

BUDDHIST HERITAGE DIGITAL PRESERVATION IN KHYBER PAKHTUNKHWA, PAKISTAN

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ABSTRACT

The Khyber Pakhtunkhwa province of Pakistan has a rich history of culture and heritage. There are many beautiful sites in the region that shows the glory of oldest civilizations in the sub-continent. Khyber Pakhtunkhwa is proud enough having the roots of Gandhara civilization. The Buddhist Stupas at Jualian in Haripur, Bhamala at the bank of Khanpur dam in Haripur and Takht-i-Bahi UNESCO World Heritage site in Mardan are some few examples of beautiful sites related to Gandhara civilization. The Directorate of Archaeology and Museums Khyber Pakhtunkhwa is working on many excavation projects in the region and getting wonderful Buddhist sculptures and other antiquates on regular basis. Peshawar Museum is one of the major places where these antiquates have been displayed beautifully that captures the eyes of tourists not only from Pakistan but around the world.

Due to prevailing security conditions in the region the number of local and foreigner tourists to these heritage sites have reduced to a great extent. In current scenario it is needed to adopt other methods to promote these heritage sites and the beautiful sculptures that are related to these sites and right now placed in different museums. One way is to preserve these sites and sculptures digitally and showcase them on national and international platforms. The Directorate of Archaeology and Museums is working with Lahore University of Management Sciences on many projects for the digital preservation of these heritage sites and sculptures. In order to promote the Museums and Heritage sites of Khyber Pakhtunkhwa we scanned different sculptures in Peshawar Museum and a famous “Dying Buddha” sculpture at Bhamala in Haripur, Buddhist Stupas at Jualian in Haripur, Takht-i-Bahi UNESCO World Heritage site. After scanning these sculptures and sites were processed to produce 3D models of the sculptures with high details. These 3D models can be used for the promotion of Museums and heritage sites online.

Keywords: Peshawar Museum, KPK Archaeology, Buddhist Heritage, Gandhara, Digital Documentation.

INTRODUCTION

The Directorate of Archaeology and Museums, Government of Khyber Pakhtunkhwa (hereafter DoAM) since its establishment in 1992, is conducting excavations, explorations and conservations in various Archaeological sites and monuments of the province. The excavated sites, particularly those belongs to the Buddhist period have brought to light wonderful art treasures and added to the Museum's collection many antiquities of extraordinary importance. Similarly, the conservation and restoration works carried out to the most important monuments have saved our cultural assets from deterioration and further decay. While since 2011, the DoAM is also the custodian of those immovable antiquities and monuments of the Khyber Pakhtunkhwa Province which were previously looking after by the Federal Department of Archaeology and Museums, Government of Pakistan.

Besides conducting archaeological excavations and conservations, the DoAM has constructed nine new museums one each at the Mardan, Swabi, Charsadda, and Bannu districts with the addition of three museums in district Chitral, for the display of the excavated and ethnological materials. The rich archaeological heritage and the art pieces preserved in different museums of the Khyber Pakhtunkhwa Province have attracted the attention of scholars, researchers, students and tourists from all over the world. However, since 2001, the prevailing law and order situation have greatly reduced the number of visitors to the sites and museums of the province. Under such circumstances some necessary measures were unavoidable to be taken for the promotion and publicity of our cultural heritage on the entire world through publication, exhibition, Seminars and workshops etc. But the most noteworthy step taken in the recent year was the decision of making a digital documentation of all the important Buddhist and Hindu period monuments and sculptures housed in various museums of the province to be available on the internet free of cost.

DIGITAL DOCUMENTATION

Digital documentation in the form of dense real-world measurements is used to preserve the sites in the form of digital 3D models. Moreover, any physical restoration is dependent on quality documentation, which is exemplified by such digital models. The approach that yields the most accurate and detailed 3D models is documenting the entire architecture with laser scanners to create the model. Digital documentation is essential for those ancient monuments and sites where physical restoration is slow, expensive time consuming while the deterioration is going on continuously at a much faster rate.

TECHNOLOGY TRAINING FOR DIGITAL DOCUMENTATION

Recognizing the dilapidated condition of most heritage sites we for the first time introduced Terrestrial 3D Laser Scanning technology in Pakistan. Terrestrial 3D Laser

Scanning is the state-of-the-art technique to perform rapid, dense and comprehensive documentation of heritage sites.

The process of digital documentation using 3D laser scanner involves four major steps:

- i) Field work that involves performing scanning at site,
- ii) Registration of various scans obtained during field work,
- iii) Texturing of scanned measurements with color information obtained from captured photographs
- iv) Further processing of images and 3D measurements to create additional deliverable such as virtual panorama tours, 2D architectural drawing (see Fig.3), 3D CAD models and animations. (See Fig.1).

Field work is one of the most critical step in the entire documentation process. If the field work is done correctly, then the obtained data can be used by anyone at any time in future to reconstruct the scanned site. Field work involves working with the scanner and cameras. The working of the scanner is explained in Fig. 2. The scanner continuously emits laser beams which hits a surface and then is received back at the scanner. The scanner checks the strength of the received signal and if it is greater than a certain threshold it is used to measure the distance between the scanner and surface using the time-of-flight information.

DIGITAL DOCUMENTATION OF THE HERITAGE SITES & MUSEUMS BY DOAM

The DoAM and Lahore University of Management Science (henceforth LUMS) in the initial phase, have digitally preserved two heritage sites in Khyber Pakhtunkhwa, namely the Buddhist establishment of Julian in the district of Haripur, and Takht-i-Bahi in the Mardan district. Both of these sites are also included in UNESCO World Heritage list. Moreover, The Buddhist stupa and monastery site of Bhamala in Haripur district as well as the Buddhist sculptures in the Peshawar museums were also partial field work of documentation.

TAKHT-I-BAHI HERITAGE SITE

Takht-i-Bahi is one of the well-known and well preserved Buddhist heritage sites in Khyber Pakhtunkhwa, Pakistan and included in the UNESCO's world heritage list. It was first reported in 1836 by General Court, a French office in the court of Maharaj Ranjit Singh. The site was first excavated in 1871 by the Punjab government in 1871, while extensive excavations and conservations were carried out by the Archaeological Survey of India till independence. The site also received considerable repair work from the concerned Federal Department till 2011, and since then the DoAM is looking after its

preservation. The Buddhist complex of Takht-i-Bahi is consisting of the main stupa, votive stupas, a monastery, meditation cells, assembly hall, and image shrines etc.

The site was digitally scanned in the month of Nov-Dec in 2015. The raw data which produce 280 scans of the site was then processed to LUMS which produced the complete result in next six to seven weeks. (See Fig. 3 & 4).

THE BUDDHIST HERITAGE SITE OF JULIAN

The Monastery of Julian in Haripur district of Khyber Pakhtunkhwa is another interesting Buddhist site which has been properly preserved. The site attracts thousands of tourists every year due to its location on the summit of a mountain (300 ft. high) and pleasant environment. The site consists of two main parts, stupa courts (upper and lower) and monastery. The stupa courts have been covered with iron and wooden roof against natural calamities since the monuments are elegantly decorated with stucco sculptures and Kharoshthi inscriptions. Along with monastery there is an assembly hall, a kitchen and dining hall. The site is surrounded by green hills providing it a very peaceful environment.

The DoAM& LUMS digitally scanned it in the month of Nov in 2015. The raw data (140 scans of the site) then processed at LUMS and after a period of three weeks the complete report was submitted to the authorities. (See Fig. 5 & 6).

BUDDHIST COMPLEX BHAMALA

The Buddhist complex of Bhamala is situated at the extreme northern part of Khanpur valley on the bank of Haro River, in the district of Haripur. This beautiful Buddhist site is surrounded by lush green mountains that would have provided a peaceful environment for the Buddhist monks to practice their religious activities. While the crystal clear blue water of Khanpur River which is flowing near the site further increases its scenic beauty. Presently the Khanpur dam is a favorite picnic and speed boating.

The eastern portion of Bhamala site was first excavated by Sir Jon Marshall in 1930-3, where the remains of cruciform style stupa, a monastery, chapels and votive stupas were exposed. The unexcavated part of the site is recently excavated by the DoAM in 2014-15 where some precious antiquities have been exposed. But the most noteworthy discovery took place when the remains of *mahaparinirvana* scene of Buddha was exposed which attracted the attention of national and international print and electronic media. The under discussion scene though badly deteriorated, is shown on a raised platform of kanjur stone masonry.

Besides scanning the whole complex, DoAM and LUMS, in the first phase focused on the digital scanning of the *mahaparinirvana* scene since the lying figure is made of stucco there was probability that the heavy rains could wash it completely. The

scanning work started in December 2015 and fortunately completed within few days which resulted in the preservation of every detail of the scene in 3D scan format which show the intricate details on the legs and foot of the statue. (See Fig. 7)

BUDDHIST SCULPTURES IN THE PESHAWAR MUSEUM

The Peshawar Museum Peshawar is the earliest Museum of Khyber Pakhtunkhwa, Pakistan which was established in 1907 in the then Victoria Memorial hall in order to display the rich harvest of Buddhist sculptures excavated from different Buddhist sites during pre and post-independence period of our region. The major collection of the sculptures at the museum came from the site of Sahri bahlol, Takht-i-Bhai, Jamal Garhi, Shah-ji-ki-Dheri etc. The way budhist narrative art was carved in Gandhara, artists, art historians, archaeologists and historians of the whole has ranked it among the highest religious arts of ancient times. Besides the excavated sculptures, the museum has also received from time to time, gifts and donation of Hindu Buddhist sculptures, ethnological materials, armory, embroidered textiles, paintings and pottery specimens from various individuals and donors.

Among most significant collection of the Buddhist art housed and displayed in the Peshawar Museum, one can easily follow events and moments explaining complete life story of the Buddha. The chorological order begins with the sculptures depicting previous births of Siddharta. The display scheme continues and showcases major as well as less popular scenes from life of the Buddha. Beautifully carved pieces, sculptures and narrative panels takes us directly to actual life of Siddharta from the dream which his mother had to the events and activities which took place after death of the Buddha. On one hand where the showcases are filled with these reliefs and panels, we also have huge number of worth seeing statues of the Buddha and Bodhisattvas in typical positions and mudras. In terms of display order and presentation, all these Gandharan pieces occupy complete space of the ground storey of the building. Maximum space has been used to display the art, however, still huge number of pieces are still laying in reserve collection of the Museum.

The preservation of the Peshawar museum collection is always remained on priority basis for the DoAM and various measures have been taken in the past few years to make the collection availed to research scholars and students of Buddhist art through a computerized database which has greatly facilitated the research work. In the recent year it was also decided that a complete digitized record of all the antiquities of the museum is to be prepared so that the general mass can view them on the official website of the DoAM.

For this purpose, a 3D model of different statues of Buddha, Bodhisattvas, royal donors etc. was prepared while work on the rest of the collection is still going on and will be completed in a couple of months. These 3d models can be utilized in the multimedia

presentation at various schools, colleges and even in Universities of the countries and abroad for delivering lectures etc. (See Fig. 8& 9)

CONCLUSION AND FUTURE PLANS

The latest technology of digital documentations of various Buddhist sites, monuments and sculptures employed by the DoAM in collaboration with LUMS, is achieving satisfactory results and every day admirable comments are communicated to the office from the research scholars throughout the world. The international scholars and tourists who have been prevented by the law and order situation prevailed in Pakistan are now getting a free access to the photographs of Buddhist monuments and sculptures preserved under the administrative control of the DoAM and acknowledging the efforts made in this direction.

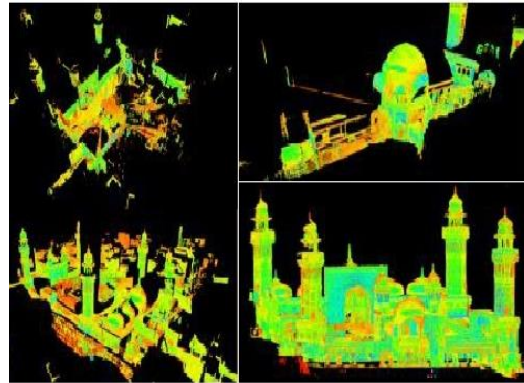
Looking to the positive response of the national and international communities, the DoAM is trying its level best to extent the project of digital documentation to different archaeological sites of the province. Although it is an expensive and time consuming job, yet it is the urgent need of the time that our cultural heritage should be properly conserved and documented for the generation to come otherwise they will be deprived of their rich archaeological and historical heritage.

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STEP 2: REGISTRATION ⇒



STEP 3: PANORAMAS & TEXTURING



STEP 4: 3D MODELS ⇒



Fig. 1. Four steps of digital preservation namely Laser Scanning, Point Cloud Registration, Panoramas and Texturing of point cloud model and 3D CAD Modeling.

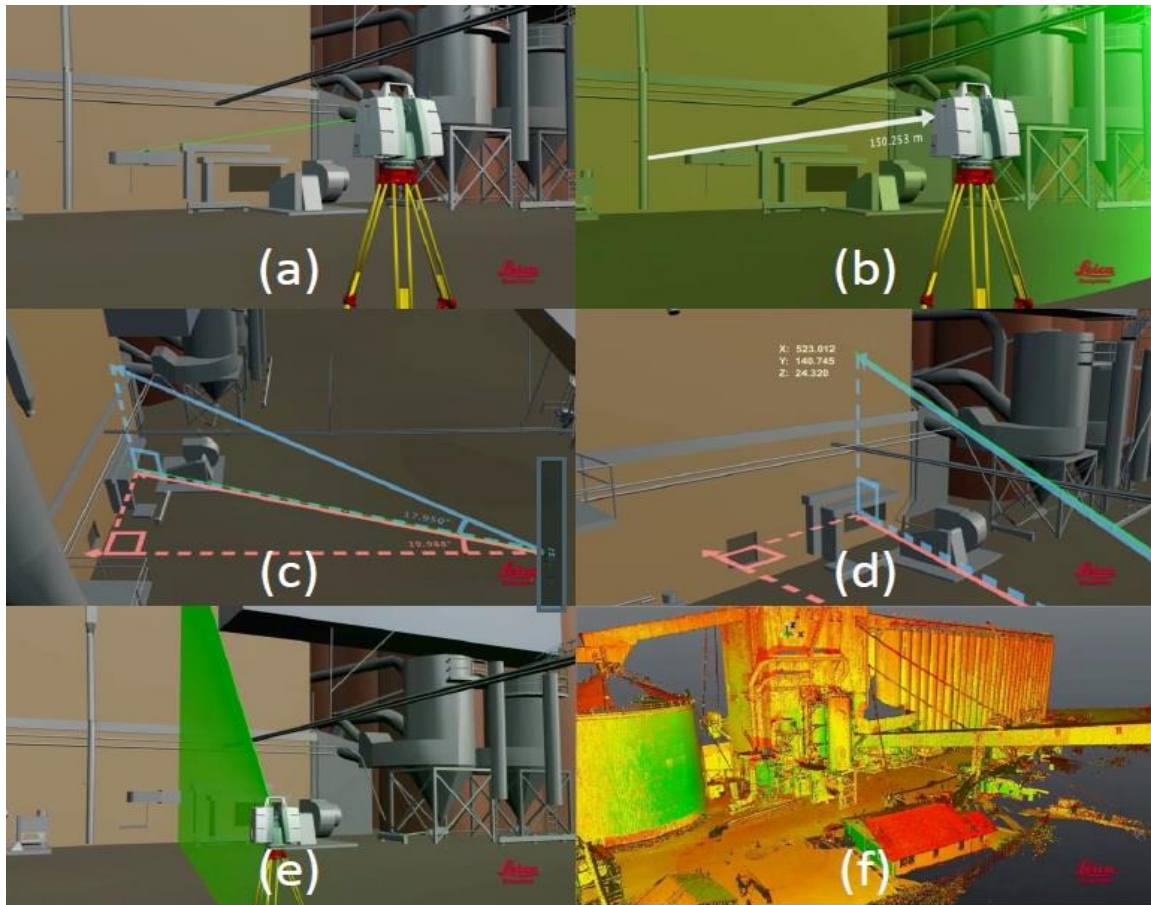


Fig. 2. 3D point cloud generation using laser scanner.

(a) Laser beam striking a surface. (b) Distance measure using the returned signal. (c) Horizontal and vertical angle measurements. (d) Real-world 3D point computation using angle and distance measurements. (e) Sweeping of surface using rotation of scanner and its oscillating mirror (f) Obtained point cloud data containing millions of 3D measurements. (Image courtesy Leica Geosystems).

2D Drawing of Takht-i-Bahi

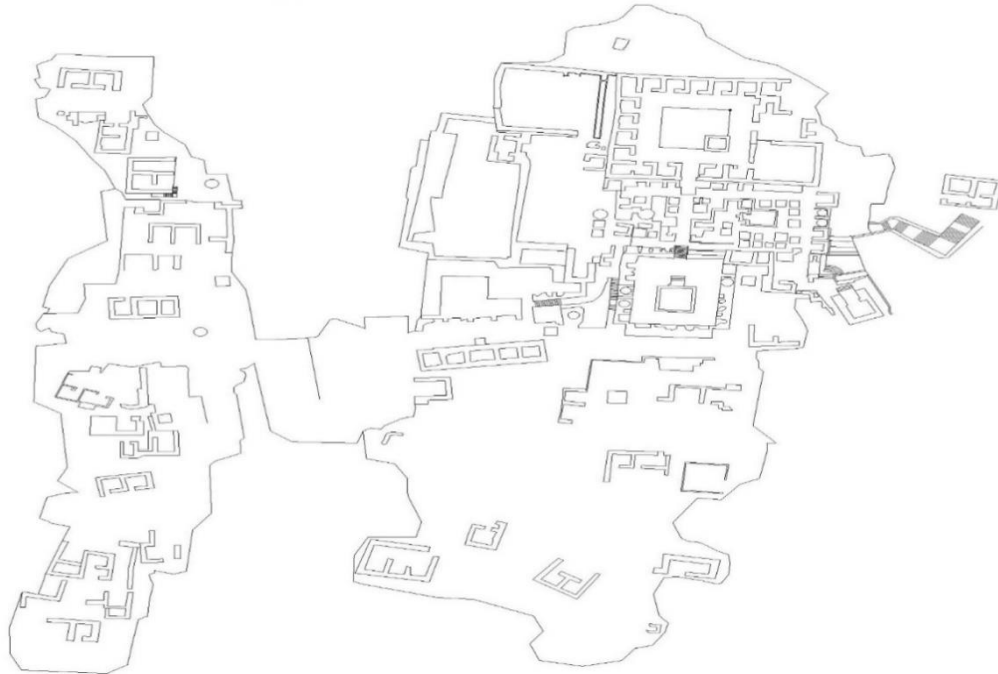


Fig. 3. 2D Drawing of Takht-i-Bahi

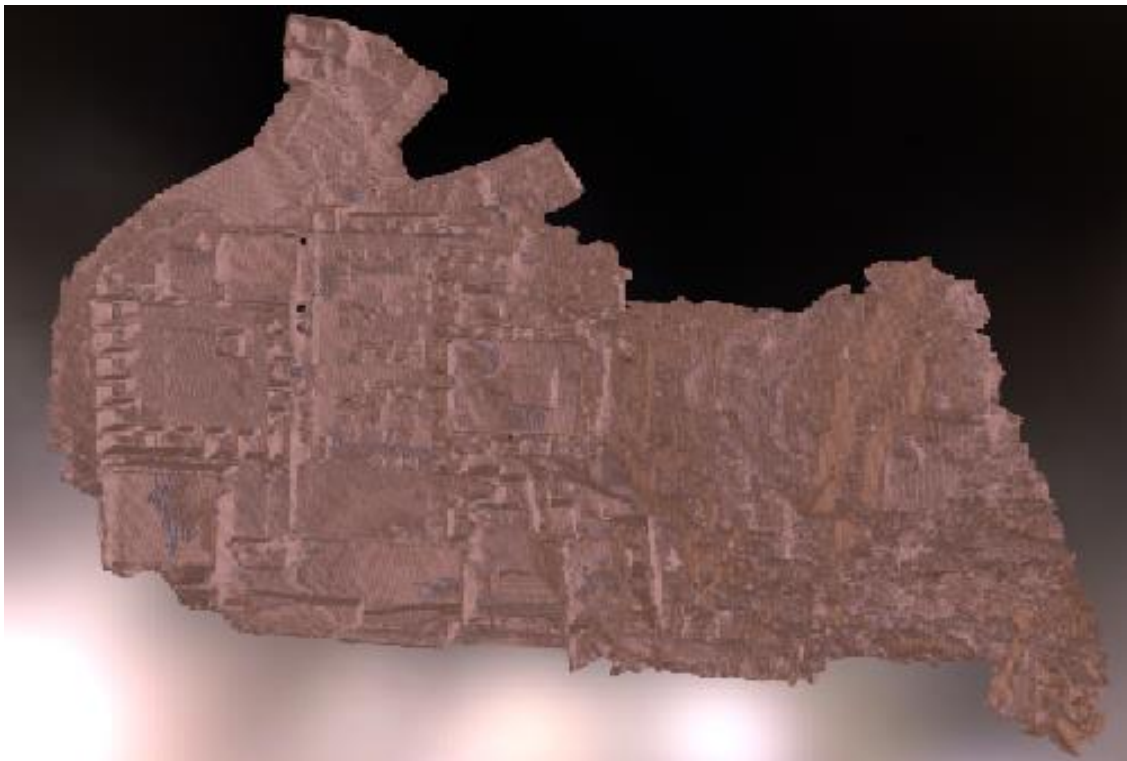


Fig. 4. 3D model of Takht-i-Bahi Heritage Site

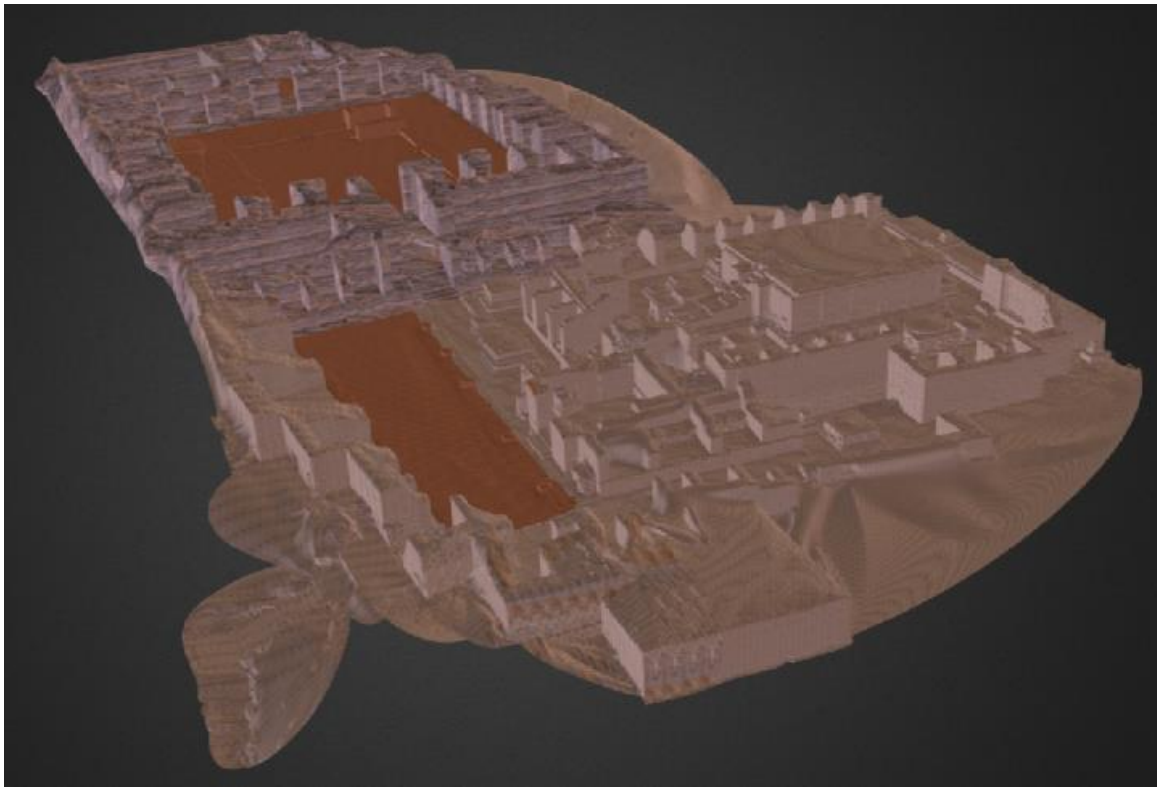


Fig. 5. 3D model of Stupas & Monastery at Julian

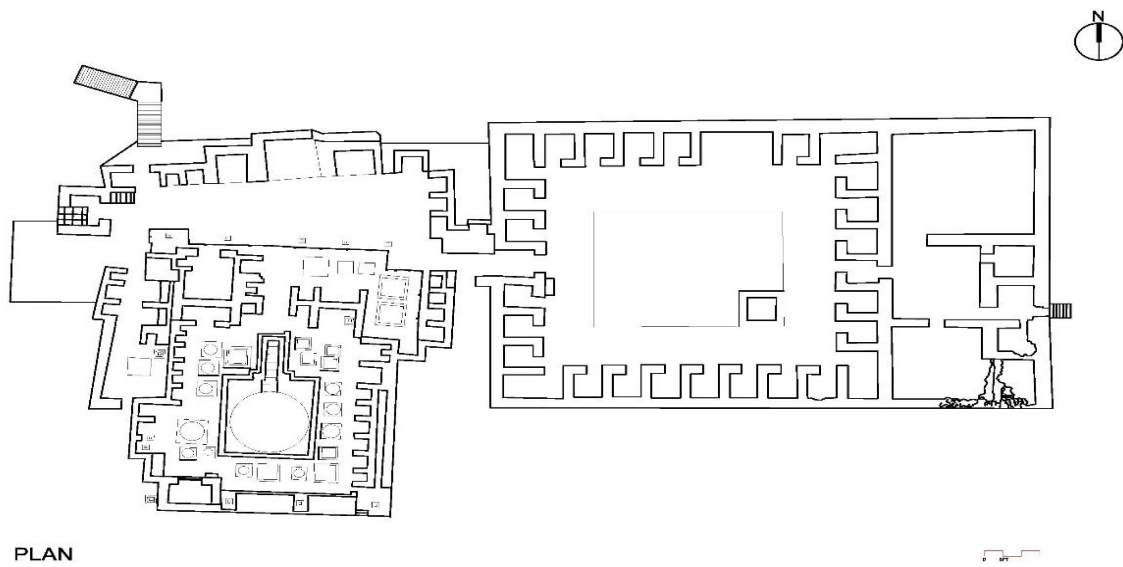


Fig. 6. 2D Drawing of Stupas & Monastery at Julian

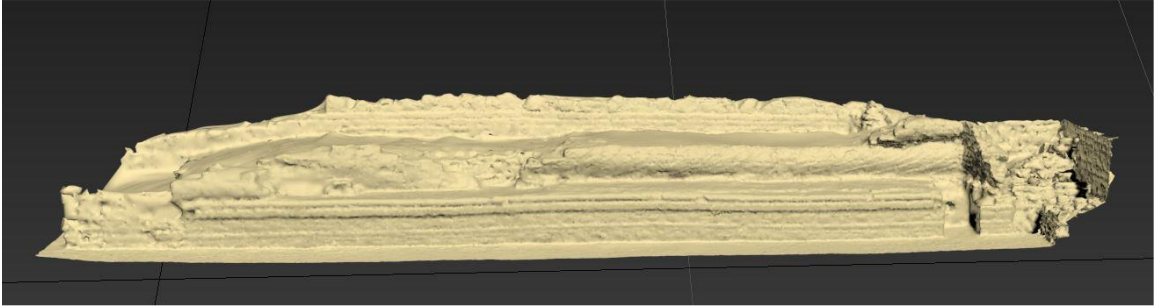


Fig. 7. *Mahaparinirvanascene at Bhamala*)



Fig. 8. *Statue of Bodhisattva Maitreya (Peshawar Museum)*



Fig. 9. Hariti Statue 3D CAD Model & 2D Panoramas and Texturing