 03)

E 194457.730
N 3034809.540
Altitude: 2878 m a.s.l.

According to "The Gem-Necklace of Short Biography of Hungrel Dung Dung and His Descendants" by Sherab Pelzang, the present Chubjakha site was earlier the seat of Kunkhen Longchen Rabjampa, a Buddhist master of the Nyingmapa sect or order of Tibetan Buddhism in the 14th century, and the place was referred to as Chewakha, meaning "area with a vast open sky" (Dargye 2013 p.10). Furthermore, history reveals that Kunkhen Longchen Rabjampa came to Bhutan in the 14th century to escape from the turmoil of Tibetan politics and established several monastic seats across the country including Samtenling at Paro (Phuntsho K. 2011 p.157; Penjore D. 2005 p.62). A similar argument is made by Rinchen (2004), who suggests that Kunkhyen Longchen Rabjampa is said to have founded Samtenling at the present Chubjakha site. These sources confirm that the present Chubjakha Dzong ruins site was the earlier seat of Kunkhen Longchen Rabjampa in the 14th century. The biography records that Kunkhen Longchen Rabjampa's seat (the present Chubjakha site)

was later offered, at an unknown date (between 1400 and 1503), to Drung Drung Gyalchog, who was at that time residing at Yang-yen Dechenling just above the present Chubjakha site. It is mentioned that once he took over the site, Drung Drung Gyalchog renovated it and converted it into his lower residence, with his earlier residence, Yang-yen Dechenling, serving as his upper residence (Pelzang 2004).

c) Obtsho Dzong ruins

The Obtsho Dzong ruins site under the Khatoed Gewog, Gasa Dzongkhag is situated on the north-eastern flank of a hill facing Gasa Dzong (Figs. 1 and 6). It is an hour's walk from the nearest road.

Site coordinates

E 219819.114
N 584527.893

The Obtsho Dzong ruins are said to have been the seat of Obtsho Choeje offshoots. Even though not much is known about Obtsho, history records that Obtsho Choeje was one of the oldest choeje in Bhutan. The current Obtsho ruins are believed to have been founded by DrupthobTerkhungpa in the early 12th century AD. It was Obtsho Lama, a descendent of Obtsho Choeji, who invited Zhabdrungto Bhutan in the 17th century. In Bhutan, the existing *dzongs* were mostly built by Zhabdrung during his era (17th century) or built later. The pre-Zhabdrung *dzongs* are mostly in ruins and the Obtsho Dzong ruins are an example of one of the pre-Zhadrung *dzongs*.

d) Wangduephodrang Dzong

Wangduephodrang Dzong is the third oldest *dzong* built by Zhabdrung Ngawang Namgyel in 1638. It is situated on top of a hill overlooking the convergence of two rivers (Figs.1, 7 and 8)—the Punatsangchu flowing from the west and the Dangchhu from the east.

The *dzong* is currently under reconstruction after a fire in 2012. History records that the *dzong* was later extended by the 4th temporal ruler (Desi) Gyalsay Tenzin Rabgye in 1683, and thereafter the *dzong* underwent several major renovations: in 1767 by Dzongzin Sonam Lhendrup, in 1837 after a fire, and in 1897 due to an earthquake. Several minor renovations were carried out in 1952 during the reign of the second King Jigme Wangchuck and in 1983 during the reign of the fourth King Jigme Singye Wangchuck.

Comparative analysis of plan form typologies of *dzongs* in different era

Wangduephodrang Dzong consisted of three distinct courtyards arranged in a north to south orientation. Each courtyard was enclosed by an elongated square and rectangular building built according to the profile of the terrain (Figs. 5 and 8). The first courtyard area housed administrative offices, and the second and third courtyards served as religious zones. Based on historical accounts and site analysis, DCHS (2013, p.16) asserted that the third courtyard area was the original fortress complex first built by Zhabdrung Ngawang Namgyel in 1638. Furthermore, DCHS asserts that the first and second courtyard area was built by his successor Gyalsay Tenzin Rabgye in 1683, a post-Zhabdrung era development (Fig. 8). The original fortress complex (third courtyard) built by Zhabdrung Ngawang Namgyel consisted of the central rectangular tower *utse* enclosed within a surrounding rectangular structure known as the *Shabkhor*, with a congregation hall known as the *Kuenrey* to the extreme south and a three-storeyed building that housed the shrines of the protective deity known as Goenkhang to the north (Fig. 8). This surviving evidence suggests that the Zhabdrung-era fortress complex was relatively small, and more importantly, more or less equal to the scale of the main fortress complex of Chubjakha Dzong ruins (Fig. 5).

The post-fire analysis of Wangduephodrang Dzong suggests that most of the *Shabkhor* structures in the third courtyard area were built at the same time as the *utse*, and the rest of the complex was also completed in the Zhabdrung era, with the exception of the eastern part of the wall and two upper floors of the *utse* added during the extension work in 1683 (DCHS 2013 p.42). Examining the layout of the third courtyard fortress complex indicates that it was a well-planned design, built according to the profile of the terrain. This shows that the design of the fortress complex originally built by Zhabdrung included the *utse* and the *Shabkhor* structures from the outset. In contrast, at the Chubjakha Dzong ruins, the *utse* building was built first and then the surrounding rectangular structures and defence towers were added later to the *utse* building since the walls of the surrounding structures are not interconnected but rather about the walls of the *utse* (Fig. 5). Drapham Dzong ruins provide a further example of a two-phase complex. Meyer W (2010) argues that the main fortress complex was built in the first phase of construction and the additional entrance side structures in the second phase (Fig. 3). Furthermore, he asserts that the first structure to be built within the Phase 1 fortress was the *utse* structure (Meyer 2010, p.163). The main fortress complex at the Drapham Dzong ruins is rectangular in plan, with an open courtyard at the centre enclosed by the *utse* building at the northern end of the fortress complex, a watch tower at the southern end and two *Shabkhor* wings on the eastern and western sides (ibid p.163). This evidence clearly shows that the courtyard concept for the building of fortresses existed before the Zhabdrung-era fortresses were built.

The courtyard concept plan is common in all the *dzongs*, however, there are interesting differences between the layouts of the Zhabdrung era fortress complexes compared to the pre-Zhabdrung and some of the post Zhabdrungera fortresses. In the fortress complex built by Zhabdrung in Wangduephodrang (Fig. 7), and also in the present preserved *dzongs* built during the Zhabdrung era (Figs. 10, 11 and 12), the *utse* structure is not only centrally located but also isolated from the *Shabkhor* structures, leaving a circumambulatory space around it. This indicates the significance of the *utse* as a building that houses the main temple in the *dzong* (MoWHS 2014, p.22). In contrast, in the pre-Zhabdrung *dzongs*, such as in Chubjakha Dzong ruins (Fig. 5), Drapham Dzong ruin (Fig. 2) and Obtsho Dzong ruin (Fig. 6), the surrounding (*Shabkhor*) structures built later were attached to the *utse*.

Further contrasts are provided by some of the present preserved post-Zhabdrung *dzongs*, where the *utse* structures are located towards the edge of the fortress complex, and built attached to the surrounding structures. For instance, at Lhuentse Dzong and Trashigang Dzong, both of which are said to have been built by the third temporal ruler Minjur Tenpa in 1654 and 1659, respectively (Namgyel T et al. 2007), the *utse* are located at the edge of the fortress complex attached to the surrounding structures (Figs. 13 and 14). In case of the post-Zhabdrung *dzongs*, it seems likely that the *utse* structure was built towards the edge of the fortress complex in order to form a huge courtyard space for festivals and public gatherings. This is one apparent reason why the Wangduephodrang Dzong was later extended by Gyalsay Tenzin Rabgye in 1683 with a huge first courtyard space (Fig. 5), since the original fortress complex built by Zhabdrung has very limited space for public gatherings during festivals. The expansion of the space clearly indicates the rise in power and establishment of the dual system of government that functioned from the *dzong*.

Conclusion

Existing literature on *dzongs* in Bhutan largely relies and reflects on Zhabdrung-era *dzongs* as the model for understanding the architectural legacy today as a system that housed administrative and religious buildings. However, the present study reveals that there is a level of continuity and yet differences between the pre-Zhabdrung *dzongs* and the Zhabdrung and post-Zhabdrung-era *dzongs*. For instance, evidence related to the Chubjakha Dzong ruins, Drapham Dzong ruins and Obtsho Dzong ruins tells us that the pre-Zhabdrung *dzongs* had primarily defensive and political functions, with the *utse* at the centre of a defensive complex, accommodating the regional chieftains. Over time, additional defensive structures were added, probably due to expansion of the lord's household and increased control over the regions. Gradually, this site, with the increase in the number of patrons and followers, became a regional centre for festivals and other gatherings as social and religious activities.

The arrival of Zhabdrung brought changes in the structure of the *dzong* system. He had appropriated and expanded the already existing pre-Zhabdrung model of building *dzongs* and had established an administrative and religious centre, which is the legacy of these sites today. He had retained the *utse* as a symbol of continuity and continued to use similar architectural construction methods and details that already existed in the country. Later, Zhabdrung and his successors expanded the administrative and religious functions of these buildings, creating the typology that endures to this day. This clearly shows us that the present surviving *dzongs* are a combination both of pre-Zhabdrung era architecture and Zhabdrung's vision of their function from the 17th century onwards.

However, due to the absence of documentary evidence and stratigraphic analysis on the development of the present surviving *dzongs* in Bhutan, the present study was hugely constrained by the limited number of case studies for comparative analysis. Therefore, there is still a gap in our understanding of *dzongs*. However, on a positive note, there is huge potential for research on the development of *dzongs* in Bhutan.

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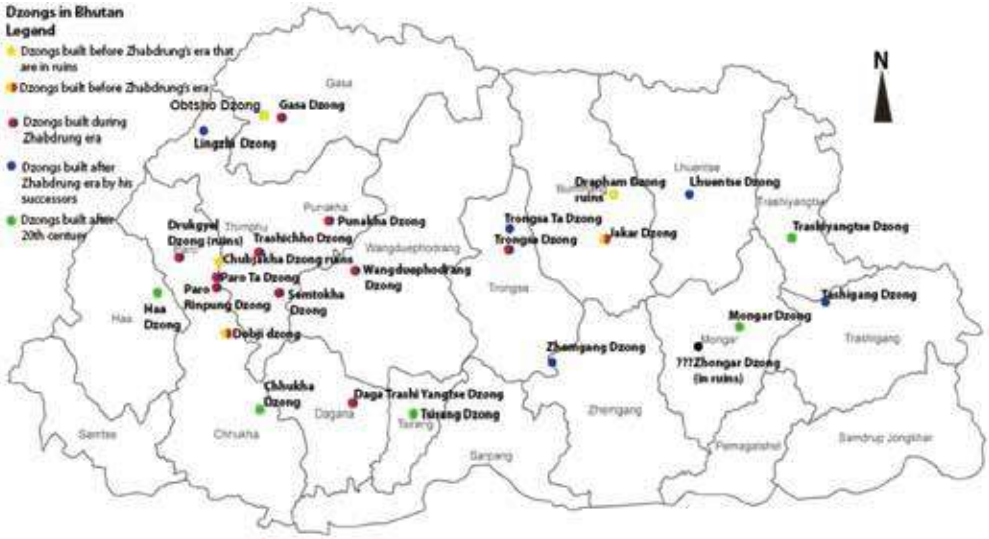

Fig. 1. Chronology of *dzong*s in Bhutan

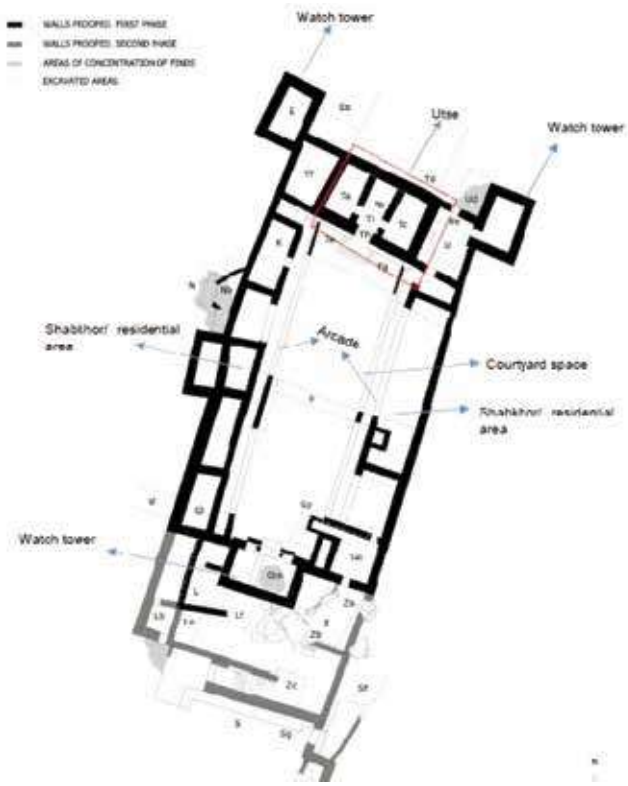

Fig. 2. A plan of Drapham

Fig. 3. A view of Drapham Dzong ruins

Fig. 4. A Google Earth map showing the location of Chubjakha Dzong ruins

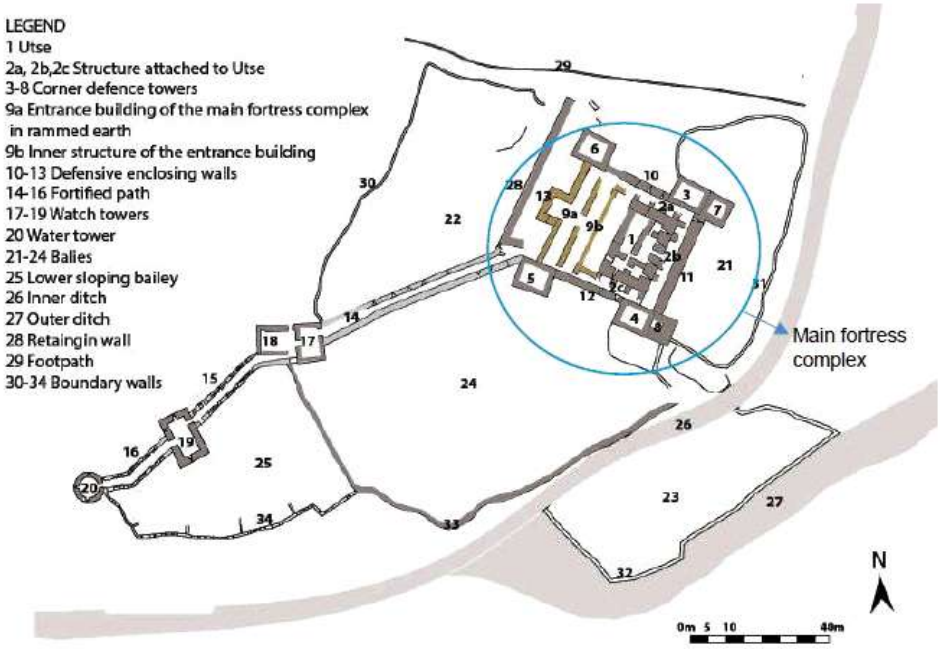

Fig. 5. A plan of Chubjakha Dzong ruins (Bader et al. 2013 p.307)

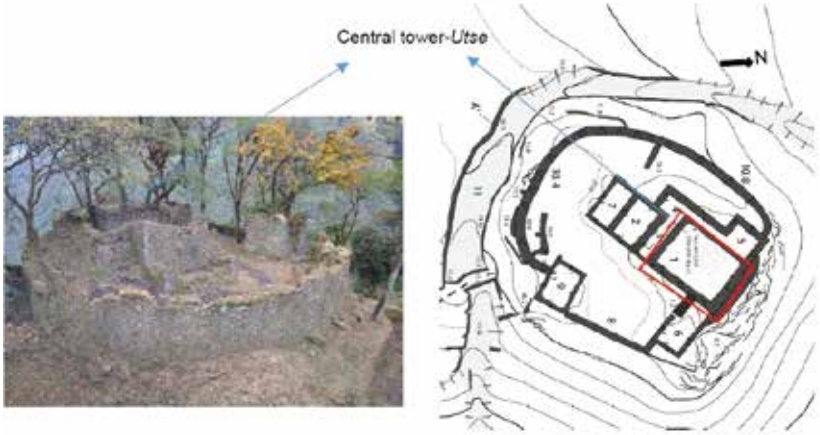

Fig. 6. A view and a plan of Obtsho Dzong ruins

Fig. 7. A location of Wangduephodrang Dzong

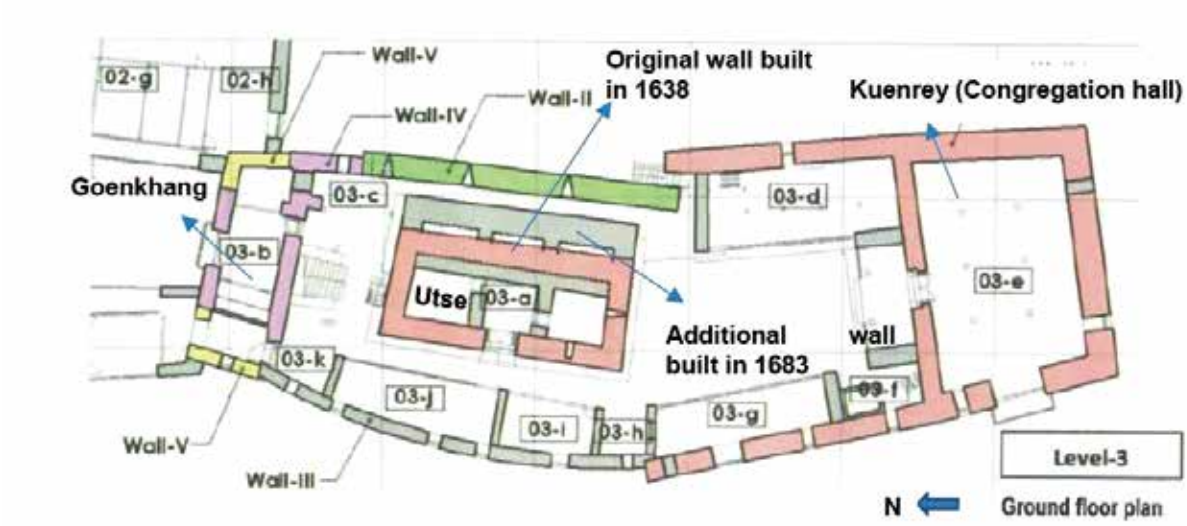

Fig. 8. Ground Plan of Wangduephodrang Dzong before the 2012 fire. The walls highlighted in pink are the walls preserved from 1638. Source: DCHS (2013 p.41)

Fig. 9. A view of Wangduephodrang Dzong before the 2012 fire. The walls highlighted in pink are the walls preserved from 1638. Source: DCHS (2016)

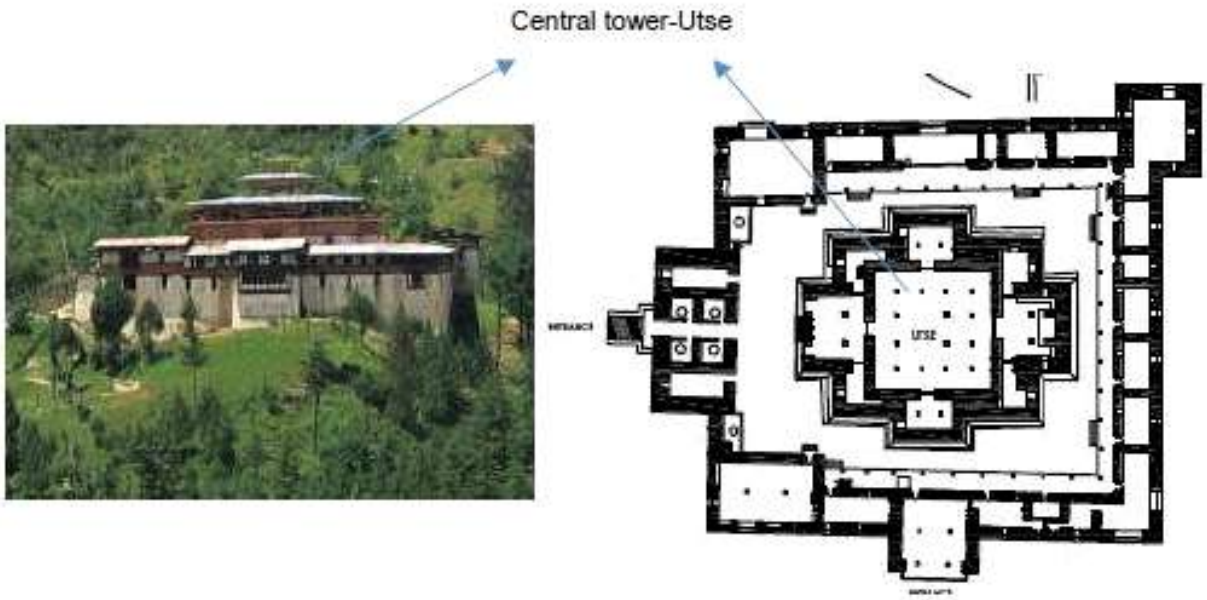

Fig. 10. A view and a plan of Semtokha Dzong built by Zhabdrung Ngawang Namgyel in 1629. Source: MoWHS (2014)

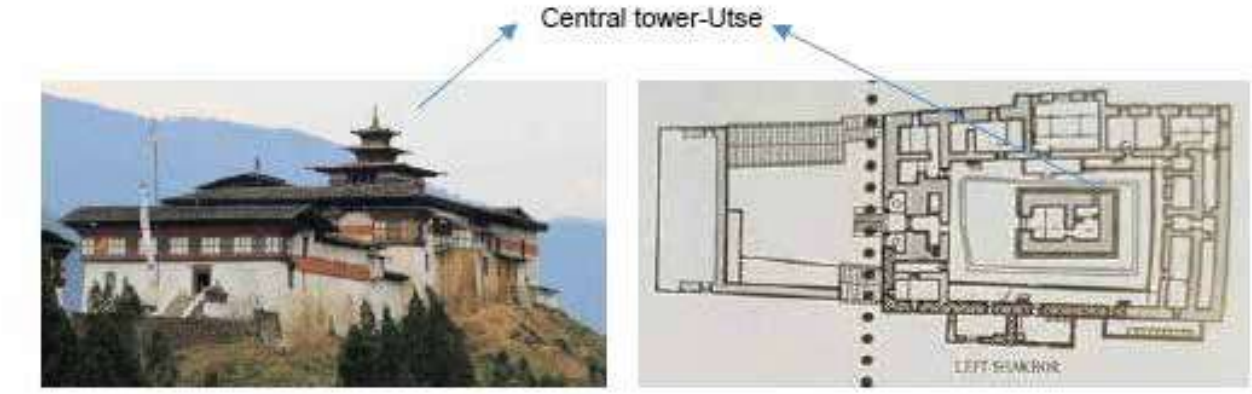

Fig. 11. A view and a plan of Daga Trashi Yangtse Dzong built in 1651. Source: DCAH (2006)

Fig. 12. A view and a plan of Paro Dzong built in 1644. Source: DCAH (2006)

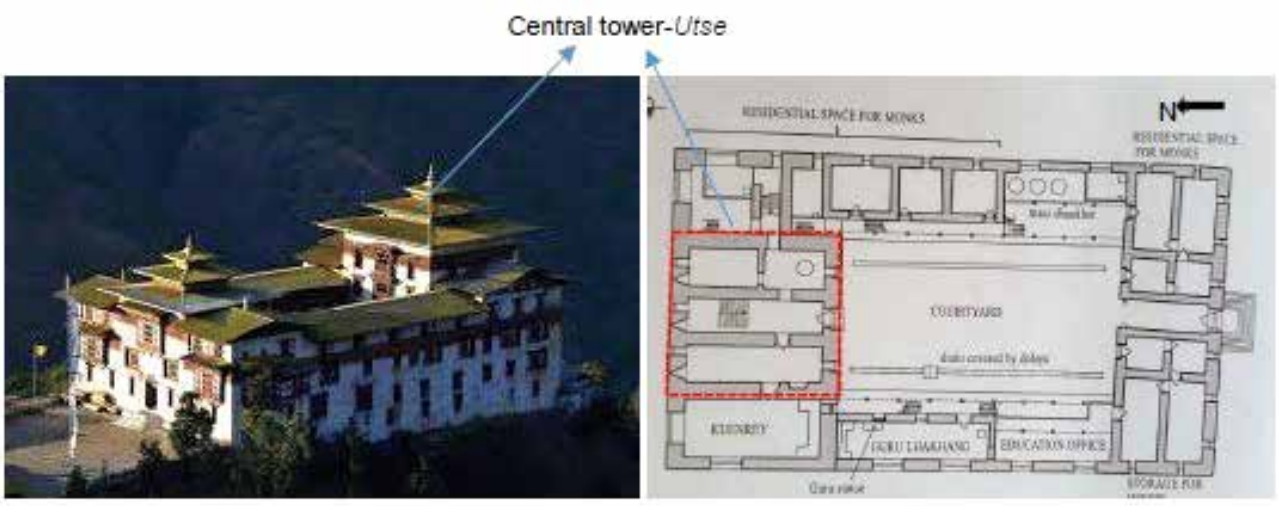

Fig. 13. A view and a plan of Tashigang Dzong built in 1644. Source: DCAH (2006)

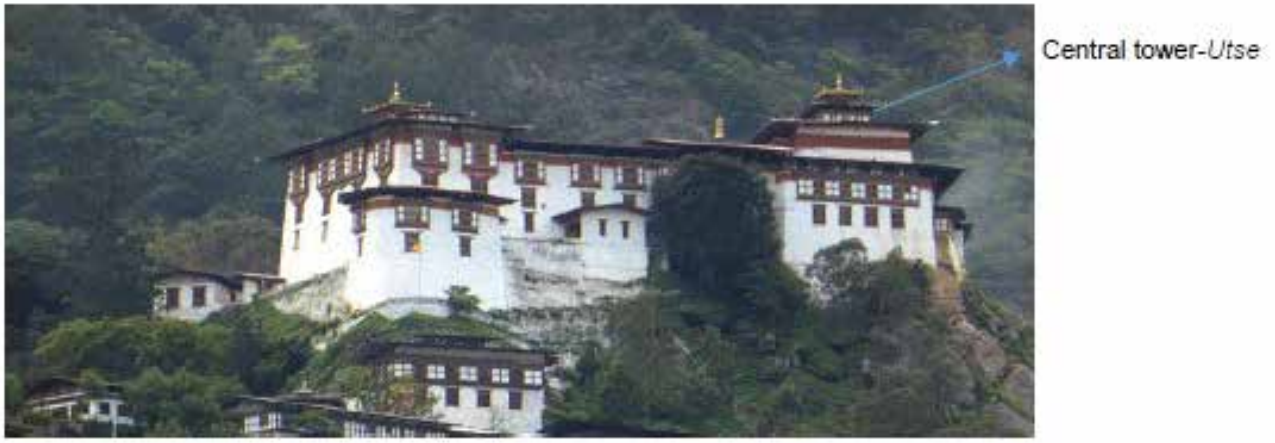

Fig. 14. A view of Ihuentse Dzong. Source: DCAH (2006)

Kazakhstan

On the Issue of the Nomination of Certain Monuments to the UNESCO World Heritage List

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This year I will touch on one of the important topics — the nomination of the cultural heritage of our people to the UNESCO Cultural Heritage List. Along with such major steps of our state as the abandonment of nuclear weapons and the closure of the landfills, Kazakhstan seeks to integrate into the world structure as a country with an ancient culture, and nominating the cultural heritage of our people on the UNESCO List is one of the priorities for the protection and promotion of antiquities.

Along with the monuments that are truly worthy of nomination, there have been a number of hurriedly included properties of historical and cultural heritage, requiring detailed study, interpretation and inclusion as properties of serial nomination as part of the Silk Road.

In this year's report, I intend to describe the situation with the Karamergen castle, which was nominated in 2013 for the UNESCO World Heritage List. "The Silk Road: the network of routes of the Chang'an-Tianshan corridor" - among other Kazakhstani sites (the settlements of Kayalyk, Talgar, Aktobe, Akyrtas, Kulan, Kostobe and Ornek). By itself, the nomination has many controversial points.

First, the concept of the Silk Road is not a historical concept, but a term coined by Ferdinand von Richthofen as a designation of trade routes between the East and the West. This became possible after overcoming the Takla Makan desert, which stretches from the east to the west for a thousand kilometers, bounded on both sides by impassable mountains, the ridges of the Pamirs and Tanir-taga (Tien Shan). From the time of Alexander the Great, the territory to the west of the Fergana Valley was included in the territorial trade, and had cultural and political relations with Persia and further to the West and ancient contacts with India. The Silk Road originated after Sogdian merchants were able to overcome the sands of Takla Makan and discover the markets of ancient China.

Secondly, the northern and northwestern territories, through the lands of nomadic peoples since ancient times, were closed both by natural barriers and antagonistic relations between sedentary and nomadic peoples. The relationship between them was limited to mainly military clashes. This is evidenced by the largest "artifact" — the Great Wall of China. It was built in the 3rd century BC, long before the start of the Silk Road. This wall, stretching nearly nine thousand kilometers, built over centuries, shows conclusively the relationship between the two worlds — nomadic and settled. The way of life and the image of the economy formed different worlds. As with the invasion of Europe by the Huns, the nomads gave rise to myths about cavalry warriors from Attila to Genghis Khan.

The insufficiency of justification for the inclusion of objects in the territory of Kazakhstan into the Silk Road system will be considered using the example of one object — the settlement of Karamergen, located in the middle part of the territories of the nomadic peoples. This is, first of all, due to lack of knowledge of the monument — the monument cannot be dated or attributed to a specific chronological period, let alone a full or partial study to reveal its attribution to monuments on the route of the Silk Road.

There are no references to the Karamergen in medieval sources, while cities like Sairam (Ispijab) and Taraz (Talas) were certainly included in the system of caravan roads, and were described by ancient historians and travelers. So medieval authors mention the existence of the Talas road linking Ancient Taraz with the Fergana Valley and Samarkand. Geographical coordinates of the settlement of Karamergen is N 46.254760, E 75.626026.

The facility is located in the delta of the river Ili, formed by three strategic channels. The settlement is located in a remote place, with the nearest small village Karaoy located 107 km west of the monument. In the territory in between there are no dwellings. The road is a dirt track, often branching out due to natural barriers. This desert territory is not even used for seasonal pastures, although in antiquity it contained fertile places for winter camps of nomads with a developed nomadic economy. This is evidenced by the remains of settlements stretched along the line of nomads from south to north and the remains of extensive irrigation systems.

For inclusion in the World Heritage List, the object must meet one of the known criteria for determining the value of the monument. Our preliminary studies have shown that the settlement represents the remains of destroyed fortress walls in the form of shafts of irregular quadrilateral shape with sides of about 120×110 m. The inner part of the settlement is flat with no traces of large structures, which indicates the seasonal use of the settlement.

In the corners and in the walls, there are elevations from the remains of the towers. Entrances to the settlement are arranged on the eastern and western sides in the form of L-shaped structures. At one time, excavations were made at the site from the inner side in the south-eastern part. This is a very unclear small sub-rectangular excavation with sides of about 6×4 m. Beside it, there are two small pits in the territory (1×1 m). Another small excavation is located on the outside of the south-west wall. Excavation boundaries are heavily blurred and difficult to fix.

When inspecting the settlement, the impression was that the settlement was not inhabited, as there is no

cultural layer inside the settlement. Fragments of pottery were found along the southern and western walls of the settlement from the outside. There are traces of later constructions attached to the shafts (nomads' wintering), and pottery fragments were also found at this place, while fragments of ceramics are practically absent in the area of the settlement itself. The fragments of ceramics are few in number and represented mainly by stucco "nomadic" early medieval ceramics.

It can be assumed that the settlement was of an earlier time, and that the medieval pottery belongs to a later time and is not connected with the settlement itself, but to later buildings built on the outside of the shafts. This is supported by the localization of fragments of medieval ceramics to the medieval buildings attached to the southwestern and southeastern fortress walls. It is premature to date the construction and existence of the settlement. There are no traces of excavated structures at the excavations. The excavations were not mothballed and if there were remains of structures there, they were not preserved.

As an example, one can cite a number of ancient sites from ancient times located in the lower reaches of the Syr Darya and Shu rivers, where medieval layers were attached or layered to the ruins of early fortifications.

The monument is located on the southern shore of Lake Balkhash, which stretches for hundreds of kilometers from east to west. The narrow isthmus in the central part of the lake is 28 km wide and I do not think it is possible to assume that caravans crossed the lake by water such a distance of the day path. A full assessment of the monument has not been carried out due to the small excavations. Therefore, to talk about the time of existence and its appointment as a city on the Silk Road has no scientific basis. The size of the fortification and the lack of cultural layers mean that it cannot be attributed to any particular type of city or even caravanserai. The location, absence of a significant cultural layer and structures inside the fortress, is most likely evidence of its designation as a winter post of the nomadic nobility.

The scientific side of the research in the dossier on Karamergen is practically non-existent, and there are no objects (except for the shafts of the settlement) for research and subsequent preservation and museumfication. In general, the monument is located in a remote place and there is no infrastructure. The roads are dangerous when driving unprepared off-road vehicles, and other types of transport are not suitable here. In addition to the inaccessibility, there is a health threat because this territory belongs to the natural foci of the plague. The last epizootic of the plague took place here in 2009.

Of great importance is the fact that the creation of infrastructure (in accordance with the requirements of UNESCO and the tourism industry) in this hard-to-reach place requires a large financial outlay (building a road in an empty desert, conducting research and conservation and restoration works, building the necessary buildings, carrying out anti-plague and anti-mosquito measures, keeping staff in extreme conditions, etc.).

It should be noted that the weaknesses of this nomination do not detract from the possibilities for our country in nominating unique objects of history for inclusion on the World Heritage List. In recent years, our country has nominated the site of world-famous monuments, museum-reserves in Turkestan, petroglyphs in Tamgaly, the Necropolis Berel, the reserve-museum "Issyk" on the site of the "Golden Warrior", Ulytau — an ancient reserve zone where the monuments are located above the graves of the eldest son of Genghis Khan, Dzhuchi, and the founder of the Nogai Horde, Emir Edigei. Among the ancient cities along with Turkestan, Taraz is a significant monument of urban culture.

Taraz is a city with two thousand years of history, mentioned in many geographical and historical writings of antiquity and the Middle Ages. Long-term studies of the city showed that it had the correct, quarterly structure. Among the finds there are unique jewelry and original ceramics. Some finds have inscriptions in Turkic runics, Arabic script, and Gupta and Sogdian letters. The trade relations of the city are illustrated by hundreds of coins, including minted silver dirhems of Taraz, Tang coins, Byzantine gold solids, gold dinars of the Samanids.

By nominating historical and cultural monuments for the discovery of our country on a global scale, we should not distort historical reality. It is necessary to present authentic and unique objects and evidentiary facts about them. We must strive to nominate objects that have been studied sufficiently and that are prepared for visitors. For this, there must be the necessary infrastructure for the development of tourist routes.

The Silk Road, as a unique phenomenon in the history of mankind, is relevant now. In 2013, PRC Chairman Xi Jinping, speaking at Nazarbayev University in Astana, put forward the concept of building the Silk Road Economic Belt — a huge area of economic cooperation that would extend from China to Europe. This modern concept aims at economic, political and cultural cooperation, a revival of the idea of the Silk Road.

The location of the settlement of Karamergen on the map

The Karamergen aerial photo : the current state

Kyrgyzstan

The Mausoleum Kyok-Tash in Kyrgyzstan

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In 2017-2018, an archaeological team of the Kyrgyz-Turkish Manas University (Bishkek) under the supervision of Prof. Kubatbek Tabaldiev conducted excavations at the Kyok-Tash site in the Kochkor region, Kyrgyzstan. The excavations were carried out thanks to the financial support of the Turkish Cooperation and Coordination Agency (TIKA).

The Kyok-Tash site, which was later identified as a mausoleum, is situated 3 km north-east from Kum-Dyobo village, on the right bank of the irrigation canal built during Soviet times. The exact geographical coordinates of the site are N 42°14´22,7´´, E075°34´36.0´´. The mausoleum was named after the location where it is situated, and where the blue-glazed ceramic fragments had been found by local people.* The results of the excavations have shown that the ceramic fragments are the remains of a table with short, triangular legs.

Originally, the Kyok-Tash mausoleum was accidentally discovered by local residents in 1988, during the construction of the silage pit. Local officials and some academicians were informed of the dis-covery, but due to the lack of financial means, archaeological excavations and conservation works have not been undertaken.

In 2010-2011, one of the residents of Ak-Zhar village, situated about 3 km south-east of the site, car-ried out illegal excavations in the precincts of the mausoleum. Thanks to the media coverage, the looting sparked a public outcry. However, as a result of the illegal excavations, a big pile of earth mixed up with fired bricks and two holes have appeared in the precincts of the site. Moreover, parts of the dome and walls were apparently destroyed during that illegal action (Fig. 1).

This fact prompted us to seek the necessary financial resources to carry out rescue excavations and conservation. In 2017, with support from the Turkish Cooperation and Coordination Agency (TIKA) archaeological excavations at the site were initiated. By September 2018, the works have practically been completed. The Kyok-Tash mausoleum was built with fired bricks using clay as mortar. The main building material comprised square bricks with sizes of 24.5×24.5×4.5 cm, 25×25×4-4.5 cm, 26.5×26.5×4.5 cm, and 27×27×4.5 cm. Rectangular bricks with sizes of 13-14×26-27×4-4.5 cm were also used to create bonds between the brick rows.

Fig. 1. The location of the Kyok-Tash mausoleum. A view of the site before excavations.

* The term Kyok-Tash (Кек-Таш) is translated into English as “blue stone”.

Several bricks were found with human and animal footprints on their faces. Apparently, the foot-prints had been made when the molded bricks were drying under the sun before firing them. These finds, along with overfired bricks discovered at the site, indicate that the bricks were made not far from the mausoleum's location.

The mausoleum consists of two rooms: one of them is smaller and rectangular shaped; the other one is larger and square shaped (Figs. 2 and 7). Its walls are oriented in the cardinal directions. An arched entrance doorway is situated in the center of the south wall of the first, rectangular room. The rooms of the mausoleum are connected to each other by an arched passage, which is partly preserved. The second square room had apparently been covered with a spherical dome, of which only the bottom part is preserved. The dome had rested on an octagon formed by the walls and corner arches, i.e. squinches. The squinches were formed by 16 arches, which were set one inside another, gradually growing down into the corner (Fig. 3). The floors of the rooms are paved with two layers of the fired bricks (Fig. 4). They are of the same sizes as those used in the walls. However, in contrast with the wall bricks, the floor bricks' front faces and sides are polished smooth.

The length of the mausoleum is 9.5 m. The interior of the first room measures 2.4×4 m. The exterior of the second room is 6-6.3×6.3 m. The width of the walls is 50-55 cm. The diameter of the dome (bottom part) is 5.2 m. In the northern half of the second room there is a burial box elongated in an east-west direction. It was built by rectangular fired bricks using *ganch* (a mixture of gypsum and clay) as a mortar and plastered inside and outside (Fig. 5). The burial box was partly destroyed too, apparently as a result of looting, which probably happened not long after the construction of the mausoleum. Only the upper part of a human skeleton, probably female, was discovered in the burial box. The skeleton had been moved from its original interment location. The lower part of the skeleton and a complete human skeleton, probably male, were found outside the burial box, at the western wall of the second room.

Shards of ceramic and glass vessels, animal bones, fragments of the blue-glazed table, a silver coin, greenstones and plates made from these mineral and other finds were discovered in the course of ex-cavations at the mausoleum. An in-depth study of the finds and the architecture of the mausoleum will be undertaken in the near future, which should result in the presentation of a more precise date and other hypotheses. At this stage of the investigations, it is safe to say that the construction date of the mausoleum fits in the chronological framework between the 11th and 13th centuries AD. The monument is the first known underground two-room mausoleum in the territory of Kyrgyzstan. It is also unique for embodying both archaic and novel architectural features, the in-depth investigation of which will shed new light on the beginnings and development of Islamic architecture in medieval Kyrgyzstan.

In accordance with the law of the Kyrgyz Republic "On the protection and use of the historical-cultural heritage," preventive conservation measures were implemented after the conclusion of the 2017 excavations. A metallic shed with side fences was constructed over the mausoleum to protect it from the rain and to prevent illegal intrusions to the site (Fig. 6). At the moment, discussions on conservation and museumification strategies are taking place in the Ministry of Culture and Tourism of the Kyrgyz Republic.

Fig. 2. A view of the partly uncovered site. The upper part of the Kyok-Tash mausoleum.

Fig. 3. One of the squinches in the second room of the mausoleum.

Fig. 4. The floor of the first room of the Kyok-Tash mausoleum.

Fig. 5. The burial box of the Kyok-Tash mausoleum.

Fig. 6. The metallic shed over the Kyok-Tash mausoleum.

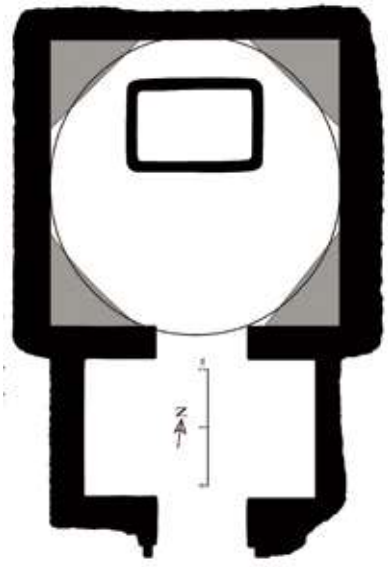

Fig. 7. A graphic plan of the Kyok-Tash mausoleum.

Malaysia

Conservation of the Flat Roofs at the National Mosque, Kuala Lumpur, Malaysia

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Regular inspections were carried out by all parties to ensure the quality of workmanship after the installation of glazed porcelain mosaics and the application of waterproofing coating on the flat roofs of the National Mosque.

Introduction

Built in 1965 at a cost of RM10 million (USD2.42 million), the National Mosque (or *Masjid Negara*) is one of Southeast Asia's largest mosques with a unique modern design embodying contemporary expressions of traditional Islamic art, calligraphy and orientation. Jointly designed by three architects of the Public Works Department (or *Jabatan Kerja Raya-JKR*), namely Howard Ashley, Hisham Albakri and Baharuddin Kassim, the National Mosque features a 73-metre-high minaret and an 18-pointed star concrete main roof reflecting an open umbrella, with the cap of the minaret resembling a folded one. The multi-fold umbrella-like roof symbolises a renewed awakening and the aspirations of a newly-independent nation, as Malaysia had gained her independence from the British on 31st August 1957. Apart from the multi-fold umbrella-like roof, the National Mosque also has massive flat roofs covering a total area of approximately 13,000m^2. The flat roofs accommodate many mosaic-finished domes, mosaic-finished pyramid roofs, sunken roofs and skylight roofs. The differing designs of the roof types are rare and hardly found in any mosque design in the country.

The National Mosque boasts a large prayer hall that can accommodate up to 15,000 worshipers at any one time, especially for the Friday prayer. The main prayer hall is surrounded by a covered deep verandah which serves a dual function, that of an additional space for prayer and also for cross-ventilation in response to the local climatic conditions. The mosque complex also has a multipurpose hall, mausoleum, library and administration office as well as open courtyards with reflecting pools and water fountains. The mausoleum is reserved for the tombs of national heroes of the country. Located on a 13-acre landscaped garden near the Lake Garden in the heart of Kuala Lumpur, the National Mosque is one of the main tourist attractions in the capital city. Both Muslims and non-Muslims alike are only allowed into the mosque building wearing a modest attire of robes and headscarves as a sense of submission, peace and respect.

The National Mosque underwent major renovation works in 1987 including treatment of surface cracks and roof leakage. However, the renovation works did not comply with standard conservation principles and guidelines.

Twenty years later in 2007, the National Mosque and its mausoleum were listed as a National Heritage under the National Heritage Act 2005 (Act 645). Thirty years after the last renovation works, the National Mosque is now faced with several building defects and problems including roof leakage, missing mosaics on domes and pyramid roofs, aging mechanical and electrical fittings, and fading paint. The building also requires upgrading of the library, offices, floors, prayer halls, open courtyard and toilets. In 2016-2017, a dilapidation survey report and a Conservation Management Plan (or *Pelan Pengurusan Pemuliharaan*) were prepared by a local consultant architect to determine and document the nature of the building defects and conditions. The Conservation Management Plan also identifies the heritage values of the building and outlines the proposed conservation policies and strategies to protect its architectural and cultural significance. Both reports were submitted to the Department of National Heritage (DNH), Malaysia for review and endorsement.

In January 2016, the Government of Malaysia through the Department of Islamic Development Malaysia (or *Jabatan Kemajuan Islam Malaysia-JAKIM*), Public Works Department (JKR Malaysia and JKR Federal Territory of Kuala Lumpur) and the Islamic Religious Council of Federal Territory (or *Majlis Agama Islam Wilayah Persekutuan-MAIWP*) had allocated an amount of RM44,491,963 (USD10,678,071) to two local building contractors to conserve the National Mosque in two parcels. Parcel One, which was completed in July 2018, involved treatment of the flat roofs including the mosaic-finished domes, mosaic-finished pyramid roofs, sunken roofs and application of waterproofing coating at a contract value of RM9,299,963 (USD2,231,991). Parcel Two involves upgrading and conservation works for the library, administration office, prayer halls, floors, ceiling, open courtyards, toilets, wiring, air-conditioning system, and indoor and outdoor lighting. It also includes new construction works such as covered walkways, a new elevator and an administration building. The contract value of Parcel Two is RM35,192,000 (USD8,446,080) and it is expected to be completed in July 2019. This article focuses on the scope of works involved in Parcel One which covers scientific tests on existing roof structures, treatment of the flat roofs including the mosaic-finished domes, mosaic-finished pyramid roofs, sunken roofs and installation of waterproofing coating on the flat roofs.

Procedures and Principles of Roof Treatment

Similar to other National Heritage buildings listed under the National Heritage Act 2005 (Act 645), conservation of the National Mosque is undertaken based on the best practices of building conservation in the country with regard to proper documentation and treatment in accordance with the 2017 Guidelines on Heritage Building Conservation published by the DNH. The Conservation Management Plan prepared for the National Mosque in 2017 is in accord with Section 46 of Act 645. A registered building conservator was engaged by the building contractor in order to ensure that all conservation works closely followed the said principles and guidelines as outlined by the consultants and the DNH. All work method statements and interventions including proposed new mosaics, scientific studies, laboratory tests, roof treatment and application of waterproofing coating were prepared by the building conservator and duly approved by the consultant architect and the DNH. Conservation of the flat roofs at the National Mosque was based on the following conservation principles;

i. To retain the authenticity and integrity of the domes, pyramid roofs and sunken roofs.
ii. To maintain the form and shape of the domes, pyramid roofs and sunken roofs.
iii. To minimise interventions to the building structures and fabric.
iv. To match the new mosaics with the existing mosaic-finished on the domes and pyramid roofs.
v. To harmonise the new additions to the existing building.
vi. To conduct scientific studies and laboratory tests on the roof structures and building materials.
vii. To apply proven methods and techniques for the conservation of roofs.
viii. To document and record the conditions of the roofs before, during and after treatment.

Mosaic-finished Dome, Mosaic-finished Pyramid Roofs and Sunken Roofs

As many as 95 mosaic-finished domes, 270 mosaic-finished pyramid roofs and 208 sunken roofs are erected on the flat roofs of the National Mosque. Each roof type measures 4 m×4 m at the base. The height of the dome is 1.8 m while the pyramid roof is 0.8 m from the flat roof level. The sunken roof is 1.3 m deep. These domes, pyramid roofs and sunken roofs are made of reinforced concrete with waterproofing, mosaics or protective screed on the outer layers. Only the domes and the pyramid roofs are finished with glazed porcelain mosaics. Based on on-site structural investigation, the domes consist of five layers while the pyramid roofs have three layers including the reinforced concrete structure or substrate in the inner layer followed by waterproofing coating, original glazed mosaics, tile adhesive and glazed porcelain mosaics on the outer layers. During the earlier renovation works carried out in 1987, the domes were finished with new blue glazed porcelain mosaics and the pyramid roofs were finished with grey glazed porcelain mosaics. Each glazed porcelain mosaic measures 19 mm×19 mm with a slightly convex-edged design. The thickness of each glazed porcelain mosaic is 5 mm. Some of the ageing glazed porcelain mosaics on the domes and pyramid roofs of the National Mosque were found to be missing, detached, loosened or had fallen off. This condition had caused water penetration, trapped moisture and roof leakage onto the prayer halls and other spaces underneath the flat roofs. The existing waterproofing coating had weathered away so much that it failed to prevent the roof leakage on the flat roofs. Thus, a new waterproofing coating which has been proven to be efficient and long lasting was applied in the conservation of the flat roofs.

Scientific Studies and Laboratory Tests

It is essential to assess the nature and condition of the

roof structures and building materials as well as the causes of the flat roof defects before determining the design and specifications of the roof treatments. Scientific studies, laboratory tests and exploratory investigations were all carried out meticulously and with great care in an effort to understand in detail the building condition, defects and structural integrity. This stage of investigation, testing and analysis is most important in order to minimise any intervention that could cause further damage to the existing building structures. In this project, samples of building materials were taken on site and sent to laboratories at Mapei Malaysia Sdn. Bhd. in Petaling Jaya, Selangor; MAEK Consulting Pte. Ltd. in Singapore; and the Centre for Global Archaeological Research at Universiti Sains Malaysia (USM), Penang. The results and findings from the tests and investigations formed the basis and justification for the conservation solutions and treatments. Investigations of the flat roofs of the National Mosque were carried out based on these non-destructive approaches:

i. Dilapidation Survey

The dilapidation survey was carried out to identify, map out and outline the current condition, various defects, distress, damage and deterioration of the flat roof before the commencement of any rectification work or development. The building defects were recorded meticulously using detailed photographic and digital documentation. It also involved investigation of any modification works carried out previously on the flat roofs. The dilapidation survey report elaborated on the nature and extent of building defects, their causes and proposed conservation treatments. A thorough investigation of the domes, pyramid roofs, sunken roofs and flat roofs was carried out by the professional consultants and building conservator. Non-destructive methods and equipment were used to determine any defects, dampness or loose or missing mosaics.

ii. Infrared Thermography

Infrared thermography (IRT) was used for the flat roofs to investigate sub-surface anomalies and trapped moisture. This non-destructive method is based on the principle that any trapped moisture below the wall surface finish can affect or change the rate at which heat flows through the structure. This is due to higher levels of thermal heat capacity and thermal conductivity of moisture. These changes in the heat flow can cause localised differences in surface temperature. Thus, by measuring surface temperature under conditions of heat flow, one can determine the location of dampness and the likely path of water seepage. A relatively high differential heat transfer between the mediums (such as paint, moisture and trapped air) and the plaster must exist in order for the anomalies to be detected by infrared thermography.

iii. Ground Penetrating Radar

Another non-destructive method used for the flat roofs was ground penetrating radar (GPR). This geophysical method uses radar pulses to produce an image of the subsurface. It generally works on the principle of reflective energy. A hand-held unit consists of a transmitting antenna and a receiving antenna for the energy. The transmitting antenna sends out a diverging beam of electromagnetic wave energy pulses in the range of 500 Mhz to 1 Ghz through a structure, while the receiving antenna receives the reflected energy pulses from materials of different dielectric properties. The received energy pulses are sent to a control unit, where they will be processed and output on a display monitor in 2D or 3D mode. Such output can determine the depth or pattern of reinforcement and any embedment or possible moisture trapped below any substrate.

iv. Petrography

A petrographic test is a microscopic method used to examine the mineralogical and chemical characteristics of rocks or concrete samples. These samples can be taken from lump samples or cores. Samples of original mosaics and mortar or plaster on the domes and pyramid roofs of the National Mosque were extracted and subjected to petrographic testing to determine their composition and condition such as type of binder, distribution of aggregates including shape and size distribution, pore characteristics, binder-aggregates interface or bond, secondary reaction, salt formation, cracks and fissures. The petrographic testing was carried out using a combination of different microscopy from stereo zoom microscopes to digital microscopes to a magnification of 500x on hand and polished sections. Thin sections were prepared for examination with a polarising and fluorescent microscope (PFM) under transmitted and reflected light.

v. X-Ray Florescence

X-ray florescence (XRF) testing is a non-destructive analytical technique used to determine the elemental composition of building materials such as concrete, plaster and mortar. It is a process whereby electrons are displaced from their atomic orbital position, releasing a burst of energy that is characteristic of a specific element. An XRF analyser determines the chemistry of a sample by measuring the fluorescent (or secondary) X-rays emitted from a sample when it is excited by a primary X-ray source. Results from the XRF tests were very important and useful to propose new building materials on the flat roofs.

vi. Pull-off Adhesive Test on Mosaic Layer

In-situ pull-off adhesive tests were carried out on the domes to determine the bond strength of "Kerapoxy" epoxy tile adhesive between the polyurea coating surface and the existing mosaic layer. A pull-off tester was used for the test and the bond value was determined by taking the load at failure divided by the dolly area which was adhered on the tile. The average bond strength was 2.5 N/mm^2 which was

acceptable. The failure mode was also observed and it was found that all test specimens failed at the existing substrate but not at the new epoxy adhesive bond interface. This indicated that the bonding strength of the new epoxy adhesive was stronger against the original substrate or structure.

Conservation Works

During the conservation of the flat roofs the National Mosque, the building was divided into five zones. Zones 1 and 5 consisted of the covered verandah areas to the south and north. Zones 2, 3 and 4 comprised the main prayer hall. The conservation of the flat roofs at the National Mosque included the reinstallation of mosaics on the domes and pyramid roofs, rehabilitation of substrate and application of waterproofing coating on the flat roofs. The National Mosque was open to the public, including foreign tourists, throughout the construction period. Religious activities and celebrations were held as usual at the mosque including Friday prayer, breaking fast and *Tarawih* prayer in the Muslim fasting month of Ramadhan, as well as *Eidul Fitri* and *Eidul Adha* prayers. The fact that the mosque remained open during the entire construction period posed a great challenge to the building contractor and workers in terms of site security, safety, cleanliness, noise pollution and site management. Thus, on-site technical and site meetings among the consultants, building contractors, government agencies and the client were held regularly to ensure that the project went smoothly and was completed as scheduled. The conservation works of the flat roofs at the National Mosque were carried out based on the following stages:

Stage 1: Preparation of Site

i. Provide temporary scaffold access to the rooftop complete with security guardrail to avoid disturbing the daily operation of the mosque and to disallow access to unauthorised persons and the public.
ii. Provide temporary netting protection along the edge of the perimeter parapet wall against falling objects during the surface preparation work.
iii. Provide temporary tents and canvas sheets to protect the domes and pyramid roofs against direct sunlight and heavy rain during the installation of the new layer of glazed porcelain mosaics.
iv. Provide daily housekeeping to upkeep and maintain the cleanliness and tidiness of the mosque.

Stage 2: Reproduction of Glazed Porcelain Mosaics

i. Verify the quantity of new mosaics required.
ii. Determine the design and reproduce new glazed porcelain mosaics based on the colour and characteristics of the original glazed porcelain mosaics such as composition, shape, form, size, thickness and type of surface.
iii. The new glazed porcelain mosaics were custom-made to match the original as closely as possible, and they were imported from Jingdezhen, the "Porcelain Capital", in Jiangxi province, China.
iv. The new glazed porcelain mosaics were handled with extra care. They were kept in a safe warehouse in Kelang, Selangor upon arrival from China before being delivered on site in batches during the installation stage.

Stage 3: Preparation of Mock-ups

i. Conduct mock-ups to verify the contractor's ability to install a given product in accordance with the stated specifications. The mock-ups could demonstrate the level of workmanship or constructability of a component, and also form a benchmark for approval.
ii. The mock-ups on site provided the owner or consultant with a means for comparison by which to judge the acceptability of the installed work.
iii. The mock-ups also helped the owner or consultant to determine the workability and acceptability of the proposed design.

Stage 4: Preparation of Surfaces

Preparation of surfaces was divided into two categories as follows:

1. The mosaic-finished dome and pyramid roofs:

i. Entirely remove the outer-most or non-original layer of glazed porcelain mosaics until the existing original layer of waterproofing coating is found by using an oscillating tool. The tool reduces the vibration and noise pollution to a minimum. It provides the least level of disturbance or nuisance to the public or the conduct of prayers inside the mosque.
ii. Entirely remove the existing layer of waterproofing coating until the original layer of glazed porcelain mosaics is exposed by using an 11,000 psi high pressure hydro jet. Similar to an oscillating tool, the hydro jet provides the least degree of disturbance or nuisance to the public or the conduct of prayers inside the mosque.
iii. Any noticeable cracks in the dome or pyramid roofs to be grooved cut and sealed with epoxy adhesive.

2. The flat roofs and sunken roofs with exposed waterproofing coating layers:

i. Entirely remove the existing waterproofing coating layer from the top surface of the concrete until the concrete is exposed by using an 11,000 psi high pressure hydro jet.
ii. Any noticeable cracks in the dome or pyramid roofs to be grooved cut and sealed with epoxy adhesive.

Stage 5: Rehabilitation of Reinforced Concrete Structure or Substrate

i. Delaminated cementitious bedding render underneath the mosaic finish for dome and pyramid roofs to be anchored mechanically into the reinforced concrete structure by using the "Helifix-DryFix" stainless steel helical pinning system.
ii. Drill 6.5 mm-diameter pilot holes through the bedding render into the reinforced concrete structure or substrate to a depth of 40 mm and at 450 mm intervals.
iii. Drive 8 mm-diameter "Helifix-Dryfix" stainless steel

helical pins through the pilot holes and into the reinforced concrete structure or substrate to secure and anchor the render mechanically.

iv. Any badly damaged or deteriorated render (on the dome and pyramid roofs) or concrete topping (on the flat and sunken roofs) to be removed until sound substrate is found.

v. Make good the render or concrete topping with "Planitop G40SP" polymer modified cementitious repair mortar, complete with "Planicrete SP" latex bonding agent.

Stage 6: Application of Waterproofing Coating

i. Apply a thin layer of "Primer SN" epoxy scratch coat on the prepared surface in order to prepare for the new waterproofing system.

ii. Spray 2 mm-thick "Purtop-1000" pure polyurea waterproofing coating on the primed surface.

iii. The exposed pure polyurea coated area such as the flat roofs and sunken roofs to be protected and finished with "Mapecoat PU15" aliphatic UV resistant polyurethane top coat.

Stage 7: Laying Glazed Porcelain Mosaics on Dome and Pyramid Roofs

i. Ensure that the surface of domes and pyramid roofs are clean, dry and free of any loose particles.

ii. Mix resin (Part A) and hardener (Part B) of "Kerapoxy" tile adhesive by using a drill mixer until a homogeneous and consistent colour is obtained.

iii. Spread the tile adhesive on the surfaces of domes and pyramid roofs by using a notched trowel.

iv. Place the mosaic sheet firmly into the wet adhesive. Push the mosaic back and forth to collapse the mortar ridges in order to achieve maximum coverage.

v. The arrangement and alignment of new mosaics must follow or match the original ones.

vi. Remove excess mortar from the joint area and allow it to cure for at least one day.

vii. Mix "Keracolor FF" pointing or grouting mortar with "Fugolastic" admixture.

viii. Fill the mosaic joints completely with the pointing mortar by using a rubber float. Remove excess grout from the surface while it is still fresh.

ix. While the grout loses its plasticity and becames matt over a period of 10-20 minutes, clean the excess grout with a damp sponge. Let it cure for another 3 days.

x. A typical sequence for laying glazed porcelain mosaics for domes and pyramid roofs is as follows:

1. Lay mosaics to form the ridge of the roof as control lines (4 ridges).
2. Set the horizontal bottom line as a benchmark.
3. Set the vertical centre line and begin the first sheet of mosaics at the lowest centre point of the dome or pyramid roof, working towards the left and right until meeting the ridges at the ends.
4. Follow the sequence at the second tier of mosaics, working upwards until reaching the top of the roof.
5. Trace and cut the mosaics to fill in the blank areas along the vicinity of the ridges.

xi. A total of 13,482,953 new glazed porcelain mosaic pieces were used to cover 5,302 m^2 of the surface areas of the domes and the pyramid roofs (2,553.6 m^2 for the domes and 2,748.4 m^2 for the pyramid roofs).

Conclusion

The conservation of the flat roofs at the National Mosque in Kuala Lumpur depicts an outstanding masterpiece of well-orchestrated efforts by all consultants, building contractors and government agencies involved in the project. The flat roof conservation project proved to be very challenging because it involved different designs of roof types, each requiring a different, specific approach. The various stages of the roof conservation in Parcel One and Parcel Two of the National Mosque also required good coordination and communication among building contractors, sub-contractors, building conservators and material suppliers to ensure that the project logistics and schedule were well-managed. It is crucial to engage competent building conservators, consultants, local experts and skilled workers to manage documentation and to undertake project execution efficiently since the National Mosque is open to the public, religious activities and tourists throughout the entire period of the works for both Parcel One and Parcel Two. Detailed research, scientific studies, laboratory tests and technical meetings were carried out at regular intervals to facilitate coordination to ensure timely progress of the works. Non-destructive tests were adopted for the project in an effect to reduce the level of noise pollution, mainly to the users of and visitors to the National Mosque. The tests would also minimise any interventions to the building structure and fabric, hence retaining the authenticity and integrity of the domes, pyramid roofs and sunken roofs. Rainy weather is a critical factor in the hot and humid climatic conditions in Malaysia. Therefore, temporary tents were erected and canvas sheets were used to cover each dome and pyramid roof during the mosaic installation stage in order to protect them from direct sunlight and heavy rain. The outsourcing of new glazed porcelain mosaics from China also involved a meticulous technical process, particularly regarding the mosaic design, reproduction, replication, delivery and coordination. Nonetheless, despite all these challenges, the flat roofs of the National Mosque have been conserved and reinstated successfully. It is hoped that the conservation of the flat roofs at the National Mosque enhances public awareness in safeguarding the National Heritage buildings of Malaysia.

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The author wishes to thank the Department of Islamic Development Malaysia (JAKIM), Public Works Department (JKR Malaysia and JKR WPKL), Islamic Religious Council of Federal Territory (MAIWP), Department of National Heritage (JWN), Ir. Abdul Karim Mohammed, Noreza Jusoh and Wan Jalaluddin Wan Mamat from MAIWP; Sr. Dr. Robiah Abdul Rashid, Wan Norazimah Wan Kamal and Nasarudin Sulaiman from JWN; Ar. Md Azahari Md Atan, Arifanrahim Abdullah and Azmi Lop Ahmad from Arkitek Md Azahari; Nurul Nadirah Ruslan from JY Cost Plan Consultants; Dr. Hazman Hazumi and Norfaezah Sanusi from Global Heritage Consultancy Sdn. Bhd., Ong Siew Wei and Shahrullail Sulaiman from Fasa Struktur

Sdn Bhd.; D'Intan Trade Sdn. Bhd.; and the School of Housing Building and Planning, Universiti Sains Malaysia for making this project and article possible.

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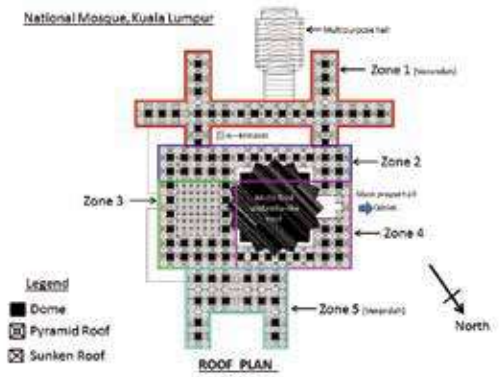
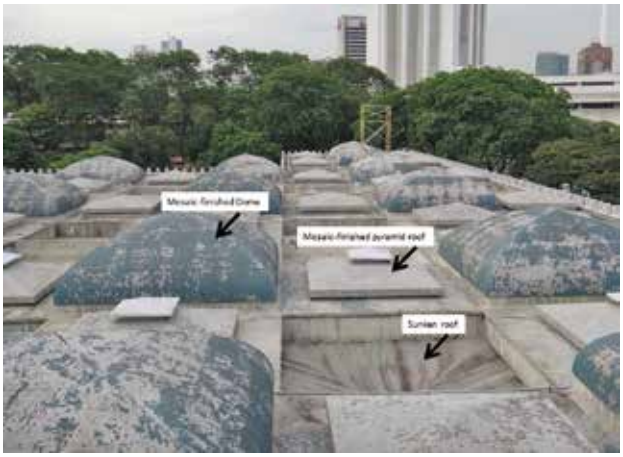
Built in 1965, the National Mosque (or *Masjid Negara*) features a 73 m-high minaret and an 18-pointed star concrete main roof reflecting an open umbrella, while the cap of the minaret resembles a folded one.

Located on a 13-acre landscaped garden near the Lake Garden in the heart of Kuala Lumpur, the mosque complex has a massive flat roof area of approximately 13,000 m^2, prayer halls, a multipurpose hall, mausoleum, library and administration office, as well as open courtyards with reflecting pools and water fountains.



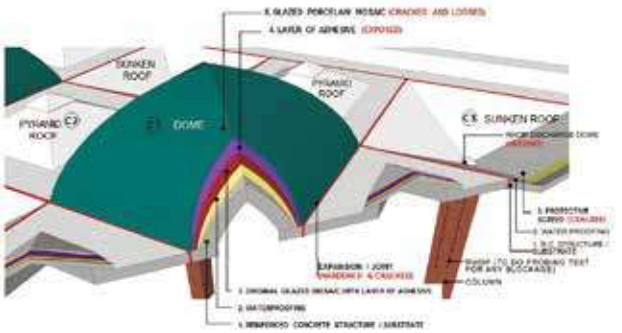
During the conservation of the flat roofs of the National Mosque, the building was divided into five zones. Zones 1 and 5 consist of the covered verandah areas in the south and north, whilst Zones 2, 3 and 4 comprise the main prayer hall.



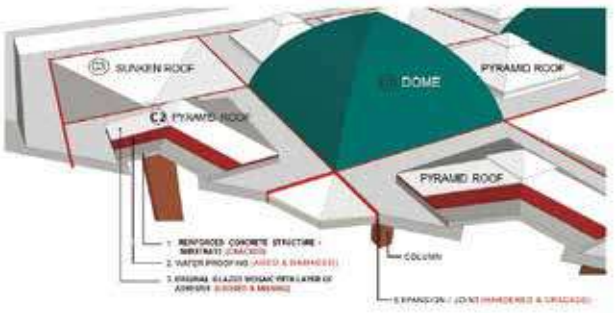
The flat roofs of the National Mosque accommodate mosaic-finished domes, mosaic-finished pyramid roofs, sunken roofs and skylight roofs. Each roof type measures 4 m×4 m at the base. The height of the dome is 1.8 m, the pyramid roof is 0.8 m and the sunken roof is 1.3 m deep.

The ageing top layer of glazed porcelain mosaics on the domes of the National Mosque were found to be either missing, detached, loosened or to have fallen off, exposing the old layer of waterproofing coating and the original mosaics. This condition had caused water penetration, trapped moisture and roof leakage onto the prayer halls and other spaces underneath the flat roofs.

Similar to the domes, the glazed porcelain mosaics on the pyramid roofs were found to be either missing, detached, loosened or to have fallen off, exposing the old layer of waterproofing coating.

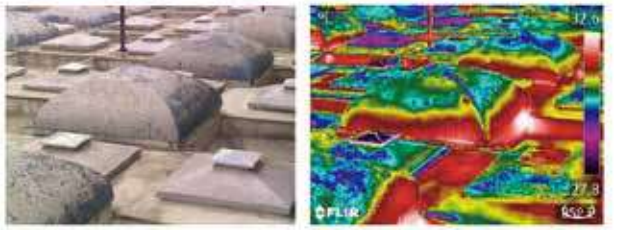


Based on on-site structural investigations, the domes consist of five layers while the sunken roofs have three layers including a reinforced concrete structure or substrate in the inner layer. Each dome has layers of waterproofing coating, original glazed mosaics, tile adhesive and glazed porcelain mosaics on the outer layers.



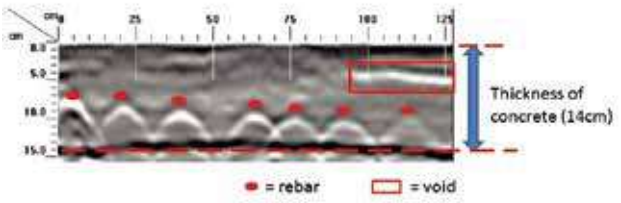
The pyramid roof has three layers including a reinforced concrete substrate or structure in the inner layer. Structural investigations showed that the pyramid roofs had building defects including cracks, damaged waterproofing coating, and loosened or missing original glazed porcelain mosaics.

Thermographic scanner (camera)



Infrared thermography (IRT) was used on the flat roofs to investigate sub-surface anomalies and trapped moisture in the domes, pyramid roof and sunken roof. The cold spots in blue indicates trapped moisture, whilst the hot spots in yellow are a sign of delamination or subsurface voids.

A ground penetrating radar (GPR) scanning device was placed on the dome surfaces to determine the depth or pattern of reinforcement and any embedment or possible moisture trapped underneath the substrate or structure.



Results from the ground penetrating radar (GPR) scan on the domes revealed that the thickness of concrete substrate or structure was 14 cm. The GPR scanned image also showed the location of rebars and voids inside the domes.

Samples of building materials from the domes including concrete substrate or structure were cored to examine the mineralogical and chemical characteristics (petrography test); and also to determine the elemental composition (X-ray florescence test).

In-situ pull-off adhesive tests were carried out on the dome to determine the bond strength of "Kerapoxy" epoxy tile adhesive between the polyurea coating surface and the exisiting mosaic layer. The result showed that the average bond strength was 2.5 N/mm^2, which was acceptable.

An oscillating tool was used to carefully remove the outer-most or non-original layer of glazed porcelain mosaics on the domes and pyramid roofs until the existing original layer of waterproofing coating was found. The tool reduced the vibration and noise pollution disturbing the public and the conduct of prayers inside the mosque.

Canvas sheets were used to cover the domes and pyramid roofs after the outer-most layer of glazed porcelain mosaics had been removed. This was to protect the exposed surfaces from water penetration.

Temporary tents were erected to cover each dome and pyramid roof during the mosaic installation stage in order to protect them from direct sunlight and heavy rain.

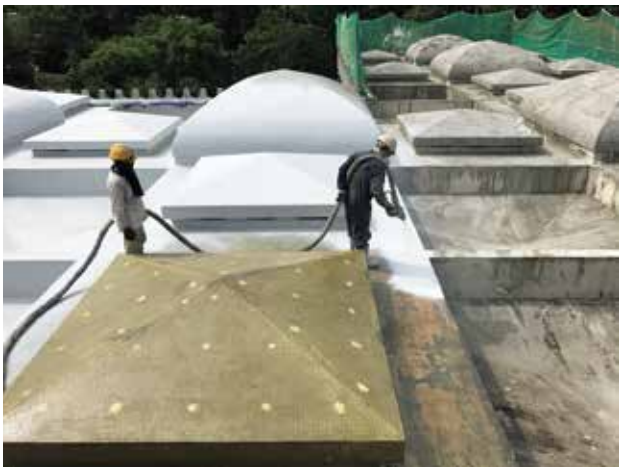
Removal of the existing layer of waterproofing coating on domes by using an 11,000 psi high pressure hydro jet, revealing the original glazed porcelain mosaic in blue.

Rehabilitation of the reinforced concrete structure or substrate of the domes was carried out by driving 8 mm-diameter “Helifix-Dryfix” stainless steel helical pins through the pilot holes and into the reinforced concrete structure or substrate.

Equipment used to secure and anchor the reinforced concrete substrate or structure of the domes and pyramid roofs, including a load tester, stainless steel DryFix tie-pins and pin drivers.

The dome after completion of work using the “Helifix-DryFix” stainless steel helical pinning system.

The domes and pyramid roofs were primed with epoxy scratch coat after application of the helical pinning system.



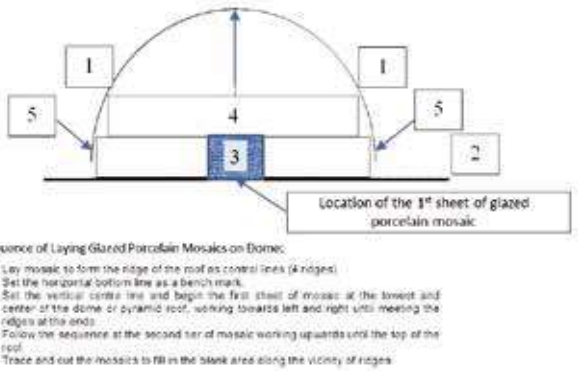
The spraying of 2 mm-thick polyurea waterproofing coating on the primed surfaces of the domes and pyramid roofs.

The flat roofs of the National Mosque covered by polyurea waterproofing coating.

New blue glazed porcelain mosaics for the domes and grey glazed porcelain mosaics for the pyramid roofs that match the original mosaics. Each glazed porcelain mosaic measures 19 mm×19 mm with a slightly convex-edged design. The thickness of each glazed porcelain mosaic is 5 mm.

Spreading the tile adhesive on the surfaces of the dome by using a notched trowel before layering the sheet of glazed porcelain mosaics.

The installation of new glazed porcelain mosaics on the dome was carried out from the bottom layer and working upwards.



Sequence of Laying Glazed Porcelain Mosaics on Domes:

1. Lay mosaic to form the ridge of the roof as control lines (4 ridges).
2. Set the horizontal bottom line as a bench mark.
3. Set the vertical centre line and begin the first sheet of mosaic at the lowest and center of the dome or pyramid roof, working towards left and right until meeting the ridges at the ends.
4. Follow the sequence at the second tier of mosaic working upwards until the top of the roof.
5. Trace and cut the mosaics to fill in the blank area along the vicinity of ridges.

The layering new glazed porcelain mosaics on domes begins with the first sheet of mosaics at the lowest centre point of the dome or pyramid roof and working towards the left and right until meeting the ridges at the ends.

The domes and pyramid roofs of the National Mosque after the installation of new glazed porcelain mosaics.

Upon completion, a total of 13,482,953 new glazed porcelain mosaic pieces were used to cover 95 domes and 270 pyramid roofs on the flat roofs of the National Mosque.

An aerial view of the National Mosque with its newly conserved flat roofs.

The conservation of the flat roofs at the National Mosque represents an outstanding masterpiece of well-orchestrated efforts by all consultants, building contractors and government agencies involved in the project.

Saraswati Temple, Hanumandhoka Darbar Square

Sabina Tandukar, *Architect*
Kathmandu Valley Preservation Trust

The temple of *Saraswati*, the goddess of knowledge and wisdom, is located adjacent to the octagonal Krishna Temple of *Hanumandhoka Darbar Square* and dates to approximately the 18th century CE. The temple is venerated by people of all castes and sects (i.e., *Shaiva, Buddhist, Shakta* and *Vaishnava*). The main festival is held during *Indrajatra* while many devotees also throng the temple during *Saraswati puja* for worship and prayer.

The single-story temple with a three-way sloped roof stands on a double plinth. The main sanctum is a small rectangular room accessed from the entry door in the front. It is surrounded by a colonnaded ambulatory on three sides. The centrally accessed sanctum has a carved entry door. This is flanked by smaller doors with carved architraves on either side, which leads to a small room which might have been a storage space but remains unused today. The sanctum has a stone idol of the goddess *Saraswati* sitting on a stone *jaladhara*. There is a total of eight carved timber posts in the outer ambulatory, which, along with the sanctum walls, supports the upper floor.

The temple, which was already in a bad condition due to a long period of negligence and lack of maintenance, experienced major damage during the 2015 earthquake. Although the temple did not collapse, a detailed assessment of the temple was carried out to understand the general condition of the various structural and non-structural members of the temple. Due to the impact of violent shaking during the earthquake, the entire temple was almost 100 mm out of plumb and tilting towards the east.

The north-eastern corner of the lower plinth had disintegrated and the brick wall together with the edge stone had dislocated from its original position. The ventilation provided between the plinth wall and the *lakasi* (lower timber tie beam) had been covered with brick rubble in cement mortar. This had led to decay of the *lakasi* and possibly the *sa* (tenon) of the timber posts. Such grave mistakes in the construction detail can have a damaging impact on the temple structure. All the timber posts needed preservation to make them suitable for future reuse.

The upper floor joists spanning the outer ambulatory and sanctum rear wall had been damaged by wet rot due to rising damp and the *chukuls* (wooden pegs) were absent in most cases. The sanctum wall made of mud mortar had been dislocated and was bulging out due to the impact of the violent shaking. Several diagonal cracks were seen in the sanctum wall. The main entry to the sanctum, accessed from the front, was found to be slightly tilted and several joinery connections had loosened and were also decaying due to rising damp. The upper plinth floor, most probably a raised timber floor, had been converted into a herringbone pattern brick floor. The upper floor as seen from below comprised random brick bat filling and timber battens covered with a mud floor. The floor seemed moist from below, which must have been due to the rain water seepage coming in from the roof.

After accessing all the structural members, the technical team decided that it was necessary to rebuild the entire temple rather than only going for partial restoration. During the rebuilding and restoration of the temple, it was ensured that the structural strength of the structure was achieved without compromising the authenticity and embedded values of the temple.

The task of restoring the temple was carried out by the Kathmandu Valley Preservation Trust (KVPT) in collaboration with the Department of Archaeology. The project was funded by the US Ambassador's Fund for Cultural Preservation (AFCP). The restoration project started in July 2017 and was completed in March 2018.

The demolition of the temple was carried out in a very systematic way, by documenting all the elements that were being removed. Reusable materials like carved timber, bricks, roof tiles, etc. were salvaged, cleaned and stored properly for future reuse. After the complete demolition, a 1m×1m control pit was excavated along the temple plinth to check the condition of the foundation wall. It revealed that the wall was in good condition and so no further interventions were carried out under the ground. All the carved timber elements were cleaned with soft brushes and clean water only and repaired by expert craftsmen. The carved *nina* (upper timber tie beam), of which only a few have been found in the valley was also repaired and prepared for reuse.

The rebuilding saw the use of traditional techniques to rebuild the temple. The plinth and sanctum walls were rebuilt in mud mortar using *ma apa* (traditional brick) and *dachi apa* (wedge-shaped traditional brick), and no brick bats were inserted inside the thick walls. The timber posts and other timber elements were reinstalled in their original positions. The doors and windows were also reinstalled in their original positions during the rebuilding.

As for the roof, the old rafters were all damaged due to wet rot and so all the members were replaced with new ones. Timber planking covered the rafters, over which a water proof layer was laid to minimize the impact of water leakage through the roof. A thick mud bed followed the waterproofing layer, over which roofing mud tiles were laid. The three-way slope roof saw the installation of a new copper pinnacle, as the original pinnacle had been lost and during an earlier unscientific

restoration, a brick pinnacle was created and plastered with lime only. After completion of the work, the site fencing was removed, the site was cleaned, and all the debris disposed of. The temple with its colonnaded portico-like space is now being frequently used by the locals.

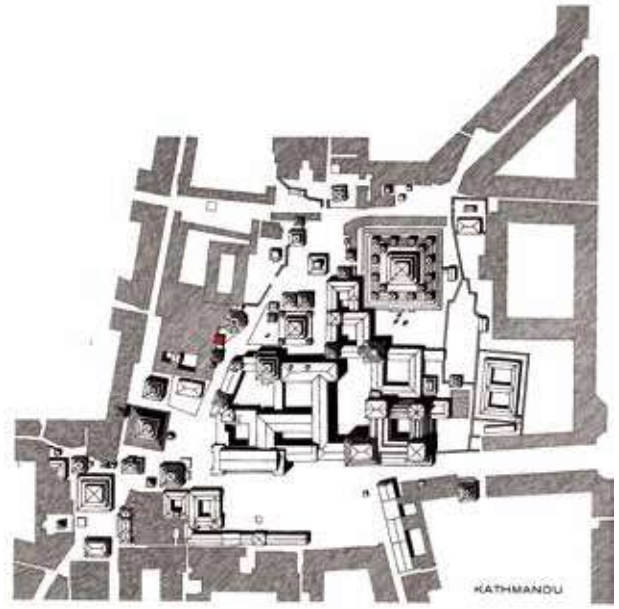


Fig 1. A map of Kathmandu Darbar Square showing the position of Saraswati Temple in red (The Physical Inventory of Kathmandu Valley).

Fig 2. The east elevation of the temple. Raking shores are provided to support the temple roof (2017-07-26).

Fig 3. The eastern view of the completed temple (2018-3-16).

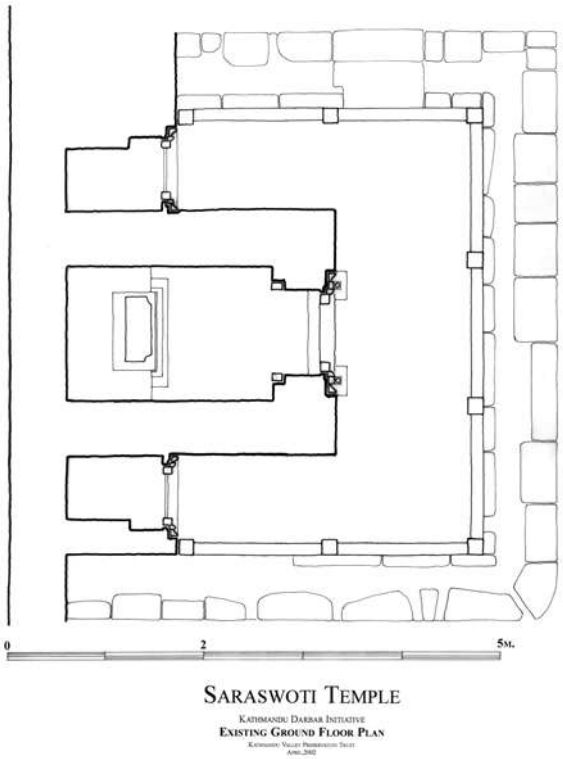


Fig 4. A temple ground floor plan

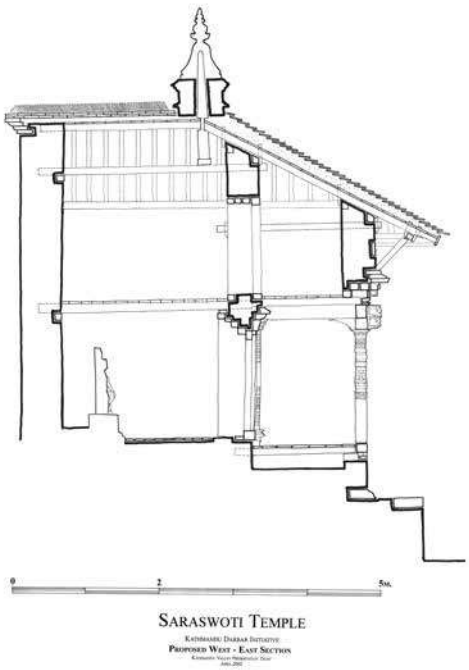


Fig 5. The east-west section of the temple

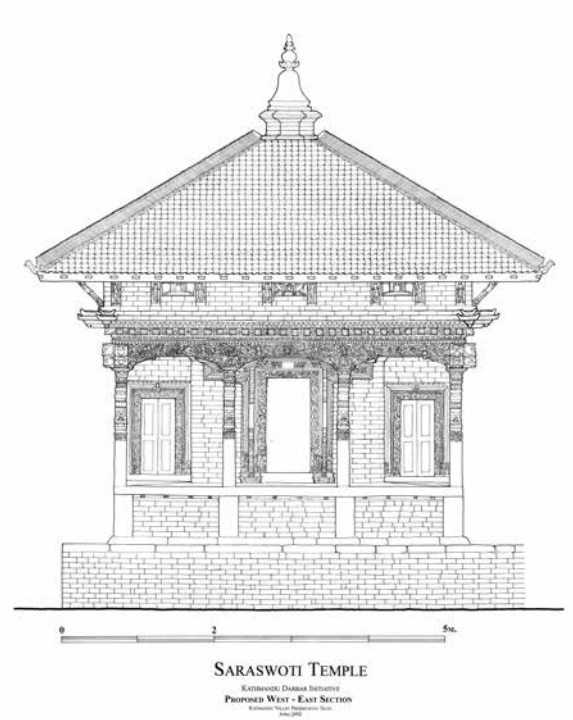


Fig 6. The principal elevation of the temple

Fig 7. A view from north. The temple is attached to the boundary wall along the western edge. The desolate rear garden and heavy vegetative growth and ground moisture are taking its toll on the temple structure (2017-07-25).

Fig 8. Dhalin khva above the nina are in a critical state due to a long period of exposure to wet rot. The faces carved in dhalin khva are not recognizable. The corner post and meth are dislocated (2017-07-25).

Fig 9. A view of the temple after removal of the roof rafters. The inner sanctum wall on the first-floor level can be seen (2017-08-27).

Fig 10. Almost all of the floor joists on the first-floor level were decayed due to wet rot (2017-08-29).

Fig 11. Wet cleaning of the door frame using a soft brush and plain water (2017-10-11).

Fig 12. A new timber added to the lion base of the main door threshold being carved. The details are as per the originals (2017-10-26).

Fig 15. Carpenters laying the roof rafters (2018-1-31).

Fig 13. Installing the main sanctum door in its proper position. Such carved doors are assembled from many complex smaller carved members which are correctly put together by master carvers (2017-11-7).

Fig 14. The Saraswati Temple beam (*Nina*) before and after cleaning on October 30, 2017 and November 5, 2017.

New Zealand

Larnach Castle Fernery: Restoration of an Early 20th Century Fernery

Matthew Schmidt, *Senior Archaeologist* Tuakana Poutairangahia *Otago/Southland*
Heritage New Zealand Pouhere Taonga

Introduction

Larnach Castle, named after its builder and owner William Larnach, is located on a high point on the Otago Peninsula and it is New Zealand's only genuine castle (Figures 1 and 2). The castle was built between 1871 and 1874 and its elevated location meant that Larnach and his family had majestic views of Dunedin, its harbour and the Peninsula. The wider estate also provided an extensive area to create gardens and plant trees to compliment the castle. After Larnach's death in 1898, the castle changed ownership a number of times with these changes also reflecting the castles decline until it was purchased by the Barker family in 1967 and brought back to its former grandeur. This paper looks at just one small feature of the Larnach Castle estate, this being the 1927-28 fernery built by one of the castles previous owners and how with the help of the Director of the Castle, Norcombe Barker, and volunteers including student archaeologists, this feature is being brought back to life.

Figure 1. The location of Larnach Castle on the Otago Peninsula, Dunedin, New Zealand.

A brief history of William Larnach & his Castle – 1874 to 1898: From riches to ruin

William Larnach (b. 1833, d. 1898) was a wealthy and influential man and as a banker he invested in shipping, farming, and land on the Peninsula and in other areas of Otago (Figures 3 & 4). His influence was not just limited to his business interests as for 25 years he was a Member of Parliament including becoming a Cabinet Minister. To compliment the huge cost of building a very large 34 room stone castle in an isolated location (Figure 5), Larnach spent lavishly on the interiors of his castle using only the best materials to embellishment the rooms with expensive furniture, wares, fixtures and fittings. The gardens were also lavish and consisted of a kauri timber entranceway, glass houses, a vinery, pergolas, a raised Italian garden, fish pond and a wishing well (see Williams 2013:29). Larnach's wider estate (913 acres) was farmland where Larnach illustrated to all his love for horses where by the 1880s he kept fifty-eight (Williams 2013:31). Associated with the castle were other important buildings required to run the estate such as a cow byre, forge house, poultry, piggery and goat houses plus workers cottages, a coachmen's house, residential laundry etc (see Williams 2013:31). On 10 December 1874 Larnach and his family moved into the completed castle (referred to by Larnach as 'The Camp'), with much fanfare which included monkeys and Llamas imported for children's entertainment.

The years that followed wavered from happy family life to sadness and hard times with the family at times being spilt up between England, Dunedin City and the castle,

and Larnach's business interests faltering. Tragedy struck the family in 1898 when Larnach committed suicide in his office at Parliament in Wellington. His suicide is believed to have been driven by a failure of his speculative investments but other factors such as the death of two of his wives and a daughter may have become too much for even this successful man bear.

The Castle after Larnach: From decay to restoration

Williams (2013:37-49) in his Conservation Plan for Larnach Castle provides a detailed history of the castle and its land after the death of Larnach. It is only summarised briefly here. The castle estate was put up for sale soon after Larnach's death with the farm land associated subdivided in 1900 into 18 Lots (Figures 6 & 7). Seventeen Lots of land sold off quite easily as did the castle contents, including some fixtures and fittings, but not Lot 18 consisting of the castle itself and its remaining 35 acres. It was not until 1906 that the castle with remaining land was purchased by the Crown for use as an asylum (Figure 8). From 1907 to 1918 the castle was home to 40 'well behaved' lunatic asylum patients. From 1918 to 1927, the Crown installed a caretaker into the castle who reported ongoing vandalism and theft at the castle but the building was still used during this time as a tourist destination and for social events such as cabarets.

In 1927, the Purdie's purchased the castle and owned it until 1940. It was during this ownership that new life was breathed into the castle and its gardens. Various buildings were repaired and made water tight, electricity installed in the castle, a modern kitchen built and repairs made to the ground veranda. Extensive work was undertaken on reinstating the castle gardens in mostly Victorian style. The works included building the biggest rock garden in New Zealand at that time, installing a marble fountain as well as a cupola with the glass dome taken from the saloon of the wreck of the Paloona in 1928 before it sunk. The castle was opened for social events with Mrs Purdie displaying her antiques collection in the rooms for sale. It was at this time that the Fernery was built (see below). Mr Purdie wished to retain the castle and continue to restore it, but for health reasons he had to sell it. In 1940, AF Armstrong purchased the castle and land and he quickly sold it on to a Mrs Stedman in 1941. Mrs Stedman retained ownership until 1959 and during this time the castle was used for public visitation, as a tourist venue and occasionally for conferences. From 1941 to about 1945 the castle housed 80 US Army Signal Corps servicemen. In 1959, Clarissa Empson purchased the castle and opened the property infrequently for public visits.

In 1967 the castle was sold to Margaret and Barry Barker and the Barker family have been the owners ever since. By this time the castle and the grounds were run down, the castle was leaking and vegetation had taken hold of the property. Much of the work by the Purdie's had become undone. The success of the Barker family in restoring the castle and its grounds to their former glory was due to their vision for the castle when they brought the property. Their vision was to create a home and tourist destination where the income from the tourists and visitors would be funnelled straight back into the restoration and ongoing management of the castle and its gardens in a manner where these restoration works would be undertaken to the highest quality and using best practice heritage techniques. Visitors to the property would therefore see over the preceding years tangible changes to the castle and its grounds which would in turn make the castle a prime destination for tourists to Dunedin and not a side-line visitor experience.

Williams (2013:45) notes that in 1967 the castle had about 10,000 visitors a year, by 1977 the Barkers had increased this to 40,000 per year (Figure 10) and in 2017 visitor numbers reached 135,000 (where the city of Dunedin has a population of only 127,000). The restoration work was undertaken and managed initially by the Margaret and Barry Barker and later involved their two children who were born and lived in the castle during the challenging early years. With more income, specialists were hired to complete the more specialist restoration works. Margaret Barker also hunted for many years for original pieces of

Figure 2. Larnach Castle as it is today restored by the Barker family (Photo used with permission from Larnach Castle Ltd, Dunedin).

furniture, fixtures and fittings from the castle which she was very successful at recovering. Today the castle and grounds are on the exclusive New Zealand Government *New Zealand Landmarks Whenua Tohunga* list which promotes and encourages people to visit New Zealand's historically and culturally important places.

The Fernery: History and 2018 conservation works

Little is known about the Fernery other than it was built by the Purdie's possibly around 1927-28. It is believed that the glass roof of the fernery was possibly from the wreck of the Paloona and was recovered at the same time as the glass for the cupola. The original glass setting was barrel shaped and so the timber framing of the fernery was long and curved to accommodate this (Margaret Barker pers comm, 1 November 2018). Ferneries were all the fashion during the Victorian period from about the 1830s onwards and this continued into the 1930s. Construction of a fernery was apt to the Victorian style of garden which the Purdie's established on the estate (Figures 11 & 12).

During a visit to the fernery by me and Norcombe Barker in 2017, it was decided that as the fernery lay next to a main path to the castle, it should be made feature of the path and managed as a hidden forest ruin with ferns re-established and interpretation installed, rather than completely restored as a heritage building. People could then 'discover' and explore the ruin and learn of its history in a less formal manner.

In Figures 13 to 16 can be seen the fernery before the first stage of the conservation works to remove the extensive vegetation commenced in April 2018. As can be seen, the fernery had been engulfed by decades of vegetation growth. In one location a tree had fallen through a wall and no discernible interior features could be seen other than piles of rock in the corners. It was unknown if the fernery had a floor or not.

On 28 & 29 of April 2018, the first stage of vegetation removal was intended to begin, but due to torrential rain, the work was limited to only the 29th of April. By the end of the day, the size of the structure and how the walls and entranceway had been constructed could be seen (Figures 17 to 25). The fernery measured ca. 8m/5m and had basalt stone walls about ca. 1m high sitting on a good quality strip concrete foundation (Figures 20 & 21). The walls were built of basalt stone rubble using a combination of dry-stacking with some sections of the wall also cement mortared. The stones used were dressed resulting in nice and clean straight walls. Stone slabs were used to create steps up to the fernery doorway, and a small garden area could be seen on either side of the doorway (Figure 22). The surviving doorway pillars were made of Oamaru stone possibly originating from a demolished building on the estate (Margaret Barker pers comm, 29 April 2018).

Although the interior of the fernery was still covered in soil and leaf litter, stonework relating to structures could be seen which appeared to be central and corner garden features, and water pipework could also be seen leading from the outside of the fernery to inside the doorway (Figures 23 & 24). On digging test pits in the interior of the fernery, it was found that at about 30cm beneath the topsoil, a floor was present. This floor was yellow in colour and initially appeared to be made of Australian sandstone pavers (Figure 25). The 29 April 2018 vegetation clearance showed that the fernery had clearly been planned and designed carefully with a great investment of time and resources by the Purdie's.

On the 26th of August 2018 a large team of volunteers assembled at the fernery to continue to remove vegetation from the inside and outside of the structure and excavate the soil fill from the interior (Figures 26 to 29). An extensive amount of smaller vegetation and

Figure 3. A photograph of William Larnach takenFigure 4. A photograph of William Larnach and family taken in 1878 by Bradley & Rulofson of San Francisco in 1878 by Bradley & Rulofson of San Francisco(Source: Wikipedia commons).
(Source: Wikipedia commons).

intrusive roots was removed from the stonework and the excavation of the deep soil layer from the interior uncovered the layout of the fernery in more detail (Figure 30 to 33). The work found that the fernery had at its centre a stone structure, which would have originally been planted with ferns, with a pond located in the middle. This pond had a cement lining which still had its blue/green painted colouring. The pond had a running water supply originating from an inlet through the back wall which supplied water via a stone channel (Figure 31). It was also found that the water pipe noted in April led to the pond. This pipe may have supplied a fountain in the middle of the pond. More excavation of this central area will confirm these observations.

At each corner of fernery was stonework which was raised probably to provide a cascade of fern plantings and along the back and side walls of the fernery were raised stone lined growing areas (Figure 32). The collapse of the wall on the left side of the fernery was obscuring the raised area on that side. The floor of the fernery was intact and the bright sandstone path continued all the way around the interior. Currently, the floor is too stained with mud to confirm the use of pavers. Few artefacts were found during the excavation and this consisted mainly of mid to late 20th century pieces of wire and beer bottles. A few fragments of plate window glass were found but so little of it was present it is difficult to ascertain if this came from the fernery roof structure. Mr Purdie is believed to have shot the glass roof and destroyed it (Margaret Barker pers comm, 1 November 2018). A very small feature on top of the right Oamaru stone pillar by the entranceway provided a clue as to the decorative nature of the fernery. This is a pair of small boots made of cement (Figure 36). The boots were clearly part of a small statuette to adorn the entranceway, perhaps a gnome or other Victorian garden character.

Conclusions

The next stage of works to be undertaken on the fernery will involve completing the excavation of the interior of the site plus remove fill which has built up around the outside foundations. After this, the collapsed walls will be rebuilt as will any interior stonework needing repair. The stonework and the floor of the fernery will then be cleaned. Finally, new ferns will be planted and interpretation installed on the site.

Acknowledgements

My thanks to Norcombe Barker, Director of Larnach Castle Limited, for access to the fernery and partnering in the vegetation removal and excavation. This project could not have been undertaken without the volunteers consisting of castle staff, the Oskam-Schmidt and Barker children, Denise & Keith Anderson, Shar Briden, the Otago University Anthropological Society, Athol Parks and Janny Sjåholm. My thanks to Margaret Barker for her knowledge about the history of the castle estate and Margaret and the late Barry Barker for their vision to restore this iconic heritage destination.

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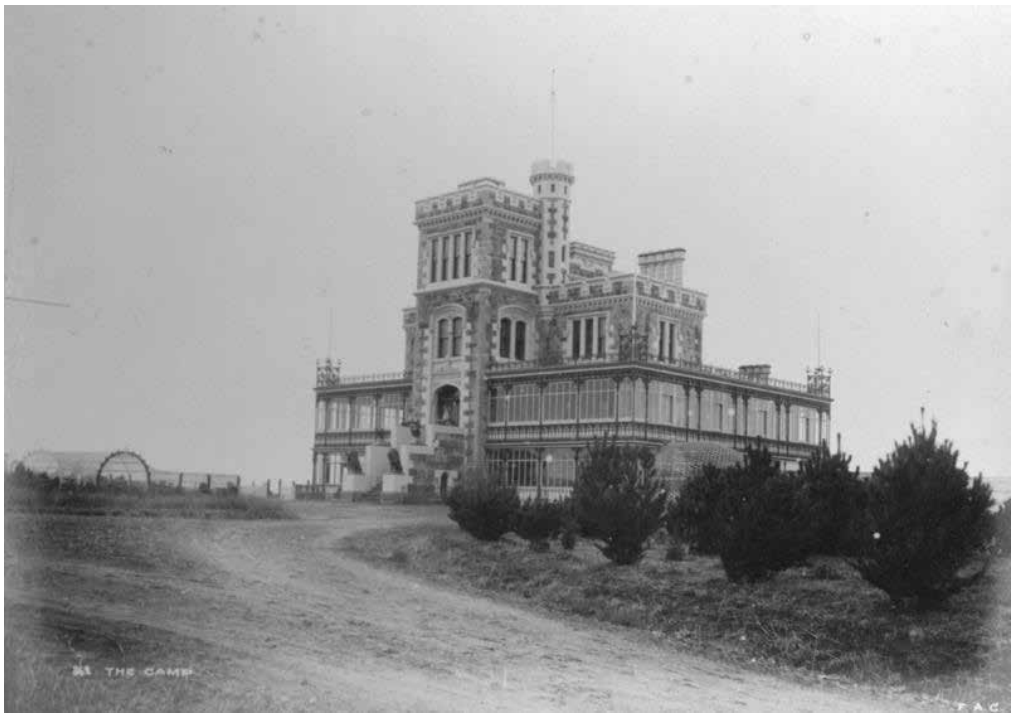

Figure 5. Larnach Castle, also known as 'The Camp', photographed possibly in the 1880s by Frank Coxhead. (Source: mtg Hawke's Bay ref: 48/75, 1213, Album 7, 80067. Gifted to mtg by Mr McCormack).

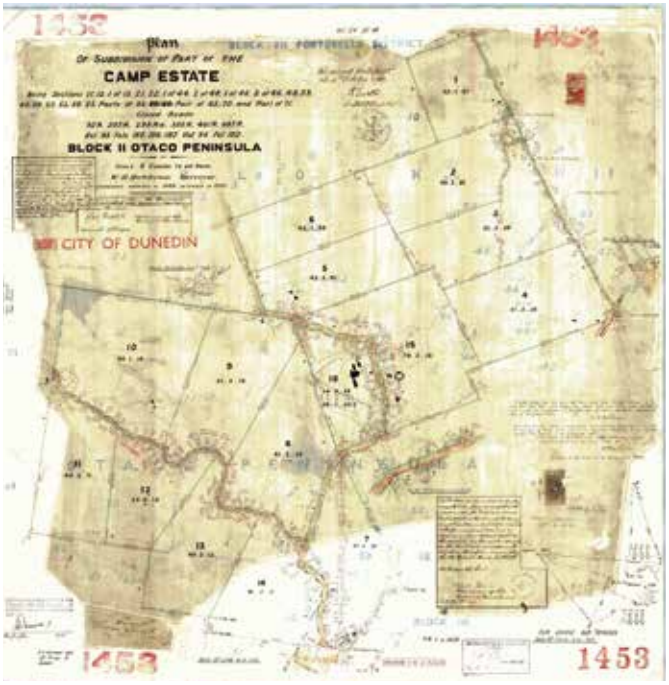

Figure 6. Subdivision plan from 1900 for the sale of Larnach's Camp Estate showing the 18 Lots.

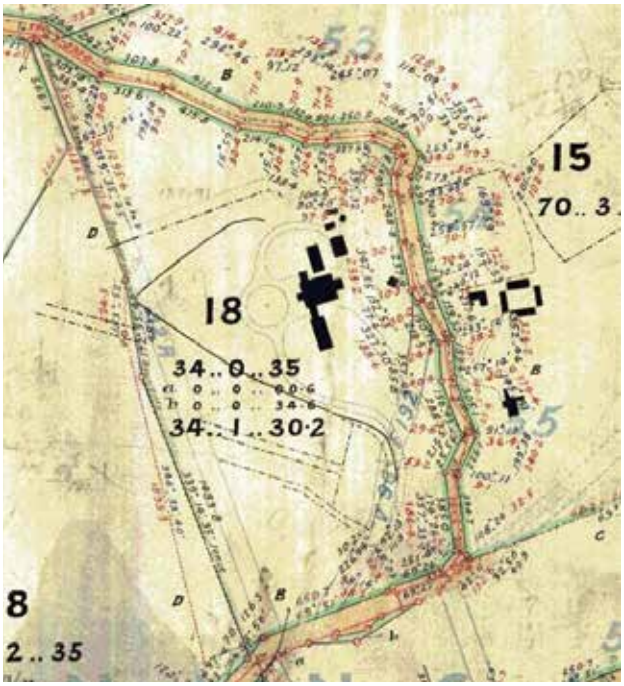

Figure 7. Crop of 1900 subdivision plan of Larnach's Camp Estate showing Lot 18 – the Castle and 35 acres.

Figure 8. The Castle in 1906 when it was used as an asylum (Source: ref. MA_I024736_TePapa).

Figure 9. 1947 aerial photograph of Larnach Castle taken by Whites Aviation (Source: Ref: WA-10670-F. Alexander Turnbull Library, Wellington, New Zealand. /records/22777584).

Figure 10. Larnach Castle in about 1972 (image courtesy of the Barker family).

Figure 11. Dunedin Botanic Gardens Fernery in 1926 (Source: Alexander Turnbull Library, by Albert Percy Godber APG-1935-12-G).

Figure 12. Fernery from an unknown location in Christchurch taken between 1880 & 1920 by Steffano Webb Photographic Studio, Christchurch (Source: Alexander Turnbull Library ref 1-1-009689-G).

Figure 13. Fernery entranceway before vegetation clearance (Photo: Matthew Schmidt).

Figure 14. View of an exterior stone wall of the fernery looking into its interior before vegetation clearance (Photo: Matthew Schmidt).

Figure 15. Damage to a wall from a collapsed tree (Photo: Matthew Schmidt).

Figure 16. The interior of the fernery with an overgrown corner stone feature (Photo: Matthew Schmidt).

Figure 17. Norcombe Barker chain sawing trees from the fernery interior, vegetation clearance on 29 April 2018 (Photo: Matthew Schmidt).

Figure 18. The outside wall as shown in figure 14 exposed after vegetation removed on 29 April 2018 (Photo: Matthew Schmidt).

Figure 19. More of the fernery uncovered after initial vegetation removal on 29 April 2018 (Photo: Matthew Schmidt).

Figure 20. The nature and extent of the fernery revealed at the end of vegetation clearance on 29 April 2018 (Photo: Matthew Schmidt).

Figure 21. The strip concrete foundation onto which the stone rough stones walls were built, 29 April 2018 (Photo: Matthew Schmidt).

Figure 22. The entranceway with its stone slab steps and side gardens, 29 April 2018 (Photo: Matthew Schmidt).

Figure 23. Interior features could be seen after the first stage of works on the fernery such as a stone piles used for growing cascading ferns built in the inside corners of the fernery, 29 April 2018 (Photo: Matthew Schmidt).

Figure 24. Water pipework coming into the fernery from an exterior water source (Photo: Matthew Schmidt).

Figure 25. A test pit dug in the interior of the fernery showing what maybe sandstone paving, 29 April 2018 (Photo: Matthew Schmidt).

Figure 26. Volunteers photographed before the second stage of works to excavate the fernery 26 August 2018 (Photo: Matthew Schmidt).

Figure 27. Volunteers excavating the fernery, 26 August 2018 (Photo: Matthew Schmidt).

Figure 28. Volunteers excavating the fernery – archaeologists Shar Briden (left) and Erica Oskam-Schmidt (right), 26 August 2018 (Photo: Matthew Schmidt).

Figure 29. Volunteers excavating the fernery –Athol Parks of City Walks (a heritage guide) (left) and Norcombe Barker, Director of Larnach Castle Ltd (right), 26 August 2018 (Photo: Matthew Schmidt).

Figure 30. The fernery after the 26 August 2018 excavation showing the layout of the structure. The entranceway is in the background, the pond in the centre and the path leading part way round the fernery interior, 26 August 2018 (Photo: Matthew Schmidt).

Figure 31. View from the back wall of the fernery where the water source comes through the back wall, along a stone channel and into the central pond. The source of the water has yet to be determined, 26 August 2018 (Photo: Matthew Schmidt).

Figure 32. The excavated path and the terraced growing areas on the left side of the fernery looking towards the entrance. The path is muddy hence hiding the bright yellow sandstone floor. The left and right corners of the interior have piles of stones possibly used for cascading fern plantings, 26 August 2018 (Photo: Matthew Schmidt).

Figure 33. View of the fernery from the entranceway showing the layout and collapsed back wall and left wall. The water pipe coming into the fernery from outside and leading to the pond can be seen, 26 August 2018 (Photo: Matthew Schmidt).

Figure 34. The water supply pipe seen in Figure 33, 26 August 2018 (Photo: Matthew Schmidt).

Figure 35. The entranceway steps and side gardens cleaned up, 26 August 2018, (Photo: Matthew Schmidt).

Figure 36. Small concrete boots from a missing statuette which used to be on top of the Oamaru stone entranceway pillars (Photo: Matthew Schmidt).

Solomon Islands

Archaeological Excavation Site on Sikopo Island, Arnavon Islands, Solomon Islands

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Solomon Islands National Museum, Ministry of Culture and Tourism

Introduction

Sikopo Island is located in Manning Strait between the two large islands that make up Choiseul and Isabel Province in the Solomon Islands, as shown in Figure 1. This island is part of a marine conservation area called the Arnavon Community Marine Conservation Area (ACMCA), which was established in 1993. It has important archaeological sites on it and three types were identified during a 2014 survey by Richard Walter and Oswald Alesasa in August 2014. The three types are the shrines for rituals or religious sites; the artefact zone which has midden shells, pottery and worked Tridacna shells; and the rock shelter comprising a cave that contains evidence of human occupation. The archaeological work, comprising a survey of the sites, continued in 2016, with collaboration between the University of Otago, New Zealand and the Solomon Islands National Museum. In 2017, archaeological excavation work was carried out by the research team, the first time that an excavation had been done in this cultural area.

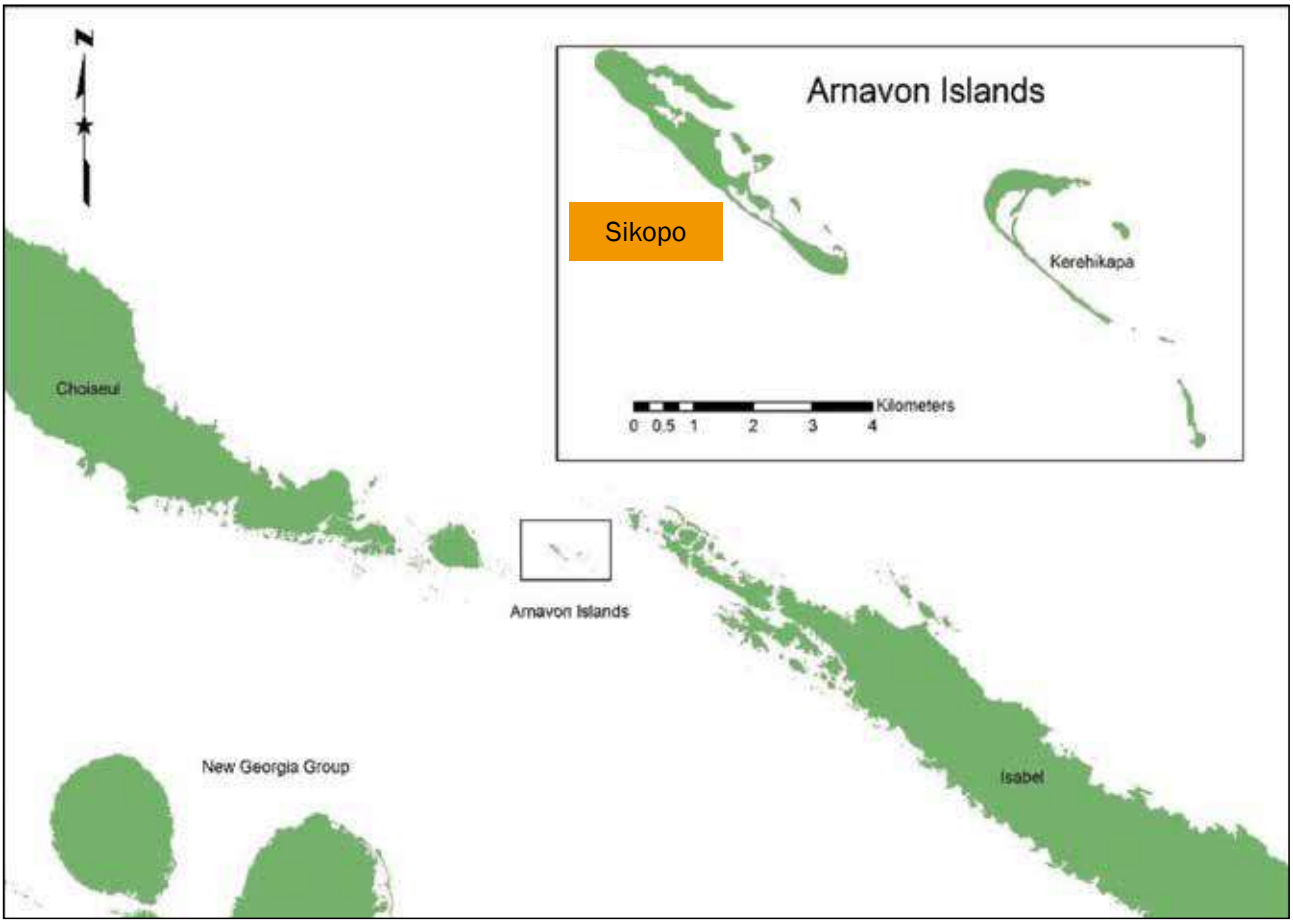

Figure 1. The location of Sikopo Island and the Arnavon Island group. (*Source: Richard Walter, 2014*)

Figure 2. Preparing and cleaning the excavation site

Figure 3 shows Layer 1, Spit 2. This contains dark, friable soil and many Trochus middens are heaped in one place.

These Trochus middens were counted and recorded as found in Layer 1, Spit 2 - 20 cm below the surface of the soil. There are about 275 Trochus shells and other Tridacna shells of different species. They are found further away from the coral outcrop and heaped in one area. Large roots are seen as one of the disturbances in this area in the upper level. Some trochuses are burnt, which is evidence of the trochus shells being placed over a cooking fire.

Figure 4 shows Layer 1, Spit 3 - 30 cm. About 42 Trochus shells have been counted in this level. There are about 15 Giant Clamshell Tridacna specimens among different species. Some Trochus shells are burnt and others are partially damaged

Figure 5 shows the Layers and Spits that have been excavated about 90 cm. It shows the cross section of the stratigraphy of a wall. Layer 2 consists of light brown soil and Layer 3 is white sandy soil and is a natural layer. It has no cultural material. The two mounds of soil shown are mixed with ash and charcoal and are very compact.

Figure 4 indicates the Eastern Section of Sikopo. Some of the artefacts are disturbed by tree roots. From the excavation shown in Figure 2-6, it is evident that this is a site that people used long ago as a cooking place near the coral outcrop. This is shown by the burnt Trochus and the charcoal that have been found.

On Sikopo Island, part of the Arnavon Islands in Manning Strait, the artefact types that were found on the surface of the excavated area are shell samples, armlet fragments and pottery. The raw materials that were found are coral, shell and ceramics. Also, the depth of the excavated area from the upper layer to the bottom layer was about 90 cm. The raw materials that were found are faunal remains, stone and ceramics. The artefact/ecofact types are bird and fish bones, shells, coral, pottery and charcoal. All the artefact/ecofact types indicate what people ate and the things they did. These people ate a lot of Trochus as part of their main diet, which is shown in the excavated area. These are the human activities they were engaged in and the behaviour they displayed.

Conclusion

The archaeological excavation of Sikopo Island has revealed many Trochus shells and other shells from the sea. It indicates what people ate and how they lived long ago. The archaeological excavation site is near the rock shelter and it is possible that this excavation area is a place that people used as a kitchen because there is evidence of charcoal mixed in with the soil. This archaeological site is conserved and protected. There are no people living in this area, although those who visit the place must be careful not to trample on the artefacts scattered on the surface.

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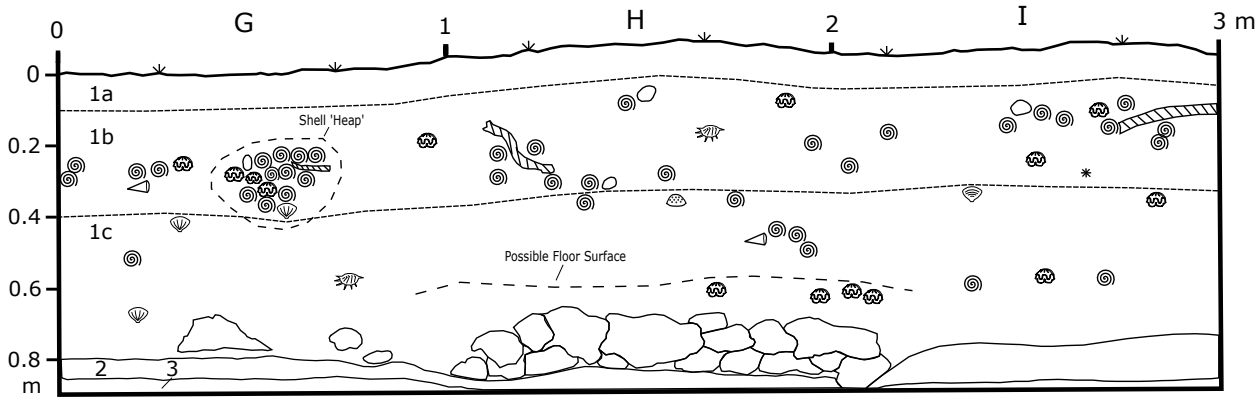
Figure 3. Layer 1, Spit 2-20cm

Figure 4. Layer 1, Spit 3 - 30 cm

Figure 5. Layer 1, Spit 5 - 50 cm; Layer 2, Spit 6 - 80 cm; Layer 3, Spit 6 - 90 cm



KEY

1 a. Brown-black topsoil, loose and friable in consistency.

b. Continuation of brown-black soil but more gravel-like in consistency due to a higher concentration of coral and shell fragments. Contained dense clusters of burnt Trochus shells and Tridacna valves that appeared as discarded shell 'heaps'.

c. Dark, almost charcoal black, soil intermixed with fragmented coral, shell and more abundant in charcoal than the upper contexts. Contained possible floor surface and, at at the same depth, several clusters of burnt shell and charcoal some of which appeared as fire scoops.

2. Thin layer of light brown, friable to loose soil containing mostly fragmented coral and shell.

3. Base layer of white, fine marine sand containing shell, fish, bird, turtle and crab remains which were bleach white in colour and predominantly undamaged.

Coral
Tree root
Trochus
Tridacna
Conus
Cowrie
Pearl
P. clathrata
Lambis
Pottery
Obsidian

Figure 6. Eastern Section - Sikopo *(Source: Charles Radclyffe, 2017)*

Uzbekistan

The Experience of Conservation of a Fragment of Wall Painting from Balalyk-tepa

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Introduction

The wall paintings of Balalyk-tepa (from Uzbek *balalyk* – childhood and *tepa* – hill) are collectively one of the most magnificent examples of the monuments of culture and art of the peoples of Central Asia in the early middle ages. They were discovered in 1953-1955 during the archaeological excavations at the archeological site Balalyk-tepa by an expedition headed by L.I. Albaum. The monument is located in the Angor district of the Surkhandarya region, 2 km east of the road from Termez to Angor (Fig. 1 a, b).

The plan site is square shaped and oriented over almost all the countries of the world. On the monument there used to be a castle, which was built in the 7th century of mud brick on a clay earthen (*pahsa*) square platform (30×30 m). At the beginning of the 7th century, the castle structures lined up around the courtyard. In the middle of the 7th century the courtyard was built up; in one of the rooms there is a wall painting with a scene of a feast. In the second half of the 7th century, Balalyk-tepa burned down. At the end of the 7th century the castle was restored; after an unsuccessful attempt at restoration the room with the painting was immured, and a staircase leading to its roof was erected. From the beginning of the 8th century, Balalyk-tepa came to desolation and collapsed (Fig. 2 a, b).

Wall Paintings of Balalyk-tepa

The murals were found in one of the rooms (No. 14) of the castle. After the completion of the excavation, it was established that the room was square in plan and each side was about 5 m in length. The entrance to the room was in the southeast corner. The preserved height of the southern wall near the entrance was 2.5 m. A solid *sufa*[1] was built along the inside of the walls, about 0.40 m high and from 0.90 m to 1.2 m wide. Above the surface of the *sufa*, 1.2-1.4 m high, the walls are plastered and covered with paintings. The average preserved height of the walls of all sides, except the western wall, was from 1.5 m to more than 2 m. As archaeologists have determined, during the discovery, the surface of the walls with paintings was thickly covered with soot.

The murals were removed in time for seasonal excavations by successively cutting them into pieces. After they were cleaned, they were fixed with chemicals. According to the authors of the reports on the excavation, when the paintings were opened, they used a solution of PBMA (poly butyl methacrylate) in xylene for fixing. This decision increased the strength of the paint layer of the painting and at the same time strengthened the 3 mm thickness of the cut clay base. Fixing the paint layer made it possible for the drawings to stand out brightly, and at the same time allowed the conservators to copy the image from the wall.

One of the Balalyk-tepa fragments came to the Termez Archaeological Museum. The fragment, designated as No. 14 (size 68×87.5 cm), belonged to the southern wall of one of the rooms of the monumental monument building. This part of the painting illustrates the feast scene: in the foreground are well-dressed men and women in a seated pose and young servants in the background. Since the fragment was in poorer condition than the others, in 1983, in cooperation with the Russians, it was studied and restored in the State Hermitage Museum (Fig. 3).

According to an article devoted to practical work on the fragment, one can observe the process of conservation. First, the surface of the fragment was removed with polymer glue, and with the opening of the painting, was found to be richly plastered. Purification was carried out by dissolving it with steam using xylene. When this method did not produce the desired result (since there were dark areas on the burn surface), several chemical analyzes were performed. As it turned out, the surface of the painting was fixed with a solution of PVB (polyvinyl butyral), BF[2] and other chemicals, which caused its darkening and protected the paint layer. According to the recommendation, the surface of the painting was cleaned with hot water, acetone and alcohol, which were used for the first time in restoration practice.

Careful study of the painting allowed specialists to determine the technical and technological methods of the wall painting of the early middle ages. In particular, by definition, the paint layer is smeared on a dense *ganch* (a kind of local stucco) base. The traces of paint suggest that it was painted with thick brushes in an exaggerated style. The orientation of the movement of the brush in the form of the image led to the transformation of the pattern as in relief. However, according to researchers, the gradation of light and shade is not traced in the paint layer.

Despite the quality of restoration, any work of art usually requires preventive conservation after a long time. This also applies to this fragment, on which, as stated above, conservation work was carried out more than three decades ago. Therefore, it was necessary to study its condition and implement conservation measures at this time. It should be noted that the project for the conservation of the fragment was initiated by the Termez Archaeological Museum in collaboration with Japanese experts.[3]

[1] *Sufa* – a clay platform for rest (seat) located along the walls. Usually it was laid out with raw bricks (or adobe *pahsa*), plastered and whitened.

[2] BF – a phenol-formaldehyde resin and polyvinyl butyral, dissolved in ethanol, acetone or chloroform. With an increase in the amount of vinyl additives, the elasticity of the seam increases, but strength decreases.

[3] This project was held on the initiative of the Termez Archaeological Museum (Director Z. Alimardonova) and participated in by H. Furusho, the author of the project, as well as N. Inutake, A. Ulmasov, and F. Sharipova – restorers and others from Termez Archaeological Museum.

Practical work

Below is a brief description of the main stages of the work regarding cleaning, fixing and dismantling the exhibit. These processes were gradually carried out in accordance with a special plan.

Stage 1. A fragment of the wall painting was carefully studied and photographed using a modern microscope. The surface of the painting was cleaned with a spray. According to the rule, in order to process the back side of the painting, the front of the painting turned to the ground. At the same time, in order not to damage the paint layer and ensure that the surface did not crack, Rayon cellulose paper was glued onto the front part before it was turned over. Gluten glue made from vegetable starch was used for bonding. This glue is easily soluble in water and therefore easy to remove with water. It does not have a negative impact on the exhibit (Fig. 4 a).

Stage 2. After the surface of the paper was covered, plastic film and foam rubber were laid under it. A polycarbonate Lexan board was inserted above the foam rubber, then from four sides the outer edges of the film were folded inside. After this, the fragment was carefully and slowly turned. On the reverse side of the painting, a previously inserted protective wooden board and two layers of thick fabric attached with buttons were removed. Also removed were the two layers of gauze, which had been fixed on the ground layer of the painting, by dissolving it with acetone (Fig. 4 b).

Stage 3. In previous conservation works, the base of the painting was saturated with polymer glue. In order to transfer the fragment to another board, it was necessary to get rid of excess glue from the base. Therefore, the base was thoroughly soaked with acetone, as a result of which excess polymer was removed. Then, a glass fiber cloth was glued to the cleaned base with the help of a 10% solution of acrylic resin (Paraloid B72) in acetone (Fig. 5 a).

Stage 4. In the last stage, the board was attached to the base, and the fragment was screwed back in the above manner. After setting, all aspects were fixed. Additional parts of the fabric were glued to the back of the board, and the edges were tightened and fixed twice with a 20% solution of Paraloid B72 on acetate. After the adhesion was well drawn, a 2-point panel was placed on the exhibit, and the two boards were joined together. Subsequently, the “district newspaper” at the top of the photograph gradually shifted from the sample to the tissue paper and its subdivisions through the application of distilled water (Fig. 5 b).

Conclusion

Thus, this part of the wall of Balalyk-tepa was ready for exposure. In practice the chemicals and raw materials that were widely used during the restoration complied with modern requirements. As a result, a unique museum object was restored. In addition, local specialists were able to share their experience with their foreign partners. Restoration of the paintings allowed local and foreign tourists to come to the museum to view a good example of this medieval work of art (Fig. 6 a, b).

Note:

Conservation of this fragment of the Balalayk-tepa wall painting inspired young specialist-students from the Restoration Department of the National Institute of Art & Design, named after K. Bekhzad. Based on the study of the conservation of these wall paintings, two of these students worked on copying and reconstructing them. Replicas of several parts of the wall painting were created using the same technique as per the original Balalyk-tepa wall paintings (Fig. 7 a, b).

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Fig. 1 a, b. A location and satellite map of the Balalyk-tepa site

Fig. 2 a, b. The general view and schematic plan of the Balalyk-tepa site (the photo by H. Furusho, the plan by L.I. Albaum)

Fig. 3. A fragment of the Balalyk-tepa wall painting before conservation


Fig. 4 a, b. A process of the conservation: cleaning and removing the old polymer resin


Fig. 5 a, b. A process of the conservation: attaching glass fiber and removing old textile from the back side


Fig. 6 a, b. The wall painting before conservation and mounting

Fig. 7 a, b. The replica of the Balalyk-tepa wall painting by students

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