



## SCOPE OF DIGITAL TECHNOLOGIES IN URBAN HERITAGE CONSERVATION A CASE OF THE ROCK-CUT CAVES OF MUMBAI

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### **Abstracts:**

*Mumbai's heritage includes a plethora of sites. Amongst these sites, the lesser known are rock-cut caves of Mumbai. Dating to Ancient and Early Medieval Period, these caves are predominantly Buddhist and some are Hindu temples as well. Most well-known is Elephanta caves situated in an island near the coast of Mumbai. The group of rock cut sites include Kanheri and the lesser known Mahakali, Mandapeshwar and Jogeshwari. The conservation of these caves has been a longstanding issue. It has also been grossly neglected. Mumbai's increasing population and urban sprawl encroaches into these heritage monuments. The paper attempts to analyse the historical importance of rock cut caves in Mumbai and also explore digital technologies that can be leveraged to conserve these sites.*

*These two case studies demonstrate unique challenges in the context of heritage conservation in an urban area. Through the analysis of these two sites, the researcher attempts to suggest the usage of digital technologies to conserve and preserve the rock-cut caves of Mumbai.*

**Key Words:** *Collaborative, adaptive, Heritage management, Sustainable , conservation Rock Cut caves, digital technologies in heritage conservation.*

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### **Introduction:**

Rock cut caves depict a diverse imagery. In Kanheri, the presence of a huge Chaitya hall in Cave no.3 is a feature in Theravada sect of Buddhism. Contrastingly, Cave no. 67 depicts the eleven-headed compassionate Bodhisattva named Avalokiteshwara, a deity worshipped in Mahayana sect of Buddhism. The ancient name of Kanheri was Krishnagiri, which could likely be an ode to the Hindu deity Krishna<sup>1</sup>. These examples demonstrate that rock-cut caves possessed religious diversity as Buddhist, Hindu and Jaina elements of art found expression in these caves. These make the caves significant specimens of inter-religious harmony in early India.

The rock-cut caves were an equivalent of modern day monastery. However, their significance surpassed that of being a mere religious monument. In Kanheri, evidences of water harvesting system has been uncovered. The presence of cisterns and tanks show the practice of rainwater harvesting. During drought, this water was channeled to nearby villages to aid them with water shortage.

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<sup>1</sup> Krishnagiri translates to Black Mountain, which could be a reference to the black basalt composition of the cave.



The patronage on the cave walls are also an ode to the significant of the monuments. Analysing the inscriptions, one can uncover the details of various donations. It is important to note that kings, nobles and dynasties were not the only patrons of rock-cut caves. Inscriptions show that merchants, travellers, and even women donated charitably. Some inscriptions are made by foreigners called as Yavanas, a Sanskrit word used for Greeks. These factors demonstrate that ordinary people held immense reverence for rock-cut caves and it was most likely important for them. The connection shared between the rock-cut caves and ordinary people living in olden era is one which increases the significance of these monuments. Thus, due to their historical significance these monuments must be conserved for the future generations.

#### Objectives of study:

- 1) Find out impact of technology on conservation of heritage sites.
- 2) Understand intricacies of using modern technology in heritage management and conservation.
- 3) Analyses potential solution in adapting technology to conserve heritage site, specifically the rock-cut caves of Mumbai
- 4) Provide innovative suggestions to have collaborative and sustainable solution for heritage management with the help of technology.
- 5) Depict the history, significance of rock-cut caves in Mumbai to advocate for its conservation.

#### Methodology:

The study uses a combination of primary and secondary research methodology. Observation method has been used by the researcher to get first-hand information about the condition of the site. Secondary sources such as books, research papers and news articles are used to collect supporting data for the research.

#### Limitation of study:

The present paper only focuses on application of digital technologies to conserve the rock-cut caves in Mumbai. Other rock-cut cave sites outside the vicinity of Mumbai, which are spread across the state of Maharashtra such as Karla Caves, Baja Caves, and Ajanta are not considered in the scope of the study. In this study, the challenges of conservation involved only in two caves, Kanheri and Magathane, are explored in depth.

#### Hypotheses:

- H1. Digital Technologies aid in conservation of rock-cut caves in Mumbai.  
 H0. Digital Technologies do not aid in conservation of rock-cut caves in Mumbai.

#### Brief History of Rock-Cut Caves in Maharashtra

Caves were inhabited by human's right from the pre-historic times as they provided safety and shelter. The rise of asceticism in Early and Medieval Ages in India contributed to the rise of rock-cut cave structures. All of the three major religions of the time — Hinduism, Buddhism and Jainism — emphasised on an ascetic and monastic way of life. In this backdrop developed the architecture phenomenon called the rock-cut caves. Early rock-cut caves in India emerged in eastern part, in modern day region of Bihar and Orissa. During, the Mauryan Empire, rock cut Buddhist caves such as the Barabar caves were abundant in North and Eastern parts of India. The decline and subsequent end of Mauryan Empire around 185 BCE was a blow to Buddhism in northern India. Buddhist monks were persecuted under the rulership of Pushyamitra Shunga the founder of the succeeding Shunga Dynasty. Many



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Buddhist monks migrated to Deccan as the rulers of Deccan were more accommodating of Buddhism. Many early caves in Deccan like Ajanta and Kanheri show continued habitation from this period which is 1st Century BCE. This marks the early phase of rock-cut cave architecture.

Mumbai has shown evidence of settlement since prehistoric times. These caves are made of basalt rock. During ancient times, the surrounding areas of Mumbai were affluent areas. The ports of Kalyan, Sopara and Chaul were trading sites. Rock-cut caves flourished in the nearby areas. Many merchants and travellers frequented diversifying the socio-cultural fabric of the area. There were two reason behind this factor. First, the presence of merchants and affluent communities led to sustained patronage. Secondly, the geographical features such and abundance of basalt was important factor in development of rock cut caves in and around Mumbai.

The inner walls of the caves are adorned with pillars, carvings and sculptures. Occasionally paintings on cave walls have survived too. These caves served as shelters for monk and nuns as well as places of worship. Typically, rock-cut caves found in the region of Maharashtra are Buddhist caves. However, these places were multi-religious as Hindu rock cut temples, such as Ellora and Mandapeshwar have been uncovered in Mumbai too. Jaina rock-cut cave are found across various parts of Deccan India.

Contrary to popular belief, Mumbai was inhabited way before colonial settlements. The art of sculpting a rock-cut cave is an incredible feat. A natural rock, most likely Basalt, is chiseled off to create sculptures. Parts which are not a part of the structure are discarded. It is often believed that sculptors were trained to visualise the motif in a stone and carve out everything that was not a part of it to reveal the sculpture. Initially, sculptors accustomed to wood work worked on these caves, lending the sculptures quintessential features of wooden structures. From an artistic and architectural viewpoint, the rock-cut caves are a marvellous phenomenon and a testament to the skill of ancient builders. These examples demonstrate that rock-cut caves possessed religious diversity as Buddhist, Hindu and Jaina elements of art found expression in these caves. These make the caves significant specimens of inter-religious harmony in early India.

The rock-cut caves were an equivalent of modern day monastery. However, their significance surpassed that of being a mere religious monument. In Kanheri, evidences of water harvesting system has been uncovered. The presence of cisterns and tanks show the practice of rainwater harvesting. During drought, this water was channeled to nearby villages to aid them with water shortage. The patronage on the cave walls are also an ode to the significant of the monuments. Analysing the inscriptions, one can uncover the details of various donations. It is important to note that kings, nobles and dynasties were not the only patrons of rock-cut caves. Inscriptions show that merchants, travellers, and even women donated charitably. Some inscriptions are made by foreigners called as Yavanas, a Sanskrit word used for Greeks.

These factors demonstrate that ordinary people held immense reverence for rock-cut caves and it was most likely important for them. The connection shared between the rock-cut caves and ordinary people living in olden era is one which increases the significance of these monuments.

### Challenges in Conservation

The heritage of Mumbai faces threat from factors like population increase and pollution. The lack of awareness amongst people regarding the importance of heritage sites also lead to deterioration of these sites. It also faces a



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threat from squatters who encroach upon the heritage site. Many sites have their own individual hurdles that arise with aspects to heritage conservation. This can be understood by analysing the two case studies.

### Magathane Caves

Magathane caves are situated in Poisar, an area bordering between Borivali and Kandivali, or Khandolee, which was its ancient name. It shares some similarities with caves in the vicinity. Suraj Pandit mentions about the water cistern in Magathane have a similarity to Kanheri<sup>2</sup>.

The caves lacked protection under Archeological Survey of India. It was occupied by squatters who encroached and made illegal settlements in the premises of the caves. An NGO named Janhit Manch had launched a movement along with a PIL to conserve the caves. A movement to preserve the caves meant removing the encroachers. The illegal dwellings in the cave premises were threatening the heritage value of the caves. Evicting these dwellers would leave many homeless. In legality, it could be argued that the encroachers were at fault and the law had every right to evict them. This course of action could have conserved the caves but would also be inhumane. Heritage conservation conflicted with human rights.

A probable solution could have been found had stakeholders, local civic bodies and local communities could have found a mutual ground. Relocating the people and providing them with compensation for loss of their home could have saved the heritage site. The concept of community involvement in the process of conserving heritage is yet to be practiced in Indian context. The bad situation worsened and became coloured by politics. Two opposing political parties took opposite sides of the case. The conflict became a power struggle. Bureaucracy and misuse of legal loopholes emerged. A lengthy legal battle continued and by the time judgement arrived, the caves had lost all the artistic and heritage importance.

The ASI and its delay in recognising the value of Magathane Caves is the foremost reason for its destruction<sup>3</sup>. ASI, an institute based in Delhi, wears itself thin in administering all of the numerous heritage sites across the country. The lack of maintenance and security measures on the premises of the ASI protected sites also lead to its deterioration. Resources in terms of finances and also skilled professions for undertaking expensive restoration work on monuments is another issue in India. Slow bureaucracy and neglect in the field of heritage conservation become a problem. These issues manifested in Magathane's case.

### Kanheri Caves

Compared to Magathane or even other rock-cut Buddhist caves, Kanheri is better preserved. Its location inside the premises of Sanjay Gandhi National Park has shielded it from pollution and human encroachment. However, it comes with a range of issues.

Major issue in Kanheri is security. Visitors would often complain about the delinquency happening in the surrounding areas. Security is essential for another important reason. Wild animals such as leopards can easily hide amongst these caves making it dangerous for visitors. During monsoon season, the cave slopes get slippery. The site is accident prone and reports deaths. This site is utterly inaccessible for people with disabilities. There is

<sup>2</sup> MMRHCS, Sathye College, Documentation of Caves in MMR. MMRHCS.

<sup>3</sup> Correspondent, HT. "Magathane Caves Could Be Lost". *Hindustan Times*, 2010, <https://www.hindustantimes.com/india/magathane-caves-could-be-lost/story-aa6v5BBVtfmeiFthbXIsIL.html>.



a lack of information on the site. Information regarding the caves, the sculptures or even the translations of inscriptions are missing. Apart from a few caves, others remain closed off for visitors. Conservation methods undertaken on the site must be ecological sensitive.

Similar to Magathane, Kanheri too is slowly encroached by squatters. Settlements of tribals in the locality have started encroaching into the territory of the monument. The group of 109 caves fall under the vicinity of Sanjay Gandhi National Park. However, they cover a vast expanse and fall under three different civic authorities. Kanheri falls under the jurisdiction of the ASI but the area around it falls under the control of Maharashtra Forest Department.

Kanheri Caves has a great potential if principles of sustainable heritage conservation are applied to it. It is essential to conserve Kanheri as its neglect could make it suffer the same fate that Magathane did.

#### **Aid of Digital Technologies in Heritage Conservation**

The Rock-cut caves of Mumbai face unique issues in conservation. Emerging digital technologies provide a great potential to save critical heritage. The application of these technologies to conserve the rock-cut caves of Mumbai. The common issues faced by the caves are the lack of security. The use of cameras and digital security in the vicinity of the site may solve some security issues.

The caves have also faced deterioration. Rock-cut caves due to its antiquity have gone through several irreversible damages due to age, natural calamities such as floods. Manmade factors such as wars, pollution and human encroachment have permanently damaged the site. Reconstruction and conservation of these sites can be an expensive endeavour. In some cases, it can be impossible to reconstruct without the risk of damaging the structure. In such situations, Augmented Reality is useful to give a virtual reconstruction without harming the condition of the site.

In India, one of the biggest problem and the most neglected aspect is education and awareness regarding heritage. Using digital technologies for educational outreach programs in heritage sector can have many benefits. These technologies can make information about the rock-cut caves available in various local languages and thus make it more accessible to people.

Most importantly, the rock-cut caves face a threat from artefact traffickers and thieves, who destroy the sites by cutting off idols from the niches, to sell it. A digital database of all the important historical artefacts found in a vicinity can be useful to law enforcement agencies to track stolen objects. Further, it also makes it easier for ASI to administer

The usage and scope of digital technologies is immense. These technologies would not just conserve the caves but also import knowledge to local communities about its historical and cultural significance.

#### **Conclusion**

The rock-cut caves in Mumbai are deteriorating simply due to neglect and carelessness. The lack of awareness amongst people about the significance of the site and the lack of initiative on part of civic authorities to conserve these monuments has led to their deterioration. A sustainable value-based approach for heritage conservation must be used. Co-ordination between stakeholders, which are local civic authorities, ASI officials, historians and local communities must be ensured.



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Prevention is better than cure, this proverb is most fitting in the context of conserving ancient sites. Protective measures must be enacted in order to prevent another site to suffer the fate that Magathane did. Laws regarding protection of heritage sites must be enforced strictly, to prevent illegal encroachments and constructions.

There is an urgent need for an appropriate heritage conservation policy. This policy must be individualised and localised to cater to regional heritage sites. Separate local authorities must be empowered and delegated the responsibility of maintenance and upkeep of the site. It would ease the burden from ASI which currently has over 3,000 monuments under its jurisdiction. It would also ensure adequate attention to local and smaller monuments which have been neglected. Heritage mapping of monuments is a need. In the year 2016, seven new caves were discovered in Sanjay Gandhi National Park, these caves were older than Kanheri. These discoveries point to the existence of many such ancient sites in Mumbai that have remained unexplored. A planned policy is needed to conserve it. Heritage conservation policy needs a shift from a restorative to a more preventive approach.

Applying digital technologies in heritage conservation projects are expensive. There is also a need for skilled professionals to implement such a scheme. However, given the historical significance of the caves and the challenges of heritage conservation in Mumbai, it becomes important to utilize new technologies to preserve these ancient cave sites across Mumbai.

Thus, the research proves the hypothesis and concludes that investing in utilisation of emerging digital technologies can pay long-term dividends when it comes to conserving the rock-cut caves of Mumbai.

#### References:

- Gaikwad, K., 2010. Patronage and Support: Socio-Cultural Role of Kanheri Caves in the Evolving Interactions. *Ancient Asia*, [online] 2, p.113. Available at: <  
[https://www.researchgate.net/publication/286242206\\_Patronage\\_and\\_Support\\_Socio-Cultural\\_Role\\_of\\_Kanheri\\_Caves\\_in\\_the\\_Evolving\\_Interactions](https://www.researchgate.net/publication/286242206_Patronage_and_Support_Socio-Cultural_Role_of_Kanheri_Caves_in_the_Evolving_Interactions)>
- McClelland, Andrew, et al. "A Values-Based Approach to Heritage Planning: Raising Awareness of the Dark Side of Destruction and Conservation." *The Town Planning Review*, vol. 84, no. 5, Liverpool University Press, 2013, pp. 583–603, <http://www.jstor.org/stable/24579196>.
- MN, Parth, and DNA Webdesk. "How India's Heritage Sites Are Fighting A Losing Battle". *DNA India*, 2015, <https://www.dnaindia.com/analysis/standpoint-how-india-s-heritage-sites-are-fighting-a-losing-battle-2070000>.
- Nasrollahzadeh, Cyrus, "The Sasanian Pahlavi Inscriptions in Kanheri Caves in India". *Language and Linguistics*, 2017.
- O'Connor, Megan et al. "A Case-Study Analysis Of The Values Based Approach And The Leventis Project". *E-Conservation Journal*, 2013, pp. 102-114. *E-Conservation Journal - University Of Evora*, <https://doi.org/10.18236/econs1.201312>.
- Pandit, Suraj. "Water Management System At Kanheri". *Journal Of Asiatic Society Of Mumbai*, 2010.
- Pandit, Suraj. Mumbai Beyond Bombay.





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*Original Research Article*

Rania Aburamadan, Claudia Trillo, Chika Udejaja, Athena Moustaka, Kwasi G.B. Awuah, Busisiwe C.N. Makore, Heritage conservation and digital technologies in Jordan, Digital Applications in Archaeology and Cultural Heritage, Volume 22, 2021, <https://doi.org/10.1016/j.daach.2021.e00197>.

(<https://www.sciencedirect.com/science/article/pii/S2212054821000266>)

Ray, Himanshu Prabha. "Kanheri: The Archaeology Of An Early Buddhist Pilgrimage Centre In Western India". *World Archaeology*, vol 26, no. 1, 1994, pp. 35-46. Informa UK Limited, <https://doi.org/10.1080/00438243.1994.9980259>.

Rees, G., 2021. Buddhism and trade: Interpreting the distribution of rock-cut monasteries in the Western Ghats mountains, India using least-cost paths,. *Archaeological Research in Asi*, [online] Volume 28. Available at: <<https://www.sciencedirect.com/science/article/pii/S235222672100053>>

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