

# Imaging Ancient Images: Challenges in Analogous and Digital Documentation of Geoglyphs on Lateritic Plateaus of Konkan, India

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## ABSTRACT

In a part of western India, rock art (of unknown age) was executed on horizontal lateritic surfaces depicting abstract, human and animal figures. This paper discusses methodological and interpretative challenges confronted during manual and digital documentation attempts at the select sites of Devache Gothane, Ukshi, Devohasol and Barsu. The need for a multidisciplinary approach is highlighted to address the questions - What type of documentation is required for a truthful or accurate representation of geoglyphs for further scientific investigation? And how to integrate ethical practices for knowledge exchange between local communities and academia during documentation processes?

**Keywords:** Geoglyphs, Konkan, Digital Documentation, Photogrammetry, Ethical Practices

## INTRODUCTION

Geoglyphs of the Konkan are relatively recent discoveries. A staggering number of engravings have survived in erosional climatic conditions in the Western Ghat Plateau. Although a few carvings have been known since the 1990s, most of the known carvings were discovered in the last ten years or so by a local group of history and nature enthusiasts<sup>1</sup>. The Directorate of Archaeology and Museums of the Government of Maharashtra later supported and expanded the regional surveys. The first response to these discoveries was to create a manual record of their locations, forms and sizes, and in some cases, the record included photo documentation as well. However, as the subject gained wider attention, the need for accurate records arose for investigation, discussions and dissemination of the available information.

This paper reflects upon the preliminary attempts of digital documentation through photogrammetry for the archetypal carvings at Devache Gothane, Ukshi, Devi Hasol and Barsu (Figure 1). These preliminary attempts aim to derive a documentation methodology for obtaining a digital twin of consistent quality that can provide a foundation for archaeological investigation, condition mapping and heritage management strategies. The paper also attempts to address the standard documentation approach necessary for assessing cultural heritage as outlined by international organisations (De la Torre 2002). Along with that, the paper discusses the challenges in achieving this aim and deliberates upon the need for ethical knowledge exchange practices.

### Geoglyphs of Konkan

Petroglyphs are impressions created by removing part of a rock surface by incising, picking, carving, or abrading (also called bruising and etching). As an important form of rock art, it forms a base for later art traditions. Globally speaking, petroglyphs are spread across all continents and have a large time-span from the Palaeolithic to the Medieval periods. In terms of size, many of them are the largest expressions of human creative art, usually called geoglyphs. The Indian Subcontinent has diverse evidence of rock art in the form of paintings and engravings in rock shelters, caves, open boulders and other rocks. On the lines of its global counterpart, rock art in India is spread from the Palaeolithic to the Colonial period in time and is found from Ladakh in the north to the southern Indian peninsula in the south.

Thus far, evidence of rock art from the coastal areas of India was scanty, as only a few sites from Goa were reported.

Konkan, also known as ‘Aparanta’ in the Historical period (Jogalekar 1996), is the western coastline of India extending in a north-south orientation over 720 km. It is a narrow coastal strip of land between the Arabian Sea to the west and the mountain ranges of the Western Ghats to the east. Geographically this region is traversed by seasonal rivers that drain the heavy monsoonal runoff from the crest of the Western Ghats.

Topographically the terrain is a result of extensive physical and chemical weathering of Deccan Trap continental flood basalt, which erupted about 65 million years ago (Duncan and Pyle 1988). The timings of lateralisation of basalt in the area date back to the Early-Tertiary (high-level laterite) and mid-Tertiary ages (low-level Konkan laterite) (Fox 1923; Widdowson and Cox 1996). Geoglyphs reported from the Konkan region are primarily associated with the low-level Konkan laterite.

1 Nisargyatri Sanstha is a Ratnagiri based organisation involved in discovery of geoglyphs in initial stage.



**Fig. 1** Location of the Konkan region along the western coast of India (inset) and location of select sites in the Ratnagiri region of the Konkan. The total number of sites discovered till today are at least 1642 engravings at 140 sites in 91 villages. *Source:* P Sukumaran, November 2022

The region has a long history of human habitation reflected in the archaeological and historical record in the form of port towns participating in international trade, rock-cut caves, forts, and colonies of foreign powers - factories, castles, and towns. The evidence of prehistoric<sup>2</sup> human habitation in the Konkan is relatively limited (Todd 1932; Marathe 2005; Sankalia 1974). However, there is continuous evidence of human settlement/s throughout the Historical, Mediaeval and modern periods. The recent discovery of rock art sites from Ratnagiri and Sindhudurg Districts of Maharashtra has created curiosity among the scholarly community and public in general across the globe, as these discoveries were highlighted by international electronic and print media. However, methodical documentation remains a major challenge due to issues related to accessibility, the nature of engravings, and the lack of a scientific approach to documentation.

<sup>2</sup> While Palaeolithic evidence in the Konkan zone is not as abundant as in other parts of India, the regional microlithic evidence is comparatively more widespread. Currently, we have no precise knowledge how far back in time these laterite engravings extend and whether they temporally encroach any prehistoric phase(s) at all (e.g. Upper Palaeolithic, Mesolithic, Neolithic). Nonetheless, there is an increasing discourse regarding aversion to the use of the term 'prehistory' due to its origin and association with colonisation in the mid-nineteenth century. The history of prehistory is related to the colonialist process where archaeology was used to promote a certain picture of the past in colonised places (Moro-Abadía 2006). In this paper, the terms prehistory or prehistoric are used to indicate the global period from 3.3 million years ago (beginning of Lower Palaeolithic) to 5000 BCE (end of the Neolithic), during which there was no presence or knowledge of writing. Therefore, this period is generally studied through other evidences including tools made from stone and other materials such as wood, bone and antler, art work, handmade pottery, fossils of various fauna including hominin species and other physical aspects found at such palaeoanthropological sites.

Most of the findings in the region are in the belt that is approximately 220 km in length along the coast and 25 km in width from the coastline. All the engravings are on the horizontal ground surfaces of lateritic plateaus. No such engravings have yet been found on vertical surfaces, in caves or valleys around the plateaus. The total number of sites discovered and reported till today is at least 1642 engravings at 140 sites in 91 villages<sup>3</sup>. A comprehensive survey is yet to be initiated to verify the informally discovered sites.

The dating of these sites remained problematic due to the absence of associated and diagnostic archaeological material as well as the lack of stratified contexts. Therefore, various scholars have casually assigned different dates and periods to these carvings. Gogate and Pradhan (2008) did not mention any date in the absence of culturally associated material. Rane-Kothare (2013) situated these carvings in the Early Historic period, while Dalvi (1990), Ghanekar (1995), and Lalit (2021) respectively assigned them to the Neolithic/prehistoric period. Lad (2018) compared these motifs to those of the Indus Valley Civilisation and thus interpreted them to belong to the protohistoric period.

### ***Categorisation of Geoglyphs***

The presently known engravings are of varied sizes and styles. They can be broadly and provisionally categorised by considering three attributes – engraving style, depiction style and the subject. Although the details of the engraving techniques are not yet known, clear variation can be observed in the depths of the engravings. The range of shallow engravings is between 1.5 to 7 centimetres, and of the deeper engravings is 8 to 25 centimetres or more. However, this understanding of the depth is based on observations as per the present site conditions and currently available data. The presently available research does not inform about the loss of the laterite surface due to erosion over the millennia or centuries. The sub-categories of the engraving style are – direct etching and relief etching. At sites such as Ukshi, the elephant is depicted by directly engraving a continuous line on the surface (Figures 8 and 9D). At sites such as Rundhye, the area around the subject is carved, and the pattern emerges through uncarved surface or through varied relief (Figure 2).



**Fig. 2** Abstract engraving at Rundhye. The pattern emerges through the uncarved surface of the laterite. **Source:** M Mane, December 2021.

<sup>3</sup> As per personal communication with Sudhir Risbud from Nisargayatri Sanstha, Ratnagiri, 2021.



The style of depiction can be sub-categorised into three types: realistic, stylised and abstract. Most faunal depictions are realistic, and in many cases, even the species are identifiable e. g., engravings at Kasheli. The human figures and a few selected animal species are also depicted as highly stylised, e.g. Barsu (Figure 3) and Devache Gothane (Figure 9D). Examples of abstract or geometric forms are also found at many plateaus, e.g. Nivali, Devihasol, and Rundhye.



**Fig. 3** Stylised human figure at Barsu with negative engraving. **Source:** M Mane, December 2022.

The third attribute - the subject of the engravings - can be subcategorised into animal figures, marine creatures, human figures and abstract/geometric patterns. Thus far, any depictions of cultural markers, such as huts, buildings, utensils, weapons, ornaments etc., are either undiscovered or not interpreted as such. Various combinations of the aforementioned categories can also be observed at various sites. Some sites consist of all these categories in proximity to each other, and in rare cases different categories overlap each other through superimposition, e.g., the abstract square pattern at Rundhye partially overlaps with the single-line direct engravings of marine creatures. In such cases, the preliminary assessment is that the more shallow engraving is older, and the deeper engravings would be younger. Distinguishing older and younger engravings when they overlap is relatively straightforward based on depth variation and how one dissects the other, unless the engraved depths of both are relatively equal. In the future, with advanced recording techniques and interpretation methods, the overlapping engravings can provide insights into the relative chronology of engraving techniques, various subjects, styles and general temporal sequences of land use.

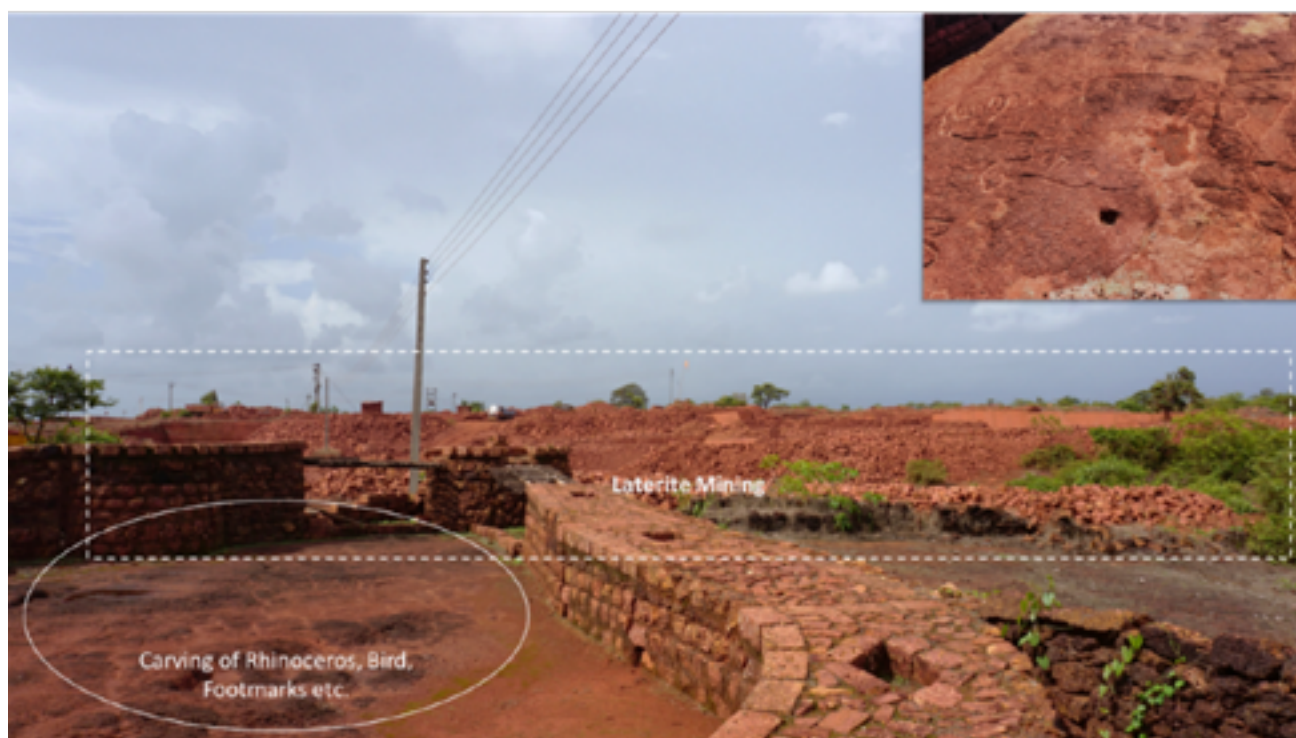
### ***Threats to the Sites***

The engravings are situated on the lateritic plateaus approximately between the altitude of 75 m to 200 m. In the regional Marathi language, these plateaus are called '*sada*', broadly translated as open rocky land at the mountaintop. Traditionally, *sadas* are not used as habitational space and the settlements and hamlets are primarily situated in the valleys and on the slopes of *sadas*. The ecology of lateritic plateaus is an independent subject of research. However, it is to be noted that vegetation type on these plateaus mainly consists of various shrubs, grasses and creepers<sup>4</sup>. Due to the natural setting in which the engravings are located, they face the impact of wind, water and seasonal temperature fluctuations. With this background, the primary threats due to natural elements are as follows.

<sup>4</sup> As per personal conversation with Dr Aparna Watve (Botanist and Ecologist) during exploration of the sada where Barsu, Devache Gothane engravings are situated.

- **Physical damage to the carvings due to the natural cycle of vegetation growth and decay:** The roots and rootlets of grasses and creepers grow through the porous lateritic stone and damage the laterite surfaces in the process.
- **Weathering and erosion due to the impact of wind and water:** Carvings are situated at an altitude where they are directly exposed to the monsoon rains which are generally heavy along the entire western coast of India.
- **Ageing of the laterite:** The ageing process of the laterite and associated geomorphological weathering patterns are yet to be fully understood. The rock consists of high iron content, which oxidises with exposure to the elements (Fox 1923; Widdowson and Cox 1996). This oxidation appears to make the laterite stronger over time. For example, freshly extracted stone blocks in nearby commercial quarries are comparatively softer than the older oxidised blocks (Figures 12 and 13). Hence, how the ageing of laterite affects the carvings requires further investigation through periodic documentation and scientific analysis. During monsoon rains, eroded soil and gravel get deposited in the carved grooves of the geoglyphs. Hence, exposure of the carved surfaces is lesser than the uncarved surface. Due to the difference in exposure period, the ageing and oxidation rate must be different for the carved and uncarved surfaces. However, the natural elements are relatively lesser threats than the modern anthropogenic factors.

The threats due to human actions are inclusive of, but not limited to the extensive plantations for agriculture and horticulture, laterite mining, industrial development, building construction, road construction and expansion, rituals conducted during religious festivals, excessive footfall in the absence of any visitors' management policies, etc. Especially laterite mining is a thriving enterprise in the Konkan region as the plateaus are the prime location for extracting stone blocks. For example, the engravings at Deood and Chave are within only 100 meters of the ongoing mining activities (Figure 4).



**Fig. 4** Engraving of rhinoceros, bird, deer, human footprint and other miscellaneous engravings at Deood. The site is situated within 100 meters of mining activity. **Source:** M Mane, 16 June 2022.



**Fig. 5** The abstract pattern at Nivali is one of the sites known since the 20th century and it was discovered during road construction. The engraving already appears to be heavily eroded and partially lost to road expansion project. **Source:** M Mane, 16 June 2022

The depiction of single-horned rhinoceros is a scientifically significant engraving. The depiction is of realistic style which indicates that the engraving is probably from the period when rhinoceroses existed in the region. Even though the general evidence of the presence of rhinoceros in South Asia extends to Historical periods, there are many unknown facts about their population dynamics and environmental stresses which led to their subsequent extinction (Shebbeare 1953; Jukar et al. 2021). In absence of preserved fossils of such fauna in a basalt and laterite terrain, archaeological depictions of realistic animal figures are one of the primary sources of information for us to decipher the past faunal community from this region. Unfortunately, carvings at Nivali (Figure 5) and Devihasol are already partially lost due to road expansion activities.

### ***Need for Urgent Documentation***

In the Konkan, anthropogenic impact is the primary factor of destruction of archaeological heritage and the geomorphological impact is the secondary factor of destruction. A comprehensive database is needed before carvings are permanently lost due to these factors. Even in case of losses, the record and, wherever possible, a digital rendering can serve as a long-term reference and research archive. The database will allow meaningful comparisons and interpretations from scientific and anthropological perspectives. It can be further used for community archaeology and anthropology, educational and training programs for various age groups, stakeholders and professionals. The database can play a crucial role in creating awareness among stakeholders, landowners, and other relevant authorities and, most notably, in community involvement in site management and conservation strategies.

In reference to the above discussion, urgent documentation is needed for the geoglyphs of Konkan. Documentation tools and methodologies need to be thoughtfully considered as they provide additional insight into assessing values. They inform understanding of the evolution of and use of objects and places, identify original elements and materials, help interpret artists'/creators' "original intent," and relate changes to intrinsic factors (design, material composition, and so on) and to extrinsic factors



(environment, human intervention or lack thereof, and so on) (De la Torre 2002). Article 4 of the ICOMOS Charter for Protection and Management of Archaeological Heritage also delineates database creation as an essential working tool for scientific study, research, and developing protection and management strategies (ICOMOS 2011).

## **Principles of Documentation**

The documentation of the geoglyphs should be based on the principles of archaeological investigation and heritage conservation. Systematic and comprehensive documentation enables better analysis and interpretation of the historical and archaeological resources and sheds light on the processes of development and decay. A poorly understood resource cannot be conserved, protected, or managed effectively (Adams 2016).

### ***Geo-Archaeological Investigation***

The priority level should be defined for archaeological and geological investigation at the planning stage. The documentation should capture the physical quality of the engraving, natural visual clarity, type and texture of rock, spatial parameters, elevation, slope and climatic parameters. Most importantly, the methods should be non-intrusive. Minimal cleaning of the site should be undertaken for the purpose of documentation. It is advisable to collect relevant data on the natural state of the engraving at the time of its discovery.

In order to capture the accurate colours and texture of the surface, trial documentation should be conducted in different light conditions, and then an appropriate time of day for documentation should be chosen based on level of the likeness of the outcome. A similar principle should be followed for selecting the angle and height from which data is collected; the depth, width and spread of the engravings should dictate these parameters. Also, it is necessary to document the engravings during different seasons to understand the annual cycle of the changes in vegetation growth, temperature, exposure values and seasonal colour changes, if any.

Documentation for geo-archaeological investigation should be inclusive of but not limited to the attributes such as size, subject matter, orientation in reference to the north, level of richness, site versus site cluster, amount of sediment, vegetation, presence of artefacts, proximity to human activities, natural impacts such as trampling and natural resources such as streams, etc. It will also be instructive and fruitful in the long run to also document and analyse ‘ambiguous’ carvings on the landscape to distinguish between natural weathering patterns and eroded or faded engravings which may be significantly older than the ones currently known.

### ***Documentation for Conservation***

From the conservation perspective, the foremost principle of documentation is to record as per the existing conditions with precision (Letellier et al. 2015). The cultural sites are documented along with the context in which they are situated. The principle of ‘whole to parts’ is followed as a rule of thumb in order to avoid gaps and inconsistencies in the data collection. The emphasis being on precision and accuracy. It is highly recommended to notify the margin of error in the data collected and the processed outcome. All the signs of the original creation and evolution over the period of existence should be documented. Equal weightage should be given to all the archaeological periods without any biases. It is advised in the published charters and guidelines on the subject of documentation to identify the main



areas in which understanding or information is lacking (*ICOMOS* 1996; *ICOMOS* 2011; Drury 2008; Letellier et al. 2015). Periodic updating of the records is also recommended for general evaluation and enhancement of preservation strategies. The documentation should highlight the potential threats in the current situation, in the near future and in the long term.

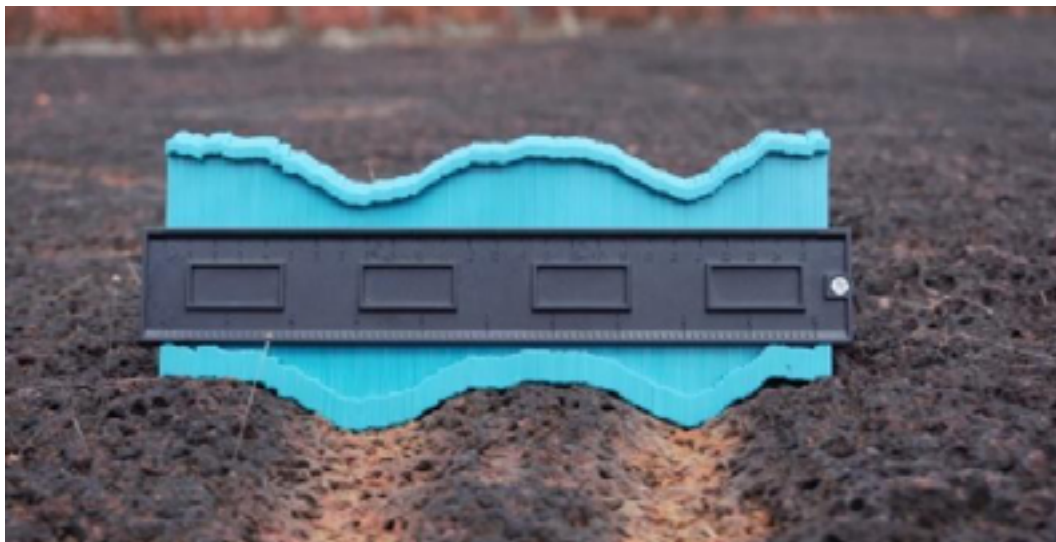
### ***Techniques of Documentation***

Numerous analogous and digital methods and tools are available for the documentation of geoglyphs. Written descriptions, proportionate sketches based on visual observations and hand-drawn measured drawings are being created by the discoverers, researchers and students of geography, environmental studies and history. The analogous documentation of select sites is available with local organisations and not yet widely published for consumption by the research fraternity. Digital methods such as photography and videography are increasingly used for many accessible and most visited sites, for example, Devihasol, Deod, Ukshi etc. GIS mapping and drone mapping were initiated in 2018 for 17 selected sites by the Tourism Department of Maharashtra in with Directorate of Archaeology and Museums of the State government<sup>5</sup>. The authors of this paper and the associated institutions have been exploring the possibility of using advanced digital techniques - photogrammetry and 3D LiDAR Scanning since 2021. The aim is to integrate the 3D models derived from the digital tools with GIS for further geospatial analysis. Such technical documentation will enable us to create a virtual platform with realistic and natural ‘feel’ of the geoglyphs.



**Fig. 6** Manual documentation of shallow human figure of approximately 1.5 cm depth at Devache Gothane by the students of M Sc Ecology, Society and Sustainable development MIT WPU, Kothrud in Pune under the guidance of Dr Aparna Watve and Mrudula Mane. Care was taken to wear appropriate footwear that will not have any abrasive effect on the engraved surface. **Source:** Photo by M Mane, 26 December 2021

<sup>5</sup> The survey was undertaken by Tejaswini Aphale Associates, Pune on behalf of the Tourism Department and the Directorate. The drone mapping outcome of this survey helped understand the potential and limitation of the technique for documentation of the engravings.



**Fig. 7** Measuring the depth of engraving at Ukshi with a contour gauge replicator made of plastic. Metal instruments are not used to avoid abrasion to the engravings **Source:** Photo by M Mane, May 2022.



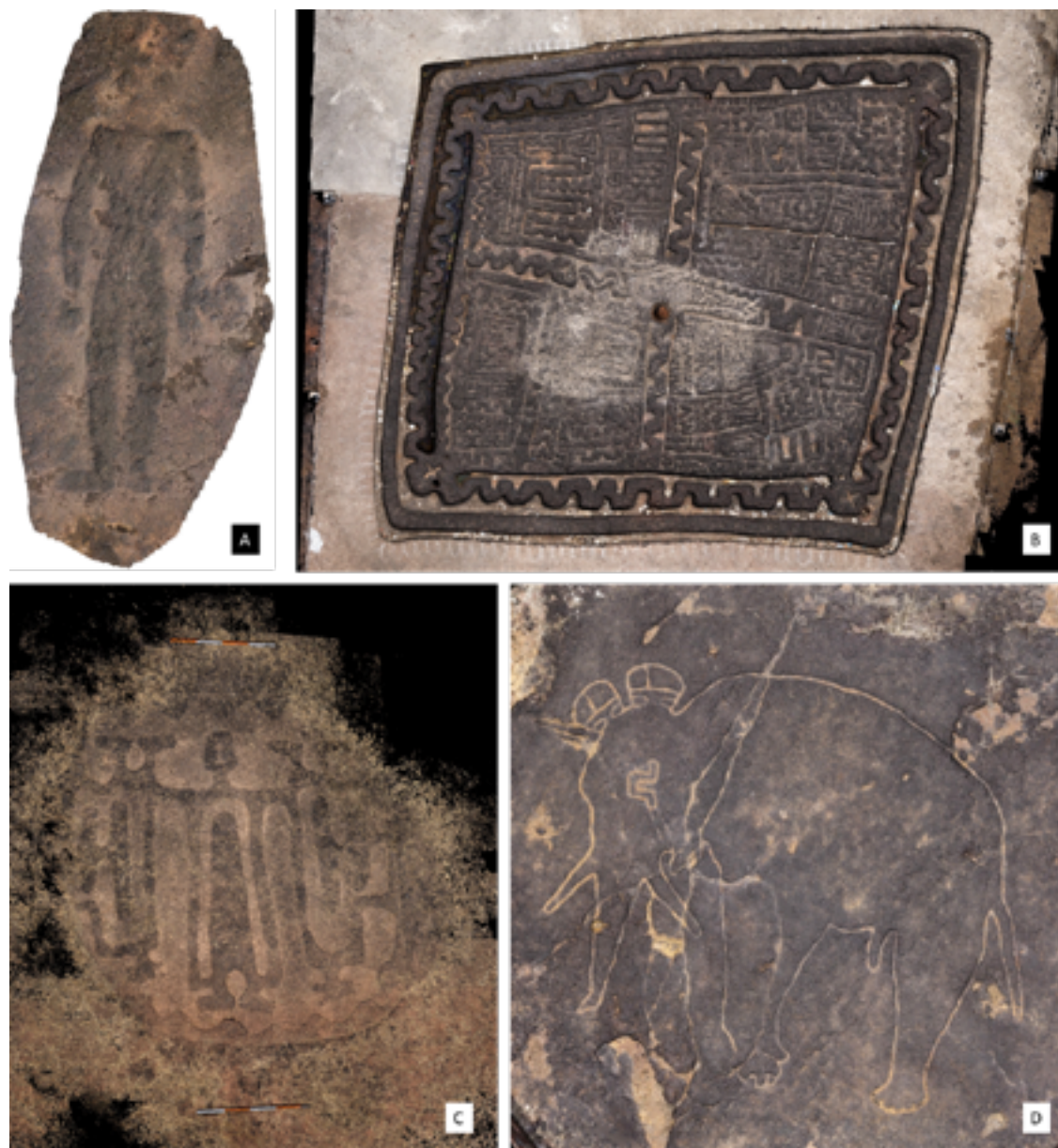
**Fig. 8** Location of the point where the contour gauge replicator was positioned in Fig 7. The depth should be measured at periodic intervals, and the point at which the depth is measured should be mapped to understand the variations. **Source:** Photo by M Mane, May 2022.

### *Examples of Photogrammetric Documentation*

Photogrammetric documentation has been conducted for the engravings at Devache Gothane, Ukshi, Devihasol and Barsu (Figure 9). As mentioned in previous sections, these documentation trials are conducted to derive a methodology for obtaining a digital replica of consistent quality. The engravings at all four sites are of different categories regarding the depth of engraving, style and subject. It is also to be noted that they are situated on different lateritic plateaus and hence, have different densities/porosities of the lateritic surface. The plateau of Devachhe Gothane is also known for the phenomenon of magnetic deflection<sup>6</sup> and some carvings may have been made in specific locations in relation to that knowledge in the past; this possibility is still being investigated by us.

<sup>6</sup> The magnetic compass does not show the north direction at this site. Nisargyatri team had experimented with keeping multiple compasses simultaneously at the same spot. All the compasses indicated different directions. The phenomenon needs further scientific documentation and investigation.





**Fig. 9** Orthoimages (of different scales) extracted from the 3D photogrammetric model processed in Agisoft Metashape. (A) Human figure at Devache Gothane. (B) Abstract Square at Devihasol (C) Stylised human figure at Barsu (D) Elephant at Ukshi. **Source:** Data captured and processed by M Mane.

	Site	Engraving Size LxB	Average Depth	No of photos processed	No of points generated	Quality of dens cloud
A	Devache Gothane	2.7m x 1.3m	2 cm	94	49,482,696	Medium
B	Devihasol	7 m x 8 m	6 to 10 cm	749	61,736,777	High
C	Barsu	4 m x 3.6 m	3 cm	178	99,403,099	Ultra High
D	Ukshi	5.2 m x 6.7 m	5 cm	349	37,937,865	Medium

**Table 1** Information about the site and the photogrammetric data

The stone surface of Devache Gothane is visibly different from the other three sites. It is also one of the shallowest engravings, with depths varying between only 1.5 to 2.0 cm. The carving at Ukshi is 5 to 6 cm deep. It was observed that the depth and profile of the engraving remained consistent. The average width is 6 to 7 cm, varying at corners and turns. Devihasol is one of the deepest engravings known thus far: at the edges of the abstract square pattern, it is more than 10 cm deep. The stylised human figure at Barsu is similar to Devache Gothane in terms of depth. However, the one at Devache Gothane is a relief engraving, and Barsu is a combination of direct and relief engraving. The spatial spread of all the sites also differs. Hence, the number of photos taken for each site is also different.

Table 1 provides comparative information about data collection and processing at the concerned sites. Photos were taken in direct sunlight at all sites between 11:00 am and 2:00 pm. The afternoon time offers minimum shadows and contrast. Photographs were taken from close range in five sets looking downwards (perpendicular to the laterite surface), at approximately 45° from four directions, to capture the depth of the engraving.

Devache Gothane and Barsu were documented during the winter season, while Devihasol and Ukshi were documented in the summer. Any special cleaning activity was not undertaken for the purpose of documentation. However, the local organisation conducts annual cleaning after monsoon season to improve visibility for tourists. The Devihasol engraving is associated with the temple of Arya Durga and is regularly visited by devotees. Due to this, it is maintained by the temple trust, and therefore heavy vegetation growth is never observed at this site.

### ***Limitations and Challenges in Documentation***

#### ***Data Collection***

The primary challenge in initiating the documentation process of geoglyphs is locating and accessing the site. The plateau undergoes physical changes through three seasonal phases annually – wet surfaces with moss, creepers and grass in monsoon; dry but overgrown grass in winter and dead or burnt vegetation on arid surfaces in summer. The sites portray different visual appearances in all three seasons and hence, locating them without the support of accurate GPS data is a challenge.

The first two weeks of the monsoon season (usually June) are ideal for locating and basic photographic documentation of the sites. The vegetation growth is not too heavy; the accumulated soil is naturally washed away with surface runoff; hence manual cleaning is not required, and reflectance due to slight water accumulation improves the visibility of the engravings (Figures 10 and 11). However, data can not be collected for the purpose of digital documentation during the monsoon season. Digital techniques are not effective for reflective surfaces and also, such data can give a false impression of the actual depths.

The engravings are often found in clusters situated across the plateaus. Hence, it is challenging to define the geographic and spatial extent of individual engravings and identify site boundaries for comprehensive documentation. This may indirectly affect the interpretation if the sites are not spatially compared in reference to each other.

Seasonal variations, vegetation growth, and soil accumulation are some of the other hindrances to collecting data and generating models of consistent quality. On the one hand, soil accumulation can



give a misleading impression of the depth of the engraving, and on the other hand, manual cleaning of the site can contribute to edge damage on the engravings.

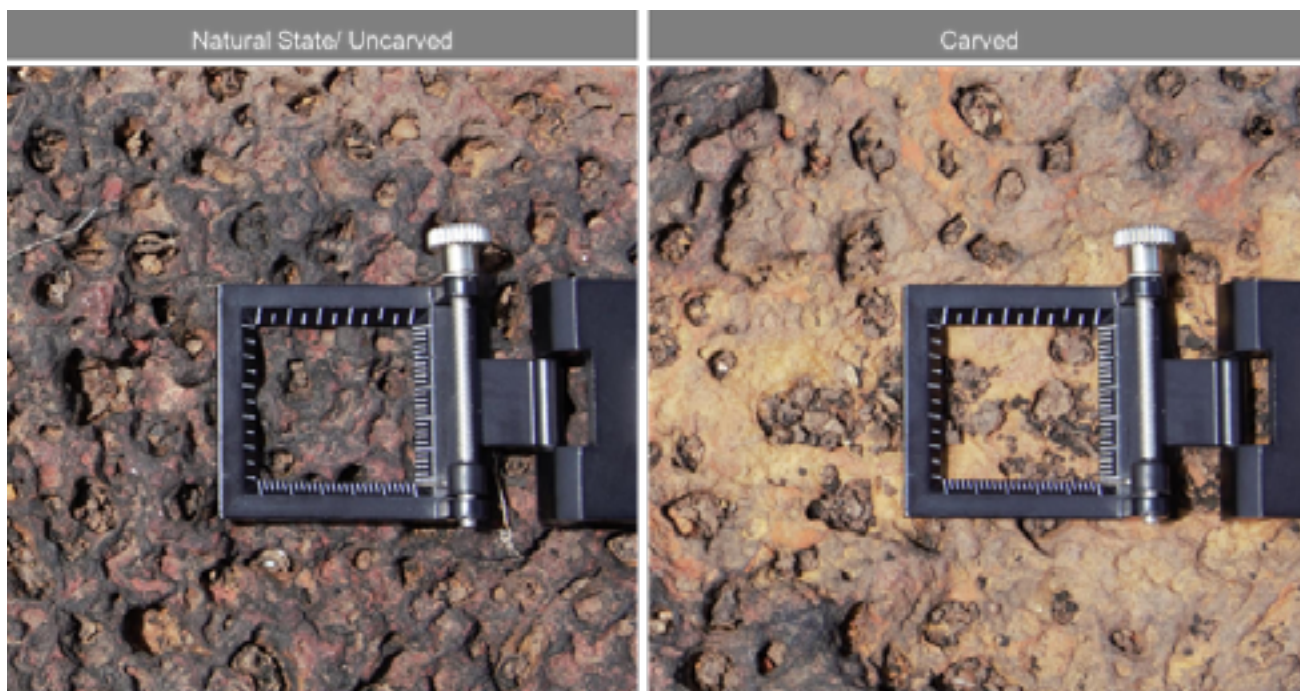


**Fig. 10** Engraving from the neighbouring cluster at Pochari. This particular engraving was not spotted during summer. It was spotted due to accumulated water. **Source:** Photo by M Mane, 24 June 2022



**Fig. 11** Increased visibility of the engraving at Ukshi due to water accumulation. **Source:** Photo by M Mane, 24 June 2022

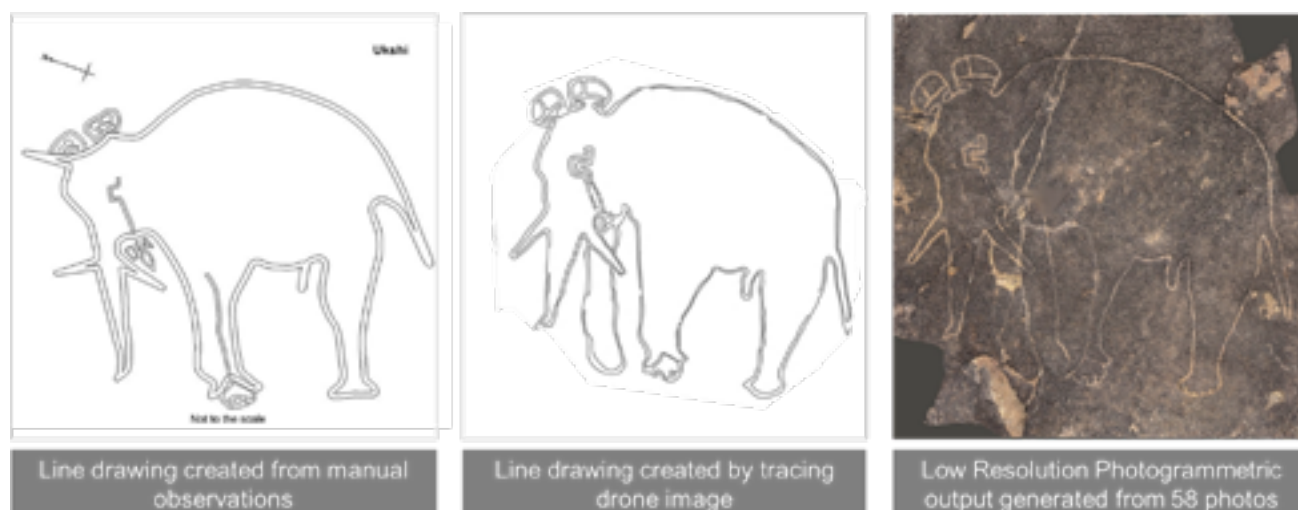




**Fig. 12** Texture, density and colour of the laterite surface at Ukshi for 2.5 sq. cm. *Source:* Photo by M Mane, 24 May 2022



**Fig. 13** Surface of newly excavated laterite block from the Ukshi region.



**Fig. 14** Comparison of three documentation methods. **Source:** Manual drawing by Nisargyatri Sanstha (2017), Drawing traced from drone image by the Directorate of Archaeology and Museums (2019); Photogrammetric output by M Mane (2022)

### *Data Processing*

The foremost challenge faced in processing the photogrammetric model was due to the texture of the lateritic surface. Laterite is a highly porous rock (Figure 12); hence the surface area is substantially more than any other rock, such as sandstone or granite. During the photogrammetric process, the porosity leads to the generation of dense point cloud data with gaps or missing information. This also causes issues in navigating through the 3D model. The model size becomes unmanageable despite the small size of the engraving and high-configuration computer system. This issue may partially affect capturing the true colour of the surface. It is to be noted that in the case of laterite, colour indicates the level of oxidation and strength. Hence, the accuracy in interpretation may get hampered due to this processing limitation.

Another challenge is that if an ultra-high-quality model is not generated, it is difficult to distinguish between the lines formed due to natural erosion and human creations. This is a peculiar problem for heavily weathered sites such as Niwali. The drawing traced from a drone image for Ukshi exemplifies the confusion between natural and human lines (Figure 14).

## **Knowledge Exchange and Ethical Practices**

### *Acknowledging local knowledge*

With the transition from analogous to digital documentation methods, it is essential to redefine knowledge exchange practices. ICCROM's guidance note on people-centred approaches to the conservation of cultural heritage highlights the importance of strengthening the ability of communities connected to the heritage to participate meaningfully in the decision-making processes of its conservation and management (Court and Wijesuriya 2015). In the case of the Konkan geoglyphs, community involvement is generally visible from the stage of site identification and documentation. The majority of the sites are discovered by the locals through their inherent understanding of the terrain, oral history and observation skills. The locals initiated safeguarding and manual documentation of selected sites with support from *grampanchayat* (village administration), state department of archaeology and various subject experts associated with the region. The local communities that are already involved



may be able to address the question of documenting numerous sites, quickly, with least damage to sites, if better tools are available to them. The aim is to develop future training programs for the communities to equip them with digital documentation methods. The objective of the training programs will be to design and develop ways for knowledge exchange between local communities and researchers while reducing the digital divide.

### ***Respecting Cultural Continuity***

Sites such as Devihasol continue to hold significance in present-day cultural practices. The geoglyph here is used as a site of ritualistic performances during annual religious gatherings (Figure 15). The rituals are performed at midnight on the eighth day of the ninth month (*Margshirsh*) as per the Hindu calendar, and communities from three villages come together to reiterate the traditional practices. The diaspora gathers for this annual event to reconnect with their kith and kins. The deity's procession traces the age-old route from the three neighbouring villages and rests at the geoglyph before returning to the temple. Documenting these connections and respecting cultural continuity is also a necessity during research. Due to the religious association, a certain code of conduct was expected from us during documentation activities. For instance, it is not allowed to walk on the carved pattern with any footwear, which poses a challenge to work on a highly textured rocky surface during summer afternoons. In short, methodologies need to be developed by taking cognisance of the cultural associations and religious values and sentiments.

### ***4.3 Documenting the Connections***

The outcomes of the digital documentation create a digital twin for experts to observe the site beyond the life of the place itself, and they create curiosity amongst communities due to the closeness to their reality. It, however, also creates a digital divide due to issues of accessibility of technology and skills. Digital documentation essentially records the heritage site as per its existing condition. Its layered relationship to traditional knowledge systems and aspirations of people for heritage futures are not necessarily recorded. A general reflection on digital documentation processes indicates the need to introduce participatory approaches in the processes of digital documentation. This may enable the new technologies to become opportunities for engagement rather than tools that create multi-faceted divides.<sup>7</sup>



**Fig. 15** Annual gathering near the Arya Durga temple at the Devihasol site. The designated representatives from different communities are waiting to receive the deity's procession at the geoglyph. The temple is surrounded by numerous engravings, and it is believed to be built on the geoglyph which depicted human footmarks. The square abstract pattern shown here is spatially used for ritualistic performances during an annual festival that takes place on the eighth day of the ninth month (*Margshirsh*) as per the Hindu calendar. **Source:** Photo by M Mane with Dr Aparna Watve, 26 December 2021

<sup>7</sup> IISER Mohali, CHC-CRDF and Charotar University have received a research grant under scheme of Science and Heritage Research Initiative (SHRI) by Department of Technology of Government of India for Digital preservation, risk assessment, spatial simulation & chronological interpretation of rock art heritage using multiple technologies.





**Fig. 16** A community representative in traditional attire is awaiting to perform the annual rituals at the geoglyph at Devihasol. **Source:** Photo by M Mane with Dr Aparna Watve, 26 December 2021

## Way forward

- Developing a combination of methods that can fulfil the requirements of archaeological investigation and provide essential data for informed preservation and scientific interpretation.
- Digital data can be effectively used for heritage management. The dynamic nature of the data allows periodic updating by various stakeholders simultaneously.
- Devising methods to use the digital documentation process as a tool to connect diverse knowledge systems (traditional and non-traditional) for effective preservation and dissemination
- Developing training programs for community capacity building through institutional collaborations.

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