Project on Replication of rock art of Chaturbhujnath Nala in India

COGNITIVE, TECHNOLOGICAL AND CULTURAL INTERFACE OF ROCK ART

Chairpersons:

Giriraj Kumar
Secretary General, Rock Art Society of India
Email: giririajrasi.india@gmail.com

Ram Krishna
Research Scholar, DEI, Dayalbagh, Agra, India
Email: ramkrishna.gem@gmail.com

Rationale

Rock art, a global phenomenon, forms the archaic visual manifestations of humankind on bare surface of rocks, which have survived the vagaries of time. Other archaic forms of human cultural activities such as dance, music, songs, thoughts, ideas, language, etc. could not survive. Therefore, rock art is the only source of the many aspects of human creativity and cultural activities which has survived and available to us. Hence, rock art is a very important source for understanding the cognitive, technological and cultural development of the early humans through time. This awareness has become very significant at present for us to know about ourselves, our identity as humans, our relationship with nature and our accountability for sustaining the natural and cultural environment. Your valuable contributions based on scientific approach (which is refutable) are invited in this Symposium. Some of the issues for discussion and presentations are as follows:

1. Rock art replication and understanding the cognitive, technological and cultural development.
2. Inter and intraregional studies for understanding the diversities and universalities in the development of human behaviour and style of living.
3. Role of human cognitive and technological development in the change of socio-economic and cultural development.
4. Epistemology of rock art.
5. Rock art and human nature of adventure and creativity.
6. Rock art message to sustain the Nature for our very existence.
7. Any other topic related with the spirit of the Symposium.

Replication of rock paintings at Chaturbhujnath Nala on Bhanpura plateau in Chambal Valley, India - Part 1

Project Introduction

Giriraj Kumar *

Summary

Chaturbhujnath Nala is a magnificent rock art gallery in India. It has more than 2500 compositions of rock art made by additive technique by using mineral colours. The site is a drift Valley, located in the Gandhisagar Wildlife Sanctuary in Chambal Valley, Bhanpura region, district Mandsaur, in Madhya Pradesh. Replication is to understand the preproduction and production processes of the creation of rock art compositions, such as conceptualisation of an idea and the theme of the composition, form, style and technique of its execution, planning and strategy to execute it such as colour to be used, exploration of the earthen pigments, its processing and technique to obtain colour from it, making proper brush(es) to execute it, selection of the site and location of its execution and the process of the execution of the conceptualised idea. However, understanding the objective of the creation of rock art composition is a tedious task. Thus, replication of rock art is to understand the cognitive, technological and cultural development of the early man. It is to explore the epistemology of cognition and the processes of the technological and cultural development. The results so obtained can be checked by anyone at any time, hence the method is scientific. It is a major project involving a lot of exercise in the rock art studio, field work, laboratory analysis and literature review, which will take many years to complete. However, we are presenting here the preliminary results of our initial work carried out in the first half of the year 2021, in the peak time of pandemic Covid-19 in India. It is a primary work to be followed by more extensive research in the field and laboratory in the coming time. The present paper gives a brief introduction of the project. Other aspects of our practical work will be discussed in the following five papers by our team.

Keywords: Replication, Rock paintings, Chaturbhujnath Nala- India- Cognitive and Cultural development.

Riassunto (Prima parte: introduzine al progetto)

Chaturbhujnath Nala, in India, è una magnifica galleria di arte rupestre. Ha più di 2500 pitture rupestri realizzate utilizzando colori minerali. Il sito si trova nel Gandhisagar Wildlife Sanctuary nella valle di Chambal, nella regione di Bhanpura, nel distretto di Mandsaur, nel Madhya Pradesh. Cercare di replicare queste pitture significa comprendere tutti quei processi di pre-produzione e produzione che hanno portato alla loro composizione: la concettualizzazione di un'idea e il tema; la forma, lo stile e la tecnica della sua esecuzione; la pianificazione e la strategia per eseguirla; la scelta del colore, la sua fabbricazione a partire dai pigmenti naturali reperibili sul territorio e la loro lavorazione; la realizzazione di pennelli appropriati; la selezione del sito e dellaposizione dove eseguire l'idea concettualizzata. Replicare un'opera rupestre significa comprendere lo sviluppo cognitivo, tecnologico e culturale dell'uomo primitivo. Si tratta di esplorare l'epistemologia della cognizione e i processi di sviluppo tecnologico e culturale. I risultati da noi ottenuti possono essere verificati da chiunque in qualsiasi momento, quindi il metodo è scientifico. Si tratta di un grande progetto che ha richiesto molti approfondimenti nello studio dell'arte rupestre, lavoro sul campo, analisi di laboratorio e revisione della letteratura. Abbiamo ancora molto da fare e lo studio richiederà ancora molti anni per essere completato. Tuttavia, presentiamo qui i risultati preliminari del lavoro, svoltosi nella prima metà del 2021, all'apice della pandemia di Covid-19 in India. Si tratta di un lavoro fondamentale a cui faranno seguito, in futuro, ricerche più approfondite sul campo e in laboratorio. Questo articolo fornisce una breve introduzione al progetto. Alcuni aspetti, più pratici, saranno approfonditi e descritti negli articoli seguenti redatti dal nostro team.

Parole chiave: Replica, pitture rupestri, Chaturbhujnath Nala, India, sviluppo cognitivo e culturale.

1. Rationale

Rock art is conscious externalisation of the perceived reality by the early humans on the bare surface of rock. It is found in the rockshelters, caves and on the rocks in the open. Rock art is a global phenomenon and is found in all the continents except Antarctica. It forms the archaic visual manifestations of humankind, the only creative source which has survived the vagaries of time, other creative forms like dance, music, language, etc could not survive. Hence, rock art is the only source for the study of the constructs of reality of early-human. If studied scientifically, it is capable of shedding light on the tangible and intangible aspects of the cultural heritage we have inherited from our early ancestors. This awareness is very significant to know about ourselves, our identity as humans, our relationship with nature, our capabilities and accountability for sustaining the natural and cultural environment.

Replication of rock art is one of the scientific methods for such kind of study, especially to understand the cognitive, technological and cultural development of early man. Replication of rock paintings of Chaturbhujnath Nala is the first project of its kind in India. It

* Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: girirajrasi.india@gmail.com

is to understand the preproduction and production processes of the creation of rock art compositions by additive technique.
We have successfully carried out the replication of early cupules of Daraki-Chattan Cave (DC), on hard quartzite rock (Krishna and Kumar 2012a, 2012b, 2012c, 2016; Kumar and Krishna 2014). DC is an important Palaeolithic petroglyph site in the river Chambal basin in Bhanpura region in India. It gave us confidence to undertake the present project.

2. Objectives

The main objectives of the project are to understand

1. The knowledge and wisdom of the authors of rock art at Chaturbhujnath Nala
2. Tools, material and technical specifications used, skills employed, reasons for selection of the spot and the site for creating specific compositions.
3. Intelligence and cultural impulses working behind the compositions.
4. The concept of the composition.
5. The Cognitive, Technological and Cultural development of its authors in different periods.

3. Methodology

To achieve the desired objectives the following methodology was adopted:

3.1 Literature review

Literature review has been made to update ourselves about the replication of the rock paintings in India and in the overseas countries, methods and techniques used and difficulties faced. The process will continue for more updates.

3.2 Pre-Production preparations, processes and planning

For the initial work we selected six Mesolithic Stone Age compositions (Broad Group I) and five Chariots from the cattle domestication mode of life and thought process (Broad Group II). The criteria of the selection of the compositions were that they must be clear to study, from which one could have the basic understanding of the form, proportions, quality of strokes, brush movement and observe other details.

3.3 Rock painting production processes, tangible and if possible intangible

A thorough study of the composition to be replicated, selection of the replication site, collection of the material for making brushes, preparation of the brushes to be used, finding the source and collection of the Iron Oxide colour pigments, process to prepare the colour from the pigment nodules, experiment with colour binder, preparation of colour chart, selection of the spot to the possible similar location to its original site, experience so obtained and observations made.

3.4 Recording and discussion

Photographic documentation of the ongoing replication process and the composition so produced, discussion on the experience and observations made, notes taken, etc.

3.5 Concluding remarks

Scope of the project

From the methodology to be followed one can understand that the scope of the project is vast and multidisciplinary. It will involve the understanding of the fundamentals of art and design, practical replication of the rock art compositions, use of science and technology, SEM and Portable field microscopes, other portable equipment and machines. These will be used at the site without interfering with rock art. The field work will be followed by laboratory and studio work, tangible and intangible study of the rock art production by the rock art scientists, technocrats, designers, artists and social scientists.
The present work is an initial phase of the preliminary exploratory work.

5. The team

Our team consists of:

1. Ram Krishna, an engineer and social scientist. He was also a team member of the DC cupule replication project.
2. Hridayshri, a professional artist and communication designer.
3. Geetanjali, a PG Research Scholar of Archaeology and Heritage Management.
4. Giriraj Kumar, Professor in rock art science and Indian Culture. Director of the Replication Project.

For further advanced study we will need the help of mineralogists, geochemists and physicists for the scientific study of the minerals in the field and in the laboratory.

6. Chaturbhujnath Nala rock art site

Chaturbhujnath Nala is a magnificent and richly painted rock art gallery in India. It is a wonderful rock art site in Bhanpura plateau in Chambal valley and located in the Dry Tropical Forest of Gandhisagar wildlife sanctuary (Fig. 1). The site acquires its name because of the temple of Chaturbhujnath, the lord Vishnu (Fig. 2). It stands on the left bank of natural water reservoir in the nala which holds water throughout the year.
The nala starts near Prempuria village as a shallow small channel in quartzite rock, which gradually goes on deepening and falls in a big reservoir near the Chaturbhujnath temple, nearly 6 km downstream from Prempuriya. From here onwards the nala flows in a rift valley forming nearly 6 km long gorge. The gorge continues downwards having painted rock shelters on its both sides and opens near Rawatbhata road where the nala is locally known as Bhadkaji nala. It proceeds further to meet river Chambal, which has been submerged now under the water of Rawatbhata-Rana Pratap Atomic Power Project (RAPP) water reservoir.
Rockshelters of Chaturbhujnath Nala are like a long continuous arch of low shelters with pseudo or almost no partition, about one kilometre long on its right bank. Besides it, there are four more comparatively smaller chains, two on the right bank and two on the left.
The rock art of Chaturbhujnath Nala is still in its pristine condition except natural deterioration and a little human vandalism in some cases. We have studied

over 2500 compositions which present varied aspects of life and cognitive development of hunter-foragers of pre-cattle domestication Stone Age (Period-I) and early pastorals of the Neolithic-Chalcolithic and Historic Age (Period-II). The figures vividly depict their understanding of the nature, challenges faced, inventions made and varied devices they created to meet them, and above all their spirit to live a happy life in harmony with nature. However, the most important feature of the rock art of Chaturbhujnath Nala is the presentation of a distinct picture of transition from hunting-food-gathering mode of life to cattle domestication, which started with humpless cattle (bull) in the late Mesolithic Age, sometimes in the mid Holocene period or a little bit early. The miniature form of figures, sometimes less than 10 mm in length and height, is one of the unique features of early pastoral rock art of Chaturbhujnath Nala.

The rock art compositions show that the artists were keen observers of the play of the nature and role of humans in it. They deeply observed the natural phenomenon and life cycle going on in it, and their own life as a part of it. They expressed their observations and feelings in an effective and powerful way in the form of creations of rock art compositions. For that they efficiently picked up specific moments of the episode of life and nature, composed and presented them in rock art artistically in such a way that the visitor can visualise the whole incident happening in front of him and feel the thrill, excitement, fear and joy in a powerful way. It is a celebration of life in harmony with nature, full of energy, spirit and social gaiety. It is a blissful experience to feel it happening.

The legacy of the creative traditions of Chaturbhujnath Nala continues in the present pastoral communities and tribes of the region. It is reflected in the construction and decoration of their houses, celebration of festivals, religious functions and affection with their animal stocks. Thus, their art echoes their integrity with nature and deep affection with their animals. It also reflects their joy, enthusiasm and folk gaiety (Kumar 2007, 2022; Kumar and Pradhan 2008).

7. Selection of the replication site

For selection of the rock art replication site the first author discussed the matter with his friend, Robert Bednarik from Australia. He advised that in order to avoid any confusion with the original rock art and replicated compositions, the replication site should be far away from CBN rock art site, and should be devoid of any rock art. It was a nice advice which we followed in letter and spirit and selected a rockshelter for replication near Bada-Mahadev, about 32 km southeast of Chaturbhujnath Nala rock art site (CBN).

Bada-Mahadev is a natural waterfall site which has been converted as a Shiva temple. The waterfall becomes live and forceful in the rainy season. Thus, it is a religious-cum tourist site, very popular in the region and nearby area. It is located in a quartzite cliff of the Bhanpura plateau, about 3 km north of the town and nearly half kilometre southeast of DC.

The cliff near the waterfall bears some rockshelters on its both sides which are devoid of rock art. We selected one of such rockshelters on the eastern side of the waterfall for replication of CBN rock art compositions. It is situated on the cliff, right side of the Baba-ki-Kutia, a rockshelter converted in to a hut. The replication rockshelter is located at 24° 31′ 37″ N, 75° 40′ 20″ E. It is L shape with two faces, A on left side and B on right side. A is bigger than B. The dimension of A is L 9.0 m x D 4.0 m x H 3.5 m, and that of B is L 6.80 m x D 2.00 m x H 2.00 m. Face A is facing 304° NW and B 230° SW. We named it as CBN Rock Art Replication laboratory, Bada-Mahadev, Bhanpura.

8. Pre-Production preparations and processes

8.1 Literature review

Replication of the rock paintings of Chaturbhujnath Nala is the first project of its kind in India. Erwin Neumayer (1983) and Y. Mathpal (1985) copied the figures. V. S. Wakankar (Wakankar, Brooks 1976) did some experiments with making the brush and preparing the pigments, but not with the replication of figures and compositions to understand the cognitive and cultural development of their authors.

In the overseas countries a lot of work has been done on the chemistry of the pigments (pigmentology) and tried to understand the nature of the pigment used, binders, extenders and fixers employed for stability of the rock paintings. A review of some of them has been given below.

To understand the red pigment used in the Cougnac Cave in France Loblanchet did experiment on the yellow ochre found in front of the Cave. It was transformed in to red by heating on a stone pan. The colour was the same as used in the Cougnac Cave (Lorblanchet *et al.* 1990). He concludes that if the pigment procured locally, it has been a routine exercise. If procured from distance then it might be an important event, might be ritualistic as in the case of Wilgie Ochre Mine in Australia as a source of ochre, which is still in operation.

The analytical results of the pigments in the Niaux paintings in France indicate that, more than 12000 years ago, artists working within a restricted area utilised a number of paint recipes which were most probably not used at the same time. These recipes are thus chronologically relevant and could hopefully assist in dating the paintings (Clottes *et al*. 1990). Ethnobotanical data from Laura, north Queensland in Australia and the analyses conducted so far suggest that fibres may occur as by-products or as integral components of the painting process (Cole, Watchman 1992).

Hodgskiss, Tamaryn Penny (2013) carried out a detailed study on the ochre use at Sibudu Cave, a Middle Stone Age site in northern KwaZulu-Natal in South Africa. A gist of it is given below:

Once the activities performed with ochre were established, thought-and-action sequences, or cognigrams, were constructed. This helped establish the steps involved in each activity and the temporal and physical distance between the commencement of a task to

its completion. Inferential sequences were constructed to establish the procedures and knowledge needed to complete an activity, thereby establishing the cognitive prerequisites. Cognitive interpretations are made using the concept of enhanced executive functions of the brain. The construction of the inferential thought and action sequences showed that the various ways that ochre was used have different cognitive requirements.

Powder-production alone is not an indicator of complex cognitive processes, although some planning, foresight and knowledge of materials is required. Some of the powder was used in the creation of hafting adhesives, which is a cognitively demanding process requiring attention-switching ability, response inhibition and abstract thought. Grinding ochre and then rubbing the piece on a soft material for the direct transfer of powder does require some complex mental abilities, such as multi-tasking and switching attention. Scoring a piece of ochre with a sharp tool does not necessitate enhanced executive functions, but some engravings demonstrate foresight, intentionality and an awareness of space and symmetry that may demonstrate abstract thought. This research provides a complete description of the Middle Stone Age ochre assemblage at Sibudu, and establishes the way that ochre was used at the site. Previously A. Marshack (1981) also carried study on Palaeolithic ochre and the early uses of colour and symbol.

Rebecca O'Sullivan (2020) carried out work on, 'Replication in Rock Art Past and Present: a Case Study of Bronze and Iron Age Rock Art in the Altai, Eastern Eurasia.

In India V. S. Wakankar and Robert R. Brooks did experiments to obtain colour by grinding haematite nodules, brush making from palmetto twigs (or porcupine quills for fine work) and dronas (cups) made of folded leaves of dhak (*Butea monosperma*) and copying the rock art compositions (Wakankar, Brooks 1976, pp. 13-14). Y. Mathpal copied most of the compositions of Bhimbetka Hill 3 by using modern brushes (Mathpal 1984). The pigment analysis at Bhimbetka and Modi in Madhya Pradesh was made by S. Subbarao and S. S. Kamavisdar (1980), at Mizapur in UttarPradesh by Tej Singh and Kamal K. Jain (1990, pp. 56-57) and by Katta Ganeswar Rao and his team in Telangana (Rao *et al.* 2019, pp. 9-14). It indicates that pigments used in Indian rock paintings were earthen colours of Iron Oxide.

The literature review is still going on, however from the present exercise it becomes clear that there are fields which were not given much attention such as use of binders and its effect on the stability and viscosity of the paint, understanding location of the rock art composition on the site, convenience and suitability to produce it and visual effectiveness from the spot of its location. Similarly, the cultural aspect of the colour processing is missing in the studies so far made, though technology of colour preparation is there. Attention to them may add new vision to understand the processes of rock art production and cognitive, technological and cultural development of its authors.

8.2 Replication Processes

We are presenting the processes of rock painting replication in different parts for the convenience of study and understanding.

Part I: The Project Introduction

Part IIa and IIb: Study of the selected rock art compositions on the site

Part III: Collection and study of the pigments used and bringing out colour from them

Part IV: Making the brushes

Part V: Replication of the processes of the rock art production and our observations

9. Remarks

Through replication of the rock art of Chaturbhujnath Nala we are trying to understand the characteristic features and concept of the composition(s), the theme and technique used, selection of the pigment, site and spot to execute it, height of the composition from the rockshelter floor, understanding the convenience for creating the composition and visual effectiveness, etc. It will help to evaluate the ability of the authors of rock art to conceptualise an idea, skill and efficiency to execute it on the bare surface of rock, and to understand his cognitive and cultural development.

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Fig. 1 - Chaturbhujnath Nala rock art gallery in Gandhisagar Wildlife Sanctuary in Chambal Valley in India.

Fig. 2 - Chaturbhujnath temple on the left bank of the nala.

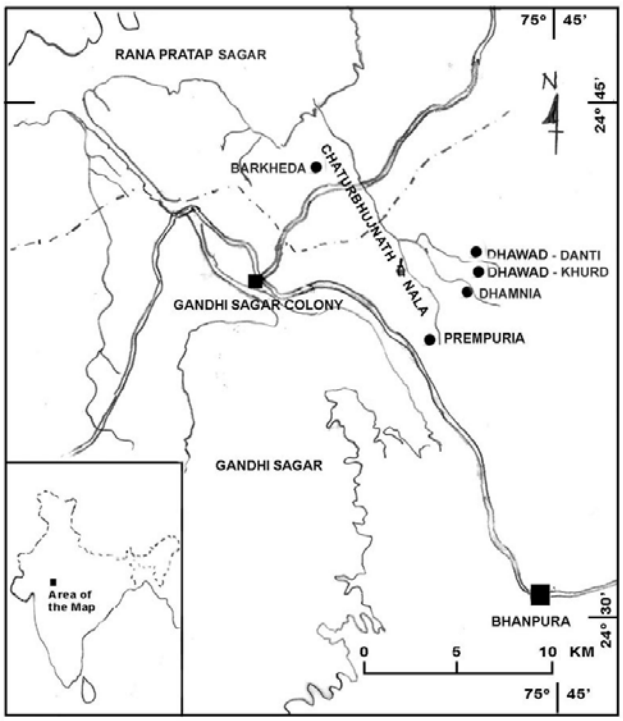

Fig. 3 - Map showing the location of Chaturbhujnath Nala in Chambal valley in Bhanpura region in Madhya Pradesh, India.

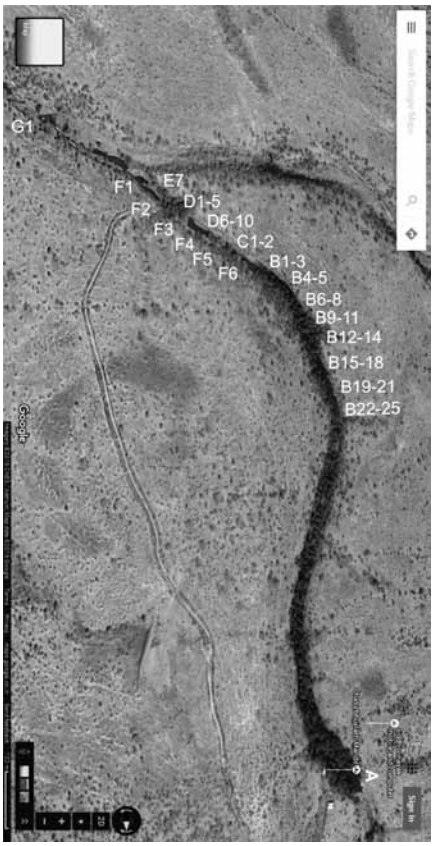

Fig. 4 - Satellite map of Chaturbhujnath Nala showing rockshelter groups.

Replication of rock paintings at Chaturbhujnath Nala
on Bhanpura plateau in Chambal Valley, India - Part 2a

Selection of the Stone Age Compositions and their study

Ram Krishna *, Hridayshri **, Geetanjali ***, Giriraj Kumar ****

Summary

Chaturbhujnath Nala, a rich rock art site, presents rock art of Mesolithic Stone Age (Broad Group I) and early Pastoral life (Broad Group II). In the initial stage of replication, we kept ourself to the minimum compositions, hence selected six compositions from Group I and five compositions of chariots from Group II. The compositions which were clear to study, where one could have the basic understanding of the form, proportions, quality of strokes, brush movement and other details form the criteria to select the compositions.

We have to understand the concept, theme and technique used, selection of the pigment, selection of the site and spot to execute it, height of the composition from the rockshelter-floor, understanding the convenience for creating the composition, its visibility and viewing experience, tentative angle and position for creation, space and environment around it and possible technique and style of its execution. We observed that some of the compositions have been made at convenient positions while some are at difficult locations. It might have been easy to execute some of the compositions at their location, while for certain compositions it might have been difficult to make them. The viewing experience was also worth noticing for some of the compositions. We tried to understand that why a particular composition has been made at a particular location in a particular rockshelter. The study has been presented in two parts: Part 2a, that of Stone Age Compositions, and 2b, that of Chariot Compositions.

The present paper will present our observation and understanding of the cognitive development and spirit of adventure of the artists used in the selection of the spot for creation of studied Stone Age Compositions in the rock art of Chaturbhujnath Nala.

Keywords: Rock art, Replication, Chaturbhujnath Nala, India, Compositions, Study.

Riassunto (Scelta delle raffigurazioni di età della pietra e loro studio)

Il ricco sito con pitture rupestri di Chaturbhujnath Nala presenta una fase riferibile al periodo mesolitico (gruppo I) e una fase del periodo pastorale (gruppo II). Inizialmente ci siamo confrontati solo con piccole composizioni pittoriche, selezionandone sei dal gruppo I e cinque dal gruppo II (in cui sono presenti rappresentazioni di carri). Abbiamo scelto le scene sulla base di alcuni criteri: chiarezza e facilità di lettura; forma ben leggibile, sia nelle proporzioni che nella qualità dei tratti; stato di conservazione tale da riconoscere il movimento del pennello e altri dettagli.

Il nostro obbiettivo era comprendere il concetto, il tema e la tecnica utilizzata, la scelta del pigmento, la scelta del sito e del punto esatto di esecuzione, l'altezza della composizione dal pavimento del riparo, la comodità di creare la composizione, la sua visibilità e l'esperienza visiva, posa e postura da assumere per la realizzazione dell'opera, spazio e ambiente intorno ad essa e possibile tecnica e stile della sua esecuzione. Abbiamo osservato che alcune delle composizioni sono state realizzate in posizioni comode mentre alcune sono in posizioni più difficili. Per alcune delle composizioni in esameaAnche l'esperienza visiva è stata degna di nota. Abbiamo cercato di capire il motivo per cui una particolare composizione è stata realizzata in un dato luogo in un particolare anfratto roccioso. Lo studio è stato presentato in due parti: la parte 2a si riferisce alle scene del gruppo I (mesolitico); la parte 2b si riferisce alle scene con i carri.

In questi articoli cercheremo di presentare le nostre osservazioni come esse ci abbiamo aiutato a comprendere lo sviluppo cognitivo e dello spirito di avventura degli artisti preistorici che hanno scelto Chaturbhujnath Nala per realizzare le loro opere.

Parole chiave: arte rupestre, replica, Chaturbhujnath Nala, India, composizioni, studio.

1. Introduction

Replication of rock art made by additive technique involves many aspects of preproduction and production processes which will be discussed in several parts. One of the important aspects is to select the compositions for replication. In the initial stage of replication, we kept ourself to the minimum compositions, hence selected six compositions from Broad Group I (Mesolithic, hunting-food gathering mode of life) and five compositions of chariots from Broad Group II (early Agro-Pastoral mode of life). The selected compositions were clear to study, where one could have the basic understanding of the form, proportions, quality of strokes, brush movement and observe other details. We have to understand the concept, theme and technique used, selection of the pigment, selection of the site and spot to execute it, height of the composition from the rockshelter-floor, understanding the convenience for creating the composition, its visibility and viewing experience, tentative angle and position for

* Ph. D. Research Scholar, Department of Management, Faculty of Social Sciences, DEI University, Dayalbagh, Agra. Email: ramkrishna.gem@gmail.com.
** Artist and Communication Designer, Rock Art Society of India. Email: hridayshri@gmail.com.
*** MA Research Scholar, Delhi Institute of Heritage Research and Management, New Delhi. Email: gitanjali26aug@gmail.com.
**** Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: giririajrasi.india@gmail.com.

creation, space and environment around it and possible technique and style of its execution. It will help to evaluate the cognitive and cultural development of its authors.

2. Study of the selected compositions

The study of the compositions was made in the RASI studio at Agra and Delhi with the help of enlarged photographs. We also grinded colour pigments to obtain colour and did experiments on making the brushes from different materials. It was followed by the detailed study on the site to have an exact idea of the location and position of the composition. The measurements of the size of composition have been given in terms of length x height.

We studied and observed the strokes and lines of the selected compositions from the photographs and on the site carefully. The point of starting and ending, then mixing it with the following lines, then systematic follow up of the lines to achieve the final composition. Quality, movement, thickness, direction and force of the strokes of the composition are communicating various information like gender, tentative age or age group, hierarchy, flow, motion, character, activity intent in the figures of the composition.

We also tried to understand the strategy and planning followed by the artist, so that we can replicate it similar to the original one as far as possible.

The study is in two parts: Part 1. Study of the Compositions of Period I, Mesolithic, and Part 2. Study of the Compositions of Chariots of Period II.

2. Part 1. Study of the Stone Age Compositions of Period I, Mesolithic.

2.1. Figure 1, Rockshelter No. D6 -10. Running Archers, Mesolithic (a composition of three archers)

Orientation of the shelter: Facing South.

Size of the composition: 45.5 x 22.5 cm.

Dimensions of the individual figures: (from left to right)

F1 - 19 x 19 cm (biggest in the composition).

F2 - 13.0 x 17.5 cm (medium in the composition).

F3 - 13.5 x 16.0 cm (smallest in the composition).

Stroke thickness of the composition: 1.0 mm average.

Viewing level: Below the eyelevel.

Composition Colour: Dark Brown.

Composition Position: It has been made on the roof of the shelter. Difficult to draw, while keeping the head tilted towards the roof with bent knees or oblique folded legs.

Composition execution position: Two workable possibilities which seems possible to be able.

Possibility 1, Standing position: The legs need to be placed at two different levels to maintain balance comfortably. The folded leg would be resting at the 135 cm from the composition, while the strait oblique leg was placed at the 160 cm.

Possibility 2, Sitting on the knees position: It is an uncomfortable position. The artist could not sit in that position for a long time. It is difficult to draw the figures while looking upwards on the roof with bent knees or oblique folded legs.

Observations: Hierarchy in the figures of the composition has been shown by the types and numbers of weapons the figures are holding, the type and style of loin cloth of the figures and the elaboration of their headgears. It is amazing to see that by the size/height and proportion of the compositions, the author was not only trying to communicate hierarchy but also the movement, motion and intending rhythm.

The techniques used for the composition to communicate vital information are worth mentioning. The thickness of the strokes, angle and quality imparts large amount of information about the compositions, such as maturity of the archers, age group and anatomical movement with reference to the age group. The quality of lines and the composition structure communicate the agility one might have around that tentative age and experience. One can see the anatomical details in the height, proportion and body contours. The angle of the limbs and their positions are in synchronisation with the body motion and group movement.

2.2. Figure 2, Rockshelter No. F1 – Women in rhythm, Mesolithic (composition of dancing lady)

a. Orientation of the shelter: Facing North.

b. Dimensions of the composition: The dimensions of the niche, 45 x 75 cm, and that of the composition, 12.5 x 19.3 cm.

c. Stroke thickness of the composition: 3.5 mm average.

d. Location: The composition is made in a niche, slightly below the eyelevel. Its location is more comfortable to view and appreciate the composition visually while standing close to it or sitting on the floor or from the distance.

e. Composition Colour: Red.

f. Visibility: It has been made inside a deep natural niche, protecting from rain water

seepage. It also provides a panoramic view like the Monalisa painting by Da Vincy (From all the angles it appears as if the dancing lady is looking at the viewer). The composition appearance equally impressive right from 30° Northeast to 285° Northwest. It is because of the niche that we are able to get excellent panoramic view from quite a distance, up to 9.00 m of the composition. One can appreciate the composition from all the angles while walking, sitting close or far. It is unlike majority of the nearby compositions, where one has to bent down, sit under or slide under the narrow cavity of the shelter for viewing.

g. Position of execution of the composition: Comfortable position to execute, yet needs technical understanding of the surface to be able to draw the composition well in the niche, as the surface is not flat. For execution of the composition the legs need to be placed at two different levels. The folded leg would be at 110 cm from the composition (lower most level) and the straight leg would be at 135 cm. It is because of the different levels on the floor.

h. Appreciation of the composition (while studying the lines and strokes of the composition): the composition is three forth facing, where the lower body appear to be standing in an angle but from the shoulder the upper

body seems to be facing towards the front. Although the composition appears to be very simple yet the technicalities to depict abstraction and other feminine details are outstanding. The starting point and ending point of the lines/strokes, the joint of the two strokes and angles of the lines are crucial to show/communicate critical anatomical structural details, body angles and twist, which makes a female composition graceful and majestic while dancing. The sophistication and grace of the composition comes from the delicate, subtle movement in lines and their joints. The composition is so perfect in its balance that even a slight alteration takes away its grace.

The structure of the composition is modern and abstract at the same time, playing with visual psychology (Gestalt law of positive and negative. Dondis 1974: 35-38). The empty space between her upraised arms gives impression of the head.

Because of the depth of the niche, it survived the dripping rain water. Hence, the quality of the survived composition is very good. The lighting due to concave niche is very good even at 4 pm on 17th April, 2021. Rather the niche surface is reflecting the light further enhancing the visibility of the composition.

2.3. Figure 3, Rockshelter No. B4. The load bearers, Mesolithic (A composition of five humans moving in the right. The last figure in the left is almost concealed underneath accretion)

Orientation of the shelter: Facing West.

Dimensions of the composition: 50 x 19 cm.

Thickness of the strokes and lines: 1.7 mm-3.4 mm.

Location: The composition figures are moving in the right in leaning forward position. The composition has been composed below the eyelevel in the small first floor of Rockshelter B4 (in its left side). From here one can have a beautiful view of the Nala and the forest. However, the location of the composition appears difficult to execute as the one is neither comfortably able to sit or stand facing the composition.

Composition Colour: Dark brown

Execution position: The composition is made at a height of 122 cm from the working floor level. It is painted on the right side of the wall, slightly above the eyelevel if seen while sitting on the knees. At present it is close to the edge of the roof, appear to be challenging and adventurous to execute the composition while sitting and looking upwards by bending the neck backward.

Observations (while studying the lines and strokes of the composition): Figures in the composition are moving in the right direction. There are four clear figures and fifth one on the left side has predominantly been washed out. The figures have short legs and large head in proportion of the body with bulging load on their back. The entire body, head, arms, load and movement have been shown by an outline and a few thick lines at head give an impression of the arms holding the load placed on their back. The figures are leaning forward to balance the load on their back.

Focus of the composition is in the centre on the figure number 3. Its head and arms are in abstract form (the stroke thickness of the suggestive arms ranges from 4.53 mm-15.33 mm) are well defined and are a bit larger as compared to the rest of the figures. The composition is dealt with an approach of abstraction, with minimal lines and strokes showing multiple information.

2.4. Figure 4, Rockshelter No. F1. Composition of a buffalo with large broad horns

Orientation of the rockshelter: Facing North-Northeast.

Dimensions of the composition: 27.0 x 9.9 cm.

Stroke thickness of the lines and strokes: Stretched legs 4.5 mm , tail 7.7 mm, horn 5.5 mm and body outline 3.5 mm. The body has been filled in with red colour after making the outline.

Viewing level: At the eyelevel (standing strait).

Composition colour: Red.

Composition Position: The shelter has large panoramic view. The composition is made in the 45 x 34.0 cm shallow niche. One has to stand facing towards Nala and tilt his head up towards the roof to see the composition.

The shelter has two levels. The composition is painted in the upper-level niche, which appears like a small first floor of the shelter. From the upper level there is a beautiful view of the nala and the forest. Yet composition's position appears to be difficult to paint where one is neither comfortably able to sit or stand facing the composition.

Execution position: The composition was made standing at a comfortable position with legs parted, one leg forward and another backwards. This position appears most comfortable due to the levels on the shelter floor. The folded leg would be resting at 125-128 cm from the composition. The strait oblique leg would be at 160 cm from the composition.

Observations: The composition is bold and the body is filled in with red colour showing the masculinity of the animal (buffalo). The quality and thickness of the strokes show the power and the majesty of the animal. The Artist was successful in delivering various information with minimal and calculated strokes. The strategic angles of the lines and form (representing the legs, tail, horns, concealed head) give an impression that the animal is looking to the backside with head concealed and the emphasis is on the huge broad horns. The strokes are not thoughtless lines, there are subtle curves, angles, intentional thickness provided to strokes to bring character and dynamism to the pose of the animal.

The unique characteristic of this composition is the huge horns of the animal. They draw viewer's attention instantly in spite of the simplicity of the composition. As we hold the gaze longer on the head of the animal appreciating the scale of horns we discover that the animal is looking away on the opposite direction of the viewer, and one of the hind leg has been stretched to balance the body weight of the animal, so also the tail has been upraised. The posture is captured beautifully with minimal strokes and force.

2.5. Figure 5, Rockshelter No. B4. A rhinoceros, Pd1 Mesolithic (one animal)

Orientation of the rockshelter: Facing South-Southwest.
Dimensions of the composition: 33.0 x 19.5 cm.
Stroke thickness: Body outline is in thin lines, 3.0 mm, and that inside the body are thick, 11.0 mm.
Execution Location: Above the eyelevel on the roof of the rockshelter.
Composition Colour: Red.
Composition Position: This composition is on the roof of the shelter. If facing towards the shelter and looking upwards the composition appears upside down. However, for the correct viewing and to appreciate the composition properly, one has to lie-down on the back, facing towards the nala and looking at the roof. This position is extremely comfortable; one can enjoy viewing and appreciating the composition for hours along with the nala and natural green landscape in front of the composition.
Position of execution: The composition is in the centre on the roof of the shelter. To execute the composition the artist has to stand facing towards the nala, fully tilting his head up looking towards the roof. The distance from the floor to the composition is 197 cm, making it extremely uncomfortable position to keep the neck tilted and arms up for long to execute the composition with precision having full control on the brush.
Observations: The shelter has a very big, long, large and comfortable roof richly painted mostly with the compositions of early period I. From the shelter one can have a beautiful panoramic view of the nala and the landscape. The floor is in large step-like rock formation inside the shelter providing many terraces to sit and sleep over it in the comfortable lounging position.
At the first glance, this specific composition of Rhinoceros seems out of place and upside down among other compositions. But once we find the right viewing angle, it appears as if it was made specifically to appreciate from that spot for one's delight. In deciding the position and angle of the composition the artist did not follow other artists, but went on to create his own viewing experience. It is strategically made with an understanding of having natural landscape in the background. Making it appear as if the Rhino is in the forest and the natural landscape with the nala as a part of the composition.
The built and the body structure of the composition is large and in the motion. The entire composition is drawn with two different thicknesses of the strokes (Gestalt law of similarity. Lester 2011: 46). The thin line is used to define the entire body form and thick strokes are to show the thick armour like skin of the animal. The slight angles and form of the small legs have been shown with deep observation, communicating how an animal with heavy weight and power would move with force.

2.6. Figure 6, Rockshelter No. B7. Colour strokes, Mesolithic (free hand colour strokes, appearing as abstract form of bamboo forest or forest fire!)

Orientation of the shelter: Facing South – South West.
Composition size: early strokes 43 x 30 cm, latter strokes 35 x 15 cm.
Stroke thickness of the composition: The strokes are going upwards, hence thick at the bottom and tapering upwards to thin top end. Early strokes are comparatively thin than the latter strokes. The thinnest stroke from the bottom is 5 mm and thickest one is 8 mm.
Composition Position: The shelter has the panoramic view of the nala. The composition can be viewed only when one is lying down on the floor and looking towards the roof.
Location of the composition: The composition is made on the roof of the shelter, above the eyelevel.
Composition Colour: Red and brown.
Execution Position: Lying on the back and painting on the roof appear fairly comfortable, however for short time.
Observations: The shelter has good shadow and comfortable temperature even in the noon in hot April. To see the composition clearly one needed light even in the afternoon.
Appreciation of the composition. The strokes are in the upwards motion from a thick brush of two different sizes and have been made at two different times. The strokes comparatively thin have been superimposed by the comparatively thick latter strokes. The brush must have been able to hold enough colour and could have moved effortlessly on the rough rock surface. These are confident strokes made with force. The study of the strokes reveals the structure of the composition. The strokes have been executed in a systematic and planned way. They exhibit alignment, pairing and sequence following the visual psychology (modern Gestalt law of proximity. Lester 2011: 46).). The thickest point of the stroke is more or less flat and it gets pointed upwards, showing the force with which, the stroke must have been made. The composition is in abstract form and could represent many concepts. It is a unique composition of its kind in the rock art of India.

3. Observations

- The compositions have been made on different uneven surfaces at different angles and heights from the floor. Study of the compositions on the site provided us a chance to understand the convenience or difficulty the artist might have faced while creating the particular compositions. The movement of the line and the thickness of the stroke also depends upon the surface and the angle of drawing.
- We observed that when the angle between the surface and the hand of the painter is about 180° or so, it is the most difficult position and exerts strain on the shoulders and the neck. As the angle decreases between the painter and the surface the complication and the strain level also decrease. The lying position is the most comfortable to execute the composition if it is made on the roof close to the shelter floor. With the increase in the height of the composition from the floor, the difficulty level increases.
- While making composition, if by mistake the stroke/line deviates from the desired direction, at

that point the artist has painted that particular portion thick to minimise the damage.

- Movement of the strokes depends upon the pigment, thickness of the brush, position of the surface and its texture.
- The position of the artist to make the figures and the height of the location from the floor determined the quality of the figures and composition. When the figure is made on the roof in standing position, The artist has to compromise with the quality of the figure, but that's not the case with the figures made while sitting or standing on the knees. In this position turning head and waist is comparatively comfortable, but looking towards the roof for a long time keeping the head high still exerts strain over the neck.
- The figures rich in artistic qualities are generally found on those surfaces which are vertical and its height is at the eyelevel. Apart from the vertical surface, such figures are found on the roof close to the floor and made in the lying position. These figures can be seen only in a lying position.
- The most comfortable and convenient angle to compose the figures is 90° between the surface and hand of the painter, either in standing, sitting or lying position.

4. Comments

Each composition has its own specific features and story/message to communicate, however, its location in the rockshelter matters a lot.

The location of the compositions can be classified in to three categories:

a) At eyelevel. Usually, the Mesolithic compositions are at eyelevel.

b) Above the eyelevel

c) Below the eyelevel

We realised that except in the case of 'a', in all other cases it is a tedious task to execute the composition. In case of 'b' the artist might have experienced a lot of pain in the neck because of looking upwards for a long time. In case of 'c' the artist has to stand either on the knees by bending the legs or sit on the knees. Both the positions are difficult and painful.

Concluding Remarks

We observed that selection and location of the Mesolithic compositions in the rockshelter was well thought out in terms of execution strategy and processes, the surrounding environment, visibility and effect of the composition on the visitors. The compositions are also well planned and thoughtfully created by the artist who was highly observant and was having analytical mind and great skills, deep understanding of the environment and structure in it.

The compositions are sophisticated and complex with applied technicalities of art and design, rich in information, analytical observations, anatomical and structural details gracefully manoeuvring simple strokes and lines. At some places, even with the limitation of the brush, the artist was able to execute powerful strokes and created soft and delicate lines. Force and power in the brush movement on hard rock surface seem surprising. It changed our perception of rock art completely.

These compositions had been made keeping in mind the following:

- Context (gender, age, clothing, weapon details, etc. to build a context of the composition).
- Surface (nature of surface, levels and textures).
- Structure (anatomical details, position and, angles of the figures).
- Viewing experience (positions, lighting conditions, proportion and size of the composition and effort required to view them building a context in itself).
- Environment (immediate surroundings and experiences).
- Narrative (the essence of the composition to generate an experience of the incident and concept).

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Fig. 1 - Composition of three running archers. CBN Rockshelter No. D6-10. Mesolithic.

Fig. 2 - Lady in rhythm (Dancing lady). CBN Rockshelter No. F1. Mesolithic.

Fig. 3 - A composition of Load bearers. CBN Rockshelter No. B4. Mesolithic.

Fig. 4 - Composition of a wild Buffalo with very broad and long horns. CBN Rockshelter No. F1. Mesolithic.

Fig. 5a - Composition of a Rhinoceros. CBN Rockshelter No. B4. Mesolithic.

Fig. 5b - Lounging is the proper position to view and appreciate the Rhinoceros composition.

Fig. 6 - A composition of freehand strokes in two layers, might be a representation of bamboo jungle in abstract form. CBN Rockshelter No. B7. Mesolithic.

Replication of rock paintings at Chaturbhujnath Nala
on Bhanpura plateau in Chambal Valley, India - Part 2b

Selection of the Chariot Compositions and their study

Geetanjali *, Ram Krishna **, Hridayshri ***, Giriraj Kumar ****

Summary

Chariots form an important feature of the rock art of early Pastoral Period at Chaturbhujnath Nala (CBN). Hence, we decided to replicate the preproduction and production processes of the chariots. We studied their location, forms, styles, number of persons riding and animals yoked in them, technical features, etc. We also observed certain features of their development, studied the minute details of the chariots for their replication, such as flow of lines and strokes, its body length, size and features of wheels, number of spokes in them, length of axel joining them, angle of their presentation, etc.

We observed that creation of chariots was a very important invention for fast conveyance and warfare. It was a deadly combination of machine, animal power, human skill and intelligence in early pastoral period representing an advanced stage of cognition and cultural development of the humans.

This study is a part of the Project on, "Replication of rock paintings at Chaturbhujnath Nala on Bhanpura plateau in Chambal Valley, India" by Rock Art Society of India.

Keywords: Rock art, Chariot Compositions, Replication, Chaturbhujnath Nala, India- Study

Riassunto (scelta delle raffigurazioni di carri e loro studio)

I carri costituiscono un soggetto importante dell'arte rupestre del primo periodo pastorale a Chaturbhujnath Nala (CBN). Quindi, abbiamo deciso di replicare i processi di pre-produzione e produzione di queste rappresentazioni. Abbiamo studiato la loro posizione, le forme, gli stili, il numero di persone a cavallo e gli animali aggiogati ad essi, le caratteristiche tecniche, ecc. Abbiamo anche osservato alcune caratteristiche del loro sviluppo, studiandoli nei minimi dettagli dei carri perché fosse possibile produrne una replica. Abbiamo analizzato il flusso di linee e colpi, la lunghezza del corpo, le dimensioni e le caratteristiche delle ruote, il numero dei raggi, la lunghezza dell'asse che le unisce, l'angolo della loro presentazione, ecc. Il carro ha rappresentato un'invenzione molto importante per il trasporto veloce e la guerra. Era una combinazione mortale tecnologia, forza animale, abilità umana e intelligenza. Nella fase iniziale del periodo pastorale testimonia uno sviluppo sia cognitivo che culturale molto avanzato.

Questo studio fa parte del progetto "Replication of rock paintings at Chaturbhujnath Nala on Bhanpura plateau in Chambal Valley, India", condotto dalla Rock Art Society of India.

Parole chiave: arte rupestre, composizioni di carri, replica, Chaturbhujnath Nala, India, Studio

1. Introduction

Chariot was a very important invention for fast conveyance and warfare in early Pastoral period (Wakankar, Brooks 1976;Wakankar 2005; Neumayer 1993, pp.159-166, 2008; Sastri 2018, pp. 5-14). It was a deadly combination of machine, animal power, human skill and intelligence in early pastoral period representing an advanced stage of cognition and cultural development of the humans. It has been vividly described in Vedic literature (Sparreboom 1985, pp. 10-12). In the rock art of Chaturbhujnath Nala, Chariots, though less in number, have been presented very brilliantly in a variety of forms and styles (Kumar 2007, in press, pl. 68-72). The present paper deals with the study and observation of the replication of chariots depicted in the rock art of Chaturbhujnath Nala. It is to understand the cognitive, technological and cultural development of their authors in early Pastoral period.

2. Preparatory study

As the present study is a part of the Project on, "Replication of rock paintings at Chaturbhujnath Nala on Bhanpura plateau in Chambal Valley, India" by Rock Art Society of India, hence the literature review, preparations, brush making, obtaining colour from Iron Oxide Mineral nodules, etc will be discussed elsewhere in the present Volume.

3. The study of the Chariots at home and on the site

The preparatory study of the compositions was made

* MA Research Scholar, Delhi Institute of Heritage Research and Management, New Delhi. Email: gitanjali26aug@gmail.com.
** Ph. D. Research Scholar, Department of Management, Faculty of Social Sciences, DEI University, Dayalbagh, Agra-282005. Email: ramkrishna.gem@gmail.com.
*** Artist and Communication Designer, Rock Art Society of India. Email: hridayshri@gmail.com.
**** Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: giririajrasi.india@gmail.com.

at home in Delhi with the help of enlarged photographs. It was followed by the detailed study on the site to have an exact idea of the location and position of the composition. The measurements of the size of composition have been given in terms of length x height.
At the site, detailed study of the location of Chariot Composition, height from the floor, visibility, dimensions, present status of its preservation and trying to figure out the technological, cognitive and cultural development of the artist and his community. We also studied the movement of strokes and noted it. For the replication we selected five Chariot Compositions from the rock art of Chaturbhujnath Nala, which were clear to study, where one could have the basic understanding of the form, proportions, quality of strokes, brush movement and other details. We have to understand the concept, theme and technique used, selection of the pigment, selection of the site and spot to execute it, height of the composition from the rockshelter-floor, understanding the convenience for creating the composition, its visibility and viewing experience, tentative angle and position for creation, space and environment around it and possible technique and style of its execution. We observed that some of the Chariot Compositions have been made at convenient positions while some are at difficult locations. It might have been easy to execute some of the compositions at their location, while for certain compositions it might have been difficult to make them. The viewing experience was also worth noticing for some of the compositions. We tried to understand that why a particular composition has been made at a particular location in a particular rockshelter. The paper will present our observation and understanding of the cognitive development and spirit of adventure of the artists used in the selection of the spot for creation of certain compositions in the rock art of Chaturbhujnath Nala.

4. Study of the Chariot Compositions of Period II

For the replication we selected five compositions of chariots from Chaturbhujnath Nala.

4.1. Figure 1, Rockshelter No. B17. Chariot Composition No. 1

Rockshelter orientation: Facing southwest.
Location of the composition: On the roof, above eyelevel.
Height of the composition from the floor: 185 cm.
Colour: Dark red ochre.
Stroke thickness: 1.0-1.4 mm.
Composition theme: A chariot yoked with two horses and three charioteers wielding parashus (metal axes), moving in the right.
Composition size: 27 x 13 cm.
Observations: The composition is covered with a thin film of salt deposit due to being washed off with rain water. Though Spokes of the wheel are not clearly visible, there are 5 spokes in one half of the wheel on the left side and in the other half only 1 spoke is visible, while in the wheel on the right side, there are more than 6 spokes. There are three charioteers, two of them are holding axes in their hands. Their head is decorated by eight dots. The height of the human figure in the middle is comparatively smaller than the other two.

4.2 Figure 2, Rockshelter No. B17. Chariot Composition No. 2

Rockshelter orinetation: Facing southwest.
Location of the composition: On the roof of the shelter, above eyelevel, 202 cm above the floor.
Colour: Red.
Thickness of the lines and strokes: In human body: 0.7-1.5 mm, parashu (axe) stick 7.0 mm.
Composition size: 24 x 13 cm.
Composition appreciation: The chariot is suggestive. The animals and wheels have not been shown attached to the chariot, still the composition appears complete and powerful.
Observations: This is the only chariot with four charioteers in CBN. The whole composition is painted solid except the human figures. The size of the wheel is comparatively smaller and divided into four quadrants. If we study the figure by dividing it horizontally in two parts, then we found that the first half is very fine and proportionate compared to the other half. This chariot is superimposed by a bold angular line and disfigured because of the exfoliation.

4.3 Figure 3, Rockshelter No. B17. Chariot Composition No. 3

Orientation: Facing southwest.
Location of the composition: Located on the roof, below eyelevel, 40 cm above the floor.
Colour: Red.
Line and strokes: Lines fine, strokes thick.
Composition size: 15.0? x 6.0 cm.
Composition appreciation: Chariot is decorated with geometric patterns; the wheels are shown in outline only without spokes.
Observations: The yoked animals have almost disappeared. Only faint traces of them are there. The artist might have painted the figure by lying down on the floor.

4.4 Figure 4, Rockshelter No. B17. Chariot Composition No. 4.

Orientation of the rockshelter: Facing southwest.
Location of the composition: Located on the inclined roof, at a height of 205 cm from the floor.
Colour: Dark red.
Lines and strokes: Executed in a combination of fine lines and filled in style.
Composition size: 18.5 x 16.0 cm.
Composition appreciation: The chariot has been shown yoked with four horses and two charioteers executed in fine lines, strokes and in filled in style. The heads of the charioteers and parashu are decorated, (parashu of the right one has been exfoliated).
Observations: The chariot is preceded by two humans and two animals and followed by a person bearing some torch like object in his hand. The chariot with four horses and the charioteers with decorated head dress makes this composition special.

4.5 Figure 5, Rockshelter No. B17. Chariot Composition No. 5.
Orientation of the rocksheletr: Facing southwest.
Location of the composition: Located on the inclined roof, at a height of 110 cm from the floor.
Colour: Dark red.
Lines and strokes: Executed in a fine lines and strokes.
Composition size: 29.0 x 21.0 cm.
Composition appreciation: The structure of the chariot is elongated, so also the body of the charioteer who is holding the reins of both the yoked animals. The animal has been shown in outlines without tail, the vertical lines are thick. Rein from the mouth of the animalis going up above their head and body. The other animal has disappeared.
Observations: It is an elongated chariot. The decorated animal above it is not the part of the chariot composition.

5. Observations and comments

Some of the chariot compositions have been made close to the floor (20-30 cm to 40-50 cm above the floor). The compositions made at the height of 20-30 cm can be made by lying down on the belly or with the stretched legs on the floor and belly, and shoulders at convenient angles. It is not an easy position to execute artistic work, however it is comfortable to make the composition by bending the legs.
Rest of our observations and comments being common have already been presented in Part 2a. Hence, we are not giving them here again.

6. Concluding Remarks

Invention of a Chariot was a deadly combination of machine, animal power, human skill and intelligence in early pastoral period representing an advanced stage of cognition and cultural development of the humans. We observed that the selection and location of the compositions in the rockshelter was well thought out in terms of execution strategy and processes, the surrounding environment, visibility and effect of the composition on the visitors. The compositions are also well planned and thoughtfully created by the artist who was highly observant and was having analytical mind and great skills, deep understanding of the environment and structure in it.
The compositions are sophisticated and complex with applied technicalities of art and design, rich in information, analytical observations, anatomical and structural details, gracefully manoeuvring simple strokes and lines. At some places, even with the limitation of the brush, the artist was able to execute powerful strokes and created soft and delicate lines. Force and power in the brush movement on hard rock surface seem surprising. It changed our perception of rock art completely.
The technological and chronological development of chariots can be understood on the basis of the types of wheels, execution of the chariot and number of animals yoked to it, size and style of it, its finishing, number of persons standing on it, their personality and implements, etc.

Acknowledgement

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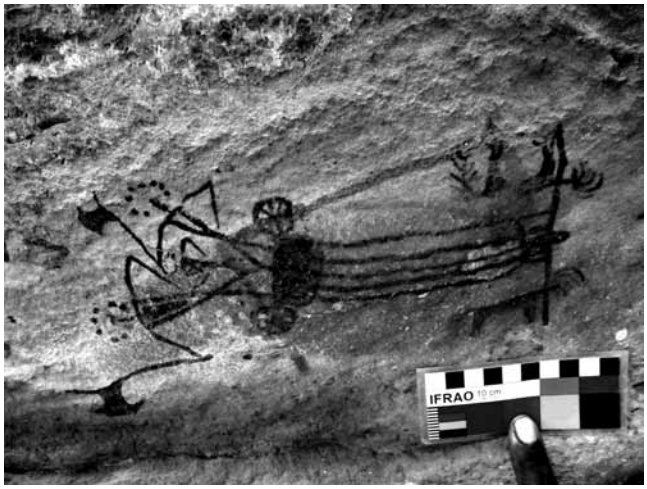

Fig. 1 - A chariot composition No. 1. CBN Rockshelter No. B17. Period IIb, Early Pastoral.

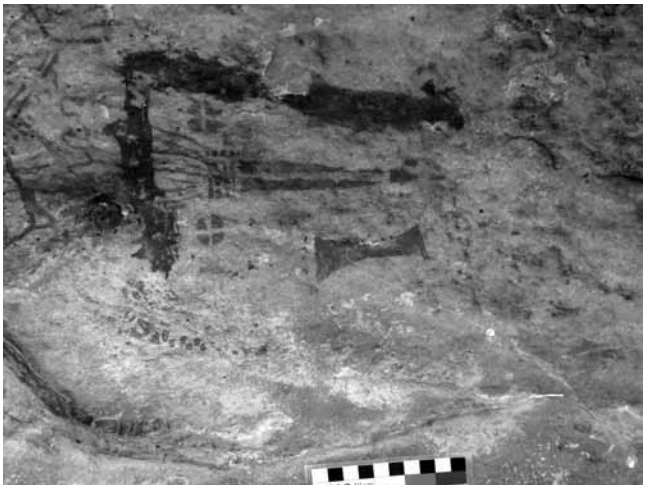

Fig. 2 - A chariot composition No. 2. CBN Rockshelter No. B17. Period IIb, Early Pastoral.

Fig. 3 - A chariot composition No. 3. CBN Rockshelter No. B17. Period IIb, Early Pastoral.

Fig. 4 - A chariot composition No. 4. CBN Rockshelter No. B17 yoked with four horses. Period IIb, Early Pastoral.

Fig. 5 - A chariot composition No. 5. CBN Rockshelter No. B17. Period IIb, Early Pastoral.

Replication of rock paintings at Chaturbhujnath Nala
on Bhanpura plateau in Chambal Valley, India - Part 3

Pigment selection and their processing for replication of rock painting compositions: A preliminary study

Hridayshri *, Geetanjali **, Ram Krishna ***, Giriraj Kumar ****

Summary

Haematite and red ochre were the most popular pigments used in the rock art of Chaturbhujnath Nala (CBN). Most of the early rock paintings in this period have been executed in line drawings in dark red colour, sometimes, with dark brown tone. We did experiment to understand the selection of the pigments used and their processing to obtain colour from them by replication process. Our team collected iron oxide pigment nodules from the area near Chaturbhujnath temple in March 2019 and again in April 2021. We short listed ten pigments, and produced a colour scale based on the variety, intensity and visual appearance. We observed that darkness of the colour was directly proportionate to the hardness of the pigment nodule and it required physical work accordingly.

The scientific analysis of the pigments will be followed in the second phase of the project. However, the present experiment throws light on the abilities of the authors of rock art to find the source and collection of the desired pigment nodules, the processes of obtaining colour from them, and their choice of pigments to execute the desired rock art compositions. It indicates about the cognitive abilities of the authors of early rock paintings of CBN, and the socio-cultural aspects involved in it.

Keywords: Rock art replication, Pigments, Processes, Socio-cultural aspects, Chaturbhujnath Nala

Riassuno (Scelta dei pigmenti e loro lavorazione per la replica di composizioni di pitture rupestri: uno studio preliminare)

L'ematite e l'ocra rossa sono i pigmenti più usati nell'arte rupestre di Chaturbhujnath Nala (CBN). La maggior parte delle pitture rupestri più antiche sono state realizzate al tratto con colore rosso scuro oppure marrone. Per arrivare a replicare queste opere sono stati necessari molti esperimenti, per individuare i giusti pigmenti e le tecniche necessarie per ottenere il colore.

Il nostro team ha raccolto noduli di ossido di ferro dall'area vicino al tempio di Chaturbhujnath nel marzo 2019 e di nuovo nell'aprile 2021. Abbiamo selezionato dieci pigmenti e prodotto una scala di colori basata sulla varietà, l'intensità e l'aspetto visivo. Abbiamo osservato più il nodulo era duro, maggiore era l'intensità e la gradazione del colore e d conseguenza maggiore era lo sforzo fisico per ottenerlo.

Le analisi di laboratorio saranno eseguite nella seconda parte del progetto. Tuttavia, il presente esperimento mette in luce le capacità degli artisti preistorici di trovare i noduli e raccoglierli, la conoscenza dei processi per ottenere il colore, la padronanza della relazione fra la qualità della materia prima e il pigmento ottenibile da essa, la capacità progettuale per eseguire le composizioni di arte rupestre desiderate. Tutte queste osservazioni ci danno un quadro sulle capacità cognitive degli autori delle prime pitture rupestri del CBN e sugli aspetti socio-culturali coinvolti in esso.

Parole chiave: Riproduzione dell'arte rupestre, Pigmenti, Processi, Aspetti socio-culturali, Chaturbhujnath Nala

1. Introduction

Haematite and red ochre were the most popular pigments used in Chambal Valley, former especially in the Stone Age paintings (Mesolithic and Upper Palaeolithic). Haematite is basically an iron oxide ore with a molecular formula of Fe2O3. Its colour is red, reddish brown to brown, black to steel or silvery grey. This ore is much harder than pure iron but also very brittle. Ochre is a natural clay earth pigment which is a mixture of ferric oxide and varying amounts of clay and sand. It ranges in colour from yellow to deep orange or brown. Besides, black pigment obtained from Manganese minerals was used in bichrome paintings. White is also used in Gandhisagar, but rarely in Chaturbhujnath Nala.

The early rock art of Chaturbhujnath Nala belongs to Pre-cattle domestication Stone Age period I, Mesolithic. Most of the rock paintings in this period have been executed in line drawings in dark red colour, sometimes, with dark brown tone. While, most of the rock paintings of period 2, Cattle Domestication phase, have been done in different shades of ochre. We did experiment to understand the selection of the pigments used and their processing to obtain colour from them by replication process in April 2021. Our team collected iron oxide pigment nodules from the area near Chaturbhujnath temple in March 2019 and April 2021.

Study of the pigment used for the execution of the compositions, finding the similar pigments from the

* Artist and Communication Designer, Rock Art Society of India. Email: hridayshri@gmail.com.
** MA Research Scholar, Delhi Institute of Heritage Research and Management, New Delhi. Email: gitanjali26aug@gmail.com.
*** Ph. D. Research Scholar, Department of Management, Faculty of Social Sciences, DEI University, Dayalbagh, Agra-282005. Email: ramkrishna.gem@gmail.com.
**** Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: girirajrasi.india@gmail.com.

field, their processing and execution process form one of the major factors for understanding the cognitive, technological and cultural development of the authors of rock art in different periods. We tried to follow these aspects in our study and understanding of the nature and behaviour of the pigments.

2. Pigment analysis: literature review

The major experiments made on the analysis of rock paintings in the overseas countries have been discussed in the Part I of our replication project (Kumar *et al.* 2021, in the current volume). In Indian context Late S. Subbarao and S. S. Kamavisdar of the School of studies in Geology, Vikram University, Ujjain, on the request of V. S. Wakankar, analysed the pigment obtained from the excavations at Bhimbetka and Modi respectively (Subbarao 1980, Kamavisdar 1980). Subbarao found that Copper compounds were used to produce a bright shade of green. Black or deep purple was obtained from Manganese oxides. To provide colour in red, yellow or brown, haematite or other oxides of Iron were used. Kaoline and kankars were used to obtain white pigment. Kamavisdar on analysing the pigments from Modi excavations, observed that the solubility of the pigments only in inorganic acids, and the absence of any band in the Infrared spectrum in between the wave number (cm^{-1}) 2000 to 2300 and then up to 2900 indicate that Modi pigments are inorganic in nature. Again, he says that Modi pigment is a complex matter of haematite, Iron, Sulphur, Phosphorus and Silica along with Aluminium, Magnesium and Calcium in little amounts (Kumar 1983, pp. 330-331).

Tej Singh and Kamal K. Jain analysed the pigment samples from Mirzapur rock paintings, provided by Rakesh Tewari (Singh and Jain in Tewari 1990). They used Emission Spectrographic Analysis and X-Ray Differection Studies. They observed the presence of minerals gypsum (CaSO4.2H2O) and haematite (Fe2O3) in all the samples. However, gypsum was the main mineral in all the four samples analysed. The presence of haematite, the main constituent of Red Ochre, in samples 2-4, which are blackish red in colour, indicates that red ochre was used as pigment in these paintings.

Katta Ganeswar Rao and his team analysed the rock painting pigments from Telangana by using portable Raman Spectrometer (Rao *et al.* 2019, pp. 9-14). They analysed four samples from rock paintings without interfering with it. The most prominent bands in the Spectra recorded on the red particles of the pigment on the rock art sample 1, 2, 3 and 4 bands at 406, 602 cm^{-1} are present which are characteristic of haematite.

The above analytical studies of the rock painting pigments from India including Chambal Valley indicates that Indian rock paintings have been executed by using earthen mineral colours. No organic material or binder has been traced so far.

3. Geomorphology of Chaturbhujnath Nala region

Basaltic flows of amygdular and vesicular type poured out from fissures and spread around over the existing pre-Cretaceous surface about 65 million years ago (Singh 1971, pp. 567-573). The basalt rocks, commonly known as Deccan trap, are overlying the Sandstones and shales of Vindhyan super group, which are about 600 million years old. The latter form linear deposits in this region and have been metamorphosed to quartzite and slatestones.

The Deccan trap rock is usually a form of olive basalt or augite-andesite, rarely porphyritic, but often vesicular with amygdale of beautiful zeolites, calcites and agate which sometimes form the principal part of the rock. Nodules are very often coated with gluconite. Traps are easy prey to weathering and weather with spheroidal exfoliation giving rise to rounded boulders (Singh 1971, pp. 568-589).

4. Denuded laterite: the source of pigments

Bhanpura plateau is a part of the Malwa region in western India which witnessed the subareal decomposition of the basalt rocks into laterite due to hot and humid climate. The peculiar structure of laterite is the result of molecular segregation among its products (Singh 1971, pp. 567-573). In its typical form laterite has a vesicular or scoriaceous appearance, occasionally having a pisolitic structure and is often mottled through irregular distribution of the ferric hydrate. Most of the laterite of the region has been washed off already in the pre-Pleistocene Age and formed thin sheets on almost entire Bhanpura- Gandhisagar plateau. It has been a good source of iron-oxide pigments of different chemical compositions and different colour shades. These pigment nodules were used for creation of rock paintings in the region. We collected iron oxide mineral colour nodules from the area around Chaturbhujnath Nala, in March 2019 and selected 7 pieces from them on the basis of variation in hue (red ochre). We did experiments of the replication of selected Mesolithic compositions on the red sandstone slabs at Dayalbagh Agra.

5. Numbering of the pigment nodules and obtaining colour out of them

To experiment in the studio (in the month of April 2021), we used the iron oxide pigment nodules which were collected from near Chaturbhujnath temple in March, 2019 (the rock art site of the same name in Chambal Valley). They were numbered from 1-7. Pigment No. 1-6 were of different shades of red colour, while No. 7 is dark brown haematite nodule, with high density and hard to obtain colour from it. All the pigment nodules we have were numbered and put in plastic bags bearing the same number. We obtained colour from them by grinding them with water on a flat sandstone slab and replicated Mesolithic compositions on sandstone slabs at Agra in the first half of April 2021.

We also prepared small plastic containers to hold the colour of the same number of the nodule, to be used for making rock art composition on sandstone slab of the agriculture field of Dayalbagh near our home. While working in the field in the replication rockshelter, we tried to use bowls made of leaves of Banyan tree (*Fis-*

cus benghalensis) and Dhak tree (*Butea monosperma*).
We selected three pigment nodules of reducing size and of varying shades, photographed the nodules along with IFRAO colour scale, rubbed one by one on a piece of sandstone slab and made vertical line from so obtained colour each side by side on another sandstone slab. We also made lines below them by crayon colour of each of them by scratching the pigment dry on the surface of the slab. So obtained colour is of three different shades of red.
We also collected pigment nodules again from near the area of Chaturbhujnath temple, on 17 April 2021. We selected three out of them and numbered as pigment nodule No. 8-10. Pigment nodule No. 8 is rich red ochre colour, No. 9 is yellow ochre, while No. 10 is light yellow ochre colour. Pigment No. 8 was used many times because of its colour matched with many of the original rock art compositions and its chunk being big in size was easy to grasp for grinding (Fig. 1). Thus, we had a range of both red ochre and yellow ochre, and that of No. 7 is dark brown.

5.1 Roasting of pigments
Most of the Mesolithic paintings are in dark red colour. Hence, we did experiment with the three nodules (No.1, 2 and 3), in the hope of getting dark red colour from the nodules we were using. Kumar first brought out a small piece of them by breaking and kept it safe in a marked plastic bag for record and analysis by XRF and XRD. The large portion was roasted for 190 minutes (3:10 hrs from 2:50 pm to 6:00 pm) in a sand-bath on 11 April 2021 at home. For this purpose, Kumar used a heavy Kadhai (an Indian kitchen utensil) half full of Chambal sand and put the pigments inside it. Sand-bath was used for smooth heating and proper roasting of the pigment nodules.

5.2 Colour obtained from the roasted pigment nodules
After cooling the pigments whole night for about 14 hrs, Kumar first photographed the roasted pigment nodules along with IFRAO scale in the sand-bath inside the Kadhai. IFRAO scale was not used in the initial photographs before roasting. The colour of the sand changed from light to brown, but not that of the pigment nodules (Fig. 2).
Then, Kumar obtained colour from all of the three roasted pigments nodules by grinding them on the same sand stone slab used previous day, close to the corresponding line of each pigment. It was surprising that there was almost no difference visible by naked eyes in the shades of colour of each nodule before and after roasting (Fig. 3). Analytical study of them in future may throw proper light on this issue.

5 .3 Pigments are not water soluble
We put the pigment nodules in water for more than 24 hrs, but to our surprise we observed that they are not water soluble. They do not yield colour even after rubbing them by hand. It is like '*hinna*' leaves, the mignonette tree (*Lawsonia inermis*). The leaves do not yield colour unless they are well crushed and made a paste of them. It is used for body decoration and hair colouring in India.
The pigment nodules produce colour only on grinding with water. So obtained colour is a suspension in water. The colour quality depends on the fineness of the grains. If the pigment grains are coarse as in case of crushing the pigment and obtaining the grains to make colour, they would not mix with water and we cannot achieve colour consistency.
It means the damage or disfiguring of the colour of rock paintings at CBN site is due to weathering of the applied pigment layer, not because of the solution of the pigment colour.

5.4 Leaf-Bowl making to collect colours and water
To collect the processed colour and to store water for replicating the rock painting compositions we required containers. We collected the large leaves of 'Dhak' tree (*Butea monosperma*) and 'Banyan' tree (*Fiscus benghalensis*), used the thorns of Karonda (*Carissa carandas*) plants available around the site to make the leaf bowls. We have to make fresh bowls every day, as the leaf became dry and would start cracking by the end of the day. We also tried coconut shell to store ready pigment, but the colour was drying very fast in it (Fig.4).
In these leaf bowls, water used to evaporate from the colour within two hours, leaving powdery colour residue behind. Therefore, we tried to cape the bowls with a leaf cap but it did not work. Then we tried narrow-elongated leaf bowls. It was observed that narrow-elongated deep leaf-bowls worked better as compared to the shallow and wide ones (Fig. 5).
We tried re-mixing the dried powdery pigment with water, but it did not work. While painting it used to become difficult to manage two bowls, one with colour and second with water, in the afternoon as the wind used to get fast and the bowl having colour sometimes used to fly away with the wind. Usually, we could make one composition only from the colour obtained by grinding the pigment for two to three hours on a stone slab in the replication shelter.

5.5 Process of colour preparation
We also tried to use verity of pigments to understand, grinding properties, pigment texture, quality of its grains, hardness, ability to mix with water, visibility and exclusiveness. Pigment no. 2, 4,7,8,9 and 10 were used for replication of the compositions. We used pigment No. 8 for many compositions as it was rich red colour closest to most of the compositions and was easy to grind, and being a big chunk, was comfortable to hold for grinding. Out of the ten pigment nodules, a small nodule No. 7, a haematite piece, was very heavy and dark in colour. It was very hard to obtain colour from it by grinding on quartzite rock with water, two times more as compared to other pigments. However, it yielded dark brown colour, almost similar to the early rock paintings of Chaturbhujnath Nala.
While preparing the pigment one has to maintain the grinding rhythm, pressure and consistency of water, then only we will get the paste appropriate for executing rock art figures comfortably. If it is not of the right consistency, one can't fix it with ease. One must follow

the entire grinding process again to prepare the fresh pigment.

Two different consistencies would result in two different colour appearances after drying. It also affects how the brush will move, hence affecting the smoothness of the strokes and causing different types of blotting. Also, if there is too much water the brush doesn't hold colour and while touching on the rock surface the colour blots uncontrollably. On the contrary if the colour is too thick it dries very fast, within minutes in the open bowl, depending on the heat and humidity in the air. Secondly the brush holds too much pigment at the tip, resulting in having a colour blob at the starting point of the line. It also restricts the brush movement.

5.6 Colour binders

We collected the milk oozing from Banyan tree leaves in a plastic bowl having some water in it. Initially it was milky, but turned to greyish after sometime. We used it as colour binder. We observed that when it was mixed with mineral colour of iron oxide, it separated water from the pigment and the pigment became sticky, not suitable to draw lines or apply strokes (Fig. 6 and 7).

6. Observations

Pigment number 2,7,8,9 and 10 were prepared at the site. Except pigment 9 and 10, all other pigments are of different shades of red ochre colour. They are fine grained and can mix with water well. Whereas the pigments 9 and 10 are of yellow ochre colour, they are of comparatively not fine grained and get separated from the water in the form of mud in bottom of the bowl.

There is no conclusive information about the binder. It needs the chemical analysis of the pigment which will be done in the next phase.

Preparing the pigment for the paintings is a tedious task. Pigment is prepared by grinding the iron oxide pigment nodules by hand on a flat stone surface using water. Some of the pigments (comparatively soft ones) were easy to grind, whereas No. 7, haematite, needed more effort and time. Preparing the pigment for 2 - 3 figures of an average size of 15-20 cm, took minimum of two hours. While making the pigment, it is observed that it needed to be collected instantly because if it was left on the stone for even a minute then it got dried up and became a powder. However, it's not certain whether the dry powder mixed with water can be used as colour or not. It can be presumed that rock painting is a group/community activity. Because during this process we did need support from other team members and that support can be physical, emotional or social. It cannot be done by an individual.

We did experiment with the milky substance of banyan tree leaves using as a binder, mixed it with the pigment 8. Approximately 30-40 ml of colour mixed with one tea spoon of binder-water (50% banyan tree milk mixed with 50 % water). The behaviour and property of the pigment changed after adding binder to it. It became even more difficult to use the brush with it. The pigment became sticky, lumpy and started sticking at the bottom of the bowl separating from the water. After drying the colour on the surface, it became dusty and would fall just by touching. It appeared that binder was restricting the rock surface to hold the pigment. The brush was not able to hold right amount of colour consistently. Once the stroke dried it would reveal that some of the strokes did not have enough pigment, just water mark is left.

7. We are presenting our experience while working with different pigment colours and their temperament in Table 1.

Sr. No.	**Pigment No**	**Pigment Colour**	**Quantity**	**Grinding Time**	**Hardness a. Hard b. Harder c. Hardest**	**Working Place Agra Bada-Mahadev (BM)**	**Residual and Texture**
1	Pigment 1	Red Ochre	05 ml	90 min.	b. Harder	Agra	Residual was a paste of fine grainy texture.
2	Pigment 2	Red Ochre	05 ml	90 min.	b. Harder	Agra and Rep. Site-BM	Residual was a paste of fine grainy texture.
3	Pigment 3	Red Ochre	-	-	-	-	-

4	Pigment 4	Red Ochre	05 ml	90 min.	b. Harder	Agra and Rep. Site-BM	Residual was a paste of fine grainy texture.
5	Pigment 5	Red Ochre	-	-	-	-	-
6	Pigment 6	Red Ochre	-	-	-	-	-
7	Pigment 7	Dark Brown Ochre	03 ml	150 min.	c. Hardest	Agra and Rep. Site-BM	Very fine residuals with smooth paste. Comfortable to work with.
8	Pigment 8	Rich red Ochre	10 ml	120 min.	a. Hard	Agra and Rep. Site-BM	Residual was a paste of fine grainy texture.
9	Pigment 9	Yellow Ochre (shade)	05 ml	60 min.	a. Hard	Agra and Rep. Site-BM	Rough residuals with grainy texture. Coarse particles separated from water.
10	Pigment 10	Yellow Ochre (light)	05 ml	60 min.	a. Hard	Agra and Rep. Site-BM	Rough residuals with grainy texture. Coarse particles separated from water.

Table 1: Nature of pigments used for replication.

8. Comments

From the present phase of replication of CBN rock paintings, we located the source of pigments and understood their processing for obtaining colour out of them, the efforts and working hours it requires and their consistencies and nature. However, the chemical analysis of the pigments of the original rock paintings on the site will help in finding the proper pigments for replication and the binder if any was used. It will be done in the next phase of the project. However, it was a good learning experience.

Acknowledgement

Rock Art Society of India for supporting the rock art replication project.

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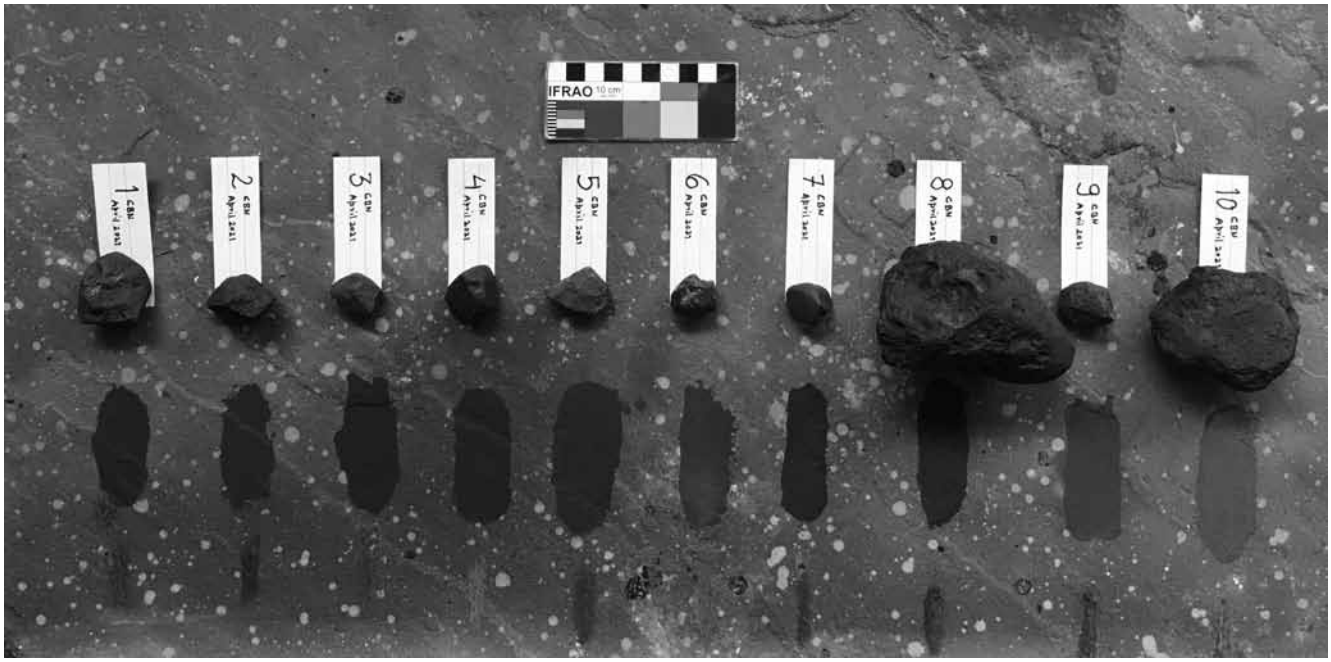

Fig. 1 - Hue scale of the pigment nodules No. 1-10, collected from in front of the Chaturbhujnath temple.

Fig. 2 - Roasting of three pigment nodules.

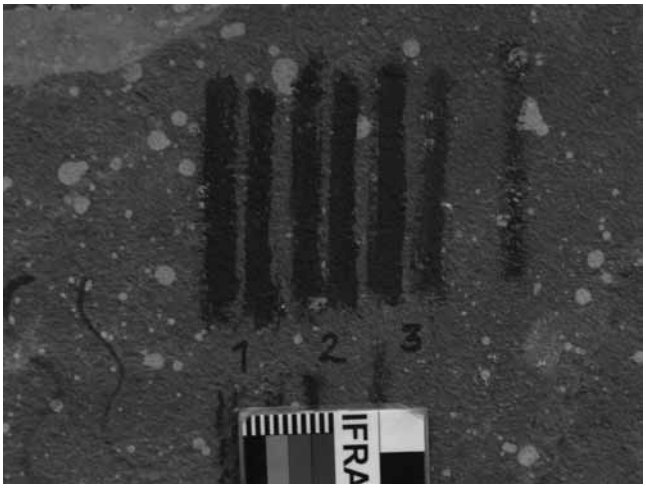

Fig. 3 - Three bands of colour in the pairs of two; left one is before roasting the pigment and right one after its roasting. The bands do not show any major difference in their colour shades.

Fig. 4 - Colour processing from the pigment nodules (pigment 4, upper one and pigment 7, lower one) by grinding on the quartzite flat surface and collecting it in banyan leaf-bowl at the replication site. Dhak leaf bowl, lying by its side, didn't work, because of cracks in it.

Fig. 5 - Colour processed from pigment 5 and collected in narrow leaf-bowl. The broad one in the upper side contains water used for grinding the pigment

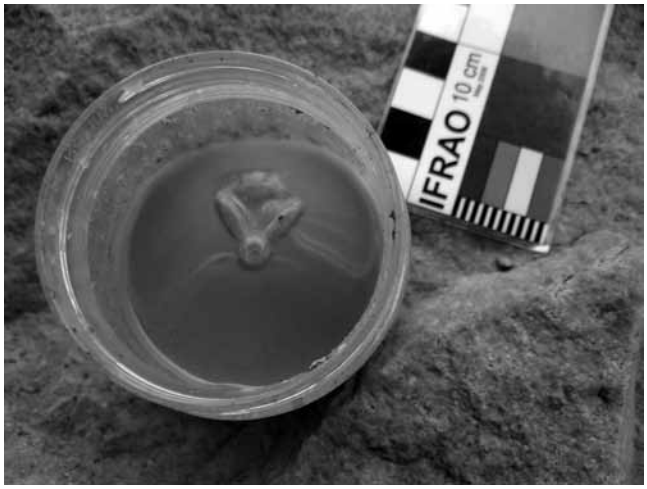

Fig. 6 - Colour obtained from pigment No. 8 and mixed with binder (Banyan tree leaves' milk).

Fig. 7 - Replication of dancing lady, Composition No. 2, with pigment No. 8 mixed with binder (Banyan tree leaves' milk).

Replication of rock paintings at Chaturbhujnath Nala
on Bhanpura plateau in Chambal Valley, India - Part 4

Replication of making brush from different organic material for producing rock paintings and their ethnographical study

Hridayshri *, Geetanjali **, Ram Krishna ***, Giriraj Kumar ****

Summary

Understanding the kind of brush used for making the quality lines and strokes of rock paintings is essential to evaluate the knowledge, skill and cognitive development of the authors of rock art. The interaction with folk artist of the region and replication of brushes and their use can help us in this direction. The paper presents our experience of the nature and temperament of the brushes we made by using different organic material while replicating the rock art of Chaturbhujnath Nala at Bada-Mahadev near Bhanpura in Chambal Valley.

Keywords: Replication- Rock Art- Brush Making-Ethnography- Chaturbhujnath Nala- India

Summary (Riproduzione di pennelli realizzati con materiale organico per la produzione di pitture rupestri e loro studio etnografico)

La collaborazione con un artista popolare della regione e la riproduzione dei pennelli e del loro uso possono aiutarci a comprendere il tipo di pennello utilizzato per realizzare le linee e i tratti delle pitture di Chaturbhujnath Nala a Bada-Mahadev vicino a Bhanpura nella valle di Chambal. Questa indagine è stata essenziale per valutare la conoscenza, l'abilità e lo sviluppo cognitivo degli artisti preistorici. L'articolo presenta la nostra esperienza nello studio della tecnologia e delle materie prime indispensabili alla realizzare i pennelli (realizzati utilizzando diversi materiali organici) che ci hanno permesso di riprodurre le pitture rupestri.

Parole chiave: Replica, Arte rupestre, Fabbricazione di pennelli, Etnografia, Chaturbhujnath Nala, India

1. Introduction

Understanding the kind of brush used for making the quality lines and strokes of the rock paintings is essential to evaluate the knowledge, skill and cognitive development of the authors of rock art. The interaction with folk artist of the region and replication of brushes and their use can help us in this direction. V. S. Wakankar and Robert R. Brooks did experiments to obtain colour by grinding pigment nodules, brush making from palmetto twigs (or porcupine quills for fine work) and *dronas* (cups) made of folded leaves of dhak (*Butea monosperma*) for copying the rock art compositions (Wakankar, Brooks 1976, pp. 13-14). Our attempt is a further study in this direction which presents our experiments with making of brush by using various kinds of organic material and their use for replication of rock paintings of Chaturbhujnath nala.

2. Ethnographical study of making brush and folk art

In the villages *mandanas (designs)* are made mostly on the floor of the houses. The ladies use fallen hair from their head as colour holder by holding it in the fingers and using ring-finger to make drawings of a design composition. For making compositions on the house-walls thick lines are made by using brushes made of palm leaf midrib, while for making compositions of thin lines, brushes made of bamboo strips are used. The dried palm midribs and bamboo strips are used for making brush. However, before making them they are soaked in water for overnight. Then their tips are chewed to make bristles of the brush. G. Kumar observed this activity in the villages in his childhood. It was also demonstrated to him by Mrs Gyarasidevi, a veteran *mandana* folk artist at Baran in Rajasthan on 6 March 2021.

Mrs Gyarasi Devi explained to Kumar the technique of brush making from organic material, method of their practical use and the process of making *mandanas*. The *mandanas* are made on the occasion of the festivals and marriages and the process is accompanied by folk songs suitable for the occasion.

Having an idea from this visit, he collected leaves and midrib of palm leaves and thin bamboo and babul twigs with the help of his friend Lakhan Singh in Sindani village in Baran district, then hair from the tail of squirrel from Ruthiyai in Madhya Pradesh. He was fortunate to obtain hair from the tail of dead langur lying in a painted rockshelter on the right bank of river Bilasi in district Baran. The material was collected from 7-10 March 2021, and was used after nearly 40 days, in the third week of April 2021. During this period the collected material became dry. Hence, we had

* Artist and Communication Designer, Rock Art Society of India. Email: hridayshri@gmail.com.
** MA Research Scholar, Delhi Institute of Heritage Research and Management, New Delhi. Email: gitanjali26aug@gmail.com.
*** Ph. D. Research Scholar, Department of Management, Faculty of Social Sciences, DEI University, Dayalbagh, Agra-282005. Email: ramkrishna.gem@gmail.com.
**** Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: girirajrasi.india@gmail.com

to soak it in water for overnight and chewed it at the tip to make the proper brush out of it. We also tried the soft fibre of Dudhi seeds to make brush on the replication site.

3. Making the brushes from organic material

We did experiment with Palm (*Phoenix sylvestris*) leaf midrib (rachis), bamboo (*Bambusa vulgaris*) branch internodes, and Indian babul (*Acacia nilotica*). Geetanjali also did experiment with brush made of common reed (*Phragmites australis*) in Delhi, prior to the field work. The reed brush absorbs colour and is not suitable for drawing lines and strokes. Out of the materials we used, the midrib fibres of palm leaf were found most suitable for making brush of the needed bristle size from thin to thick. The brushes made from the dried palm leaf midribs were found most suitable for painting than that of the fresh palm midrib. The latter lost moisture very fast, curled on drying and was unable to hold pigment properly. Besides, they were difficult to use and control. We also did experiments with the brush made of petiole of Dhak (Butea monosperma) leaf.

It is hard to cut palm leaves from the tree even with iron sickle and scissors. So, it might have been a tedious task for early man by using implements made of microliths, we presume. The palm leaflets are also wonderful. We can bring out very thin fibres from the dried young leaves after softening them in water. We prepared a brush from the hair of a dead langur (Hanuman monkey) and fastened it by a thin fibre obtained from palm leaflet. We also made brushes from Dudhi (*Wrightea tomentosa*) plant seed fibres (Fig. 1-12).

4. Testing the nature and temperament of the brushes we made

In order to test the nature and temperament of the brushes we made; we replicated the Mesolithic composition of colour strokes from rockshelter no. B7. This is a composition of freehand colour strokes made in two phases. The earlier thin ones are superimposed by latter thick strokes. To replicate the latter strokes Hridayshri did experiment with four different types of brushes by using pigment no. 8, as follows:

- Attempt one with Dhak leaf petiole brush (*patti ka danthal*). The brush could not hold sufficient colour for rapid strokes.
- Attempt two with Dhak leaf petiole brush (*patti ka danthal*). After adding a little water, the brush was holding the pigment but lost the richness of the colour and water started to trickle down.
- Attempt three with Dudhi seed fibre brush. The bristles were too soft and did not have strength to move with force, hence difficult to control.
- Attempt four with bamboo brush. This brush comparatively had the best result from the rest, but could not be called perfect. The bamboo stick was dried for forty days and the bristles were slightly harder to generate the right effect.

The brush used for these compositions did not have long bristles. When we worked with long bristles, the nature of lines on turns and at joints became very different. With the brushes made from bamboo, palm and dhak material we were able to achieve the results close to the original one. We are presenting our observations on working with different kind of brushes in Table 1.

Table 1.

Sr. No.	Brush (Materials and making details)	Bristle Size (Line thickness)	Temperament (After being soaked overnight)	Comments
1	**Bamboo, Dry** Chewed at the tip and flattened for required softness and length of the bristles.	Brush a: 2 mm	Bristles were hard and brittle, not getting wet enough to hold the pigment. Could not get continued strokes; it was stiff and not working smoothly.	Not convenient
2	**Bamboo, Fresh** Chewed at the tip and flattened for require softness and length of the bristles.	Brush a: 2 mm	Bristles were soft. Getting continued strokes with agile movement was possible but with difficulty.	Comfortable to use
3	**Babul** Chewed at the tip and flattened for required softness and length of the bristles	Brush a: 2 mm	Bristles were soft but brittle. It was getting dry very fast. Getting continued strokes was possible but with difficulty.	Difficult to use
4	**Reed** Chewed at the tip and flattened for required softness and length of the bristles	Brush a: 4 mm Brush b: 8 mm	Bristles were stiff and brittle. It was absorbing colour and getting dry at the same time. Getting continued strokes was difficult.	Not convenient
5	**Palm midrib, Dry** Chewed at the tip and flattened for required softness and length of the bristles	Brush a: 2 mm Brush b: 5 mm	Bristles were semi soft, and were able to hold a good amount of colour at a time. Getting continued strokes was comfortable.	Most convenient

6	**Palm midrib, Fresh** Chewed at the tip and flattened for required softness and length of the bristles	Brush a: 2 mm	The brush was curling when drying. The pigment was getting stuck at the tip leading to blot and needed constant washing.	Difficult to use
7	**Dhak leaf petiole - *two days old*** Chewed at the tip for required softness and length of the bristles	Brush b: 9 mm	Bristles were semi soft, and were able to hold a good amount of colour at a time. Getting a continuous and agile stroke was comfortable.	Convenient to use
8	**Dudhi Seed fibre** Tied to bamboo stick with palm leaf fibre	Brush a: 2 mm Brush b: 5 mm	Bristles were too soft. Getting continued and agile strokes was comfortable, however it was difficult to control the strokes. Though it was working smoothly but could have been better for delicate small strokes.	Difficult to use
9	**Langur's tail hair** Tied to bamboo stick with palm leaf fibre	Brush a: 2 mm Brush b: 9 mm	Bristles were slightly coarse but soft, could hold enough colour at a time. Getting a continuous and agile stroke was comfortable. It was the most comfortable brush to achieve thin and thick lines with desired control and effect maintain some amount of pigment consistency.	Most convenient

Table 1. Brushes made of different organic material and their temperament.

Concluding remarks

While replicating the compositions we realised that good quality of brush is as important as the good pigment consistency. If the brush is not in control, it moves everywhere except where we want it to move. Hence, one would feel frustrated. Working with natural brushes on the rough rock surface needs very calculated and skilled wrist movement to obtain the desired results. The brushes made of different natural material had different temperaments and different pigment holding capacities. With these brushes it is even more difficult to maintain certain thickness of lines especially at curves, angles, arches, circles, starting and ending points of the strokes. For that one needs a lot of planning and skill before putting the brush on the working surface. But in rock art we do not see any such evidence. It means the artists who created rock art were matured and skilled enough to deal with the entire process of rock art execution effortlessly.

Acknowledgement

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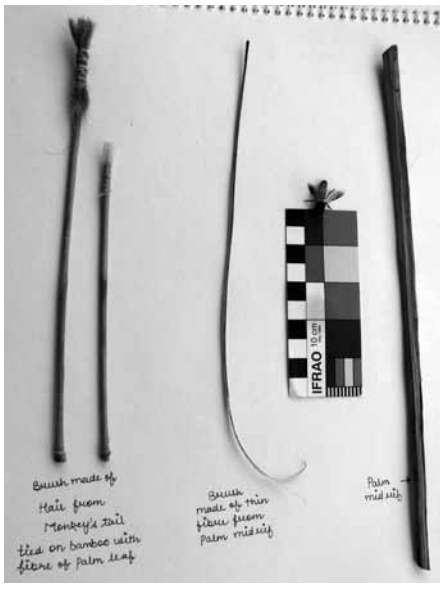

Fig. 1 - Brush made of hair from Langur tail (dead), left side; that of palm midrib, right side.

Fig. 2 - Brush made of petiole of Dhak leaf (extreme left) and rest are different kind of brushes made of dry palm midrib soaked in water overnight.

Fig. 3 - Brush made of palm midrib (left) and thin bamboo stem (right).

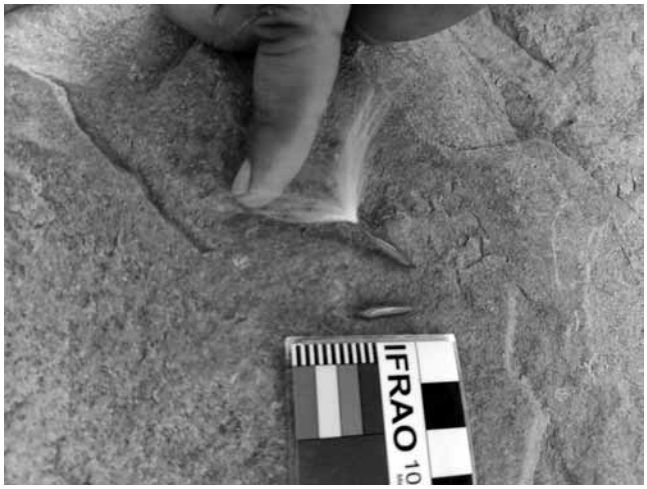

Fig. 4 - Fibres of Dudhi seeds.

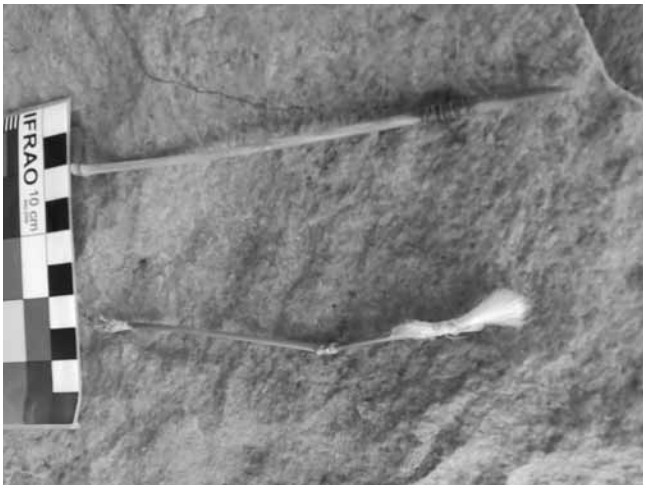

Fig. 5 - Brush made of Dudhi fibres, upper one used and lower one unused.

Fig. 6 - Brush made of Langur hair.

Fig. 7 - Brush making from Langur tail hair.

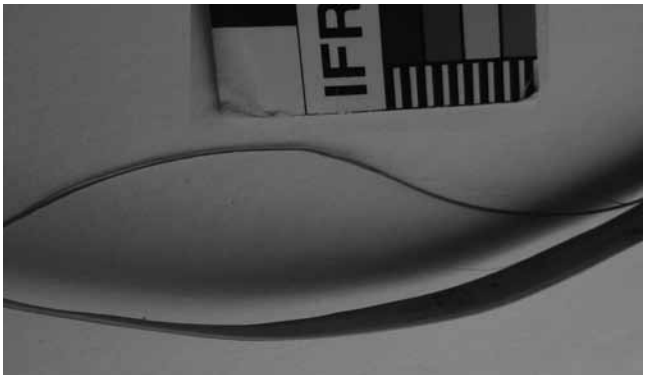

Fig. 8 - Obtaining thin fibre from dry Palm leaflet, soaked in water overnight, to tie fibres and hair for making brush.

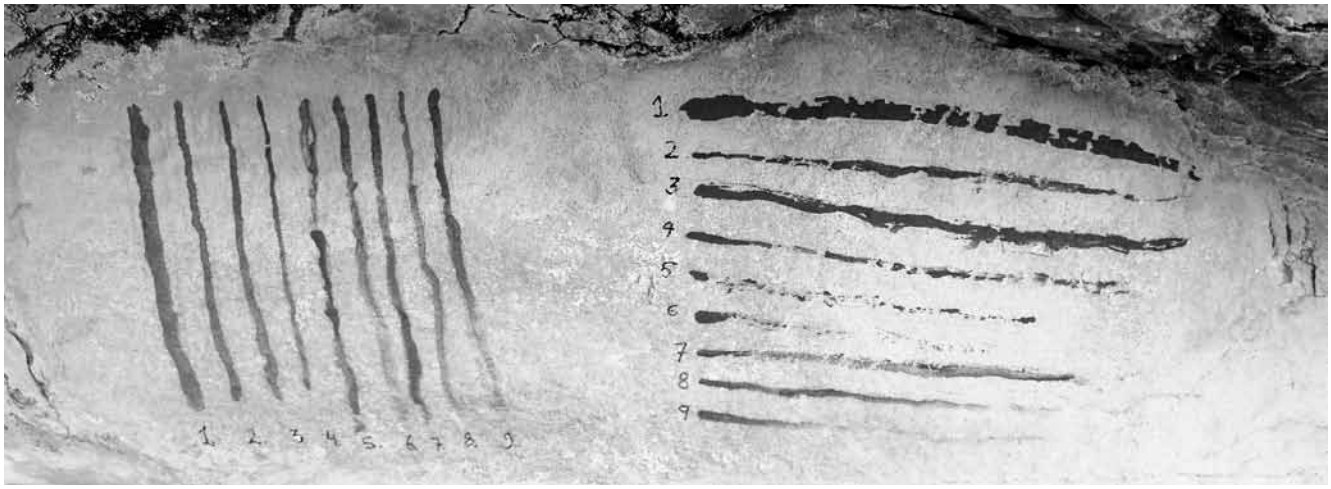

Fig. 9 - Strokes made from 9 types of brushes from pigment no. 9 (left, vertical strokes) and from pigment no. 8 (right, horizontal strokes). Table 1 follows the same sequence of the brushes.

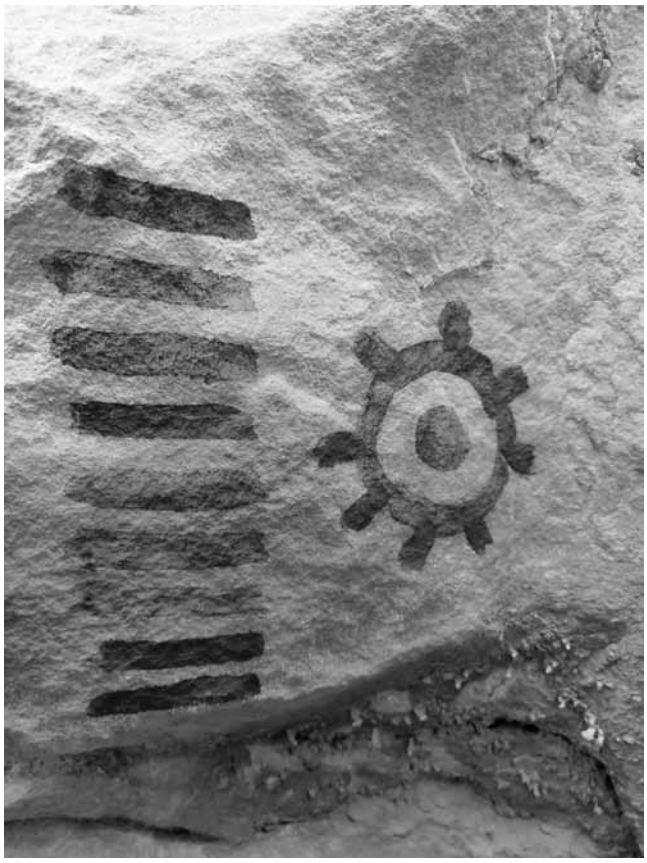

Fig. 10 - Strokes made from brush made of Langur tail-hair, 9.0 mm thick.

Fig. 11 - Practical use of thin brush made of palm midrib.

Fig. 12 - Different brush materials soaked in water container made by cutting of 2 litre of plastic water bottle.

Replication of rock paintings at Chaturbhujnath Nala
on Bhanpura plateau in Chambal Valley, India - Part 5

Replication of the processes of rock art production and our observations

Giriraj Kumar *, Ram Krishna **, Hridayshri ***, Geetanjali ****

Summary

While replicating the preproduction and production process of making rock painting compositions of Chaturbhujnath Nala, such as collection of pigment nodules, material for making brush, selection of the site and spot, making colour from the pigment nodules by grinding on the flat rock surface and executing them on the rocksheter surface we realised that creation of rock art composition is a laborious, lengthy and time-consuming process. It requires conceptualisation of the perceived reality, an idea to produce it in the form of a particular composition, selection of the site and spot for its execution, planning and team effort to execute it. To make the process enjoyable and meaningful it might have been associated with conducive climate, working hours as per the movement of the natural light, singing and other cultural activities. After finishing the task, it must have been celebrated in a humanly way as per the cultural norms of the group. It is also evident from the study of the tradition of making folk art. Thus, rock art is a reflection of the cognitive, technological and cultural development of its authors and the community it belonged to.

Riassuno (Replicare i processi di produzione dell'arte rupestre: le nostre osservazioni)

Mentre cercavano di riprodurre le pitture di Chaturbhujnath Nala, raccogliendo i noduli di pigmento, cercando il materiale per la realizzazione di pennelli, selezionando il sito e il luogo esatto per realizzare la nostra opera, molando i noduli di pigmento su una superficie rocciosa piatta ed eseguendo infine la pittura, ci siamo resi conto della laboriosità dell'intero processo e del tempo richiesto per concludere l'opera. Completare una pittura rupestre richiede la concettualizzazione della realtà percepita, un'idea per produrla sotto forma di composizione, la scelta del sito e del luogo per la sua esecuzione, la pianificazione e lo sforzo di squadra per eseguirla. Per rendere il processo piacevole e significativo potrebbe essere stato associato a un clima favorevole, orari di lavoro che sfruttassero la luce naturale, canti e altre attività culturali. La fine dell'opera, doveva essere celebrata secondo le norme culturali del gruppo, come suggeriscono le tradizioni di arte popolare. L'arte rupestre è dunque un riflesso dello sviluppo cognitivo, tecnologico e culturale dei suoi autori e della loro comunità di appartenenza.

1. Introduction

The main objective of the project on Replication of the Rock Art of Chaturbhujnath Nala was to understand the cognitive, technological and cultural development of its authors and the community it belonged to. It required proper planning and strategy such as conceiving an idea of the project, forming a team to execute it, finding a source of funding, kind of study on the Chaturbhujnath Nala rock art site such as location of the compositions to be replicated, quality of lines and strokes, overall effect of the composition, analytical study of the pigments already made in India to understand the nature of the pigments, study of the processes of making folk art in the region, collection of the material for making brush and pigments from around the rock art site under study in that light, practice to make the compositions at the respective home towns of the team members,etc., have already been presented and discussed in the previous papers from Part 1 to 4 (Kumar *et al*. 2021, Ram Krishna *et al*. 2021, Geetanjali *et al.* 2021, Hridayshri *et al*. 2021a, 2021b). Here we are presenting the actual replication process of the execution of the selected rock art compositions and our experience and observations made during this process (Fig. 1-10).

2. Selection of the replication site

As already discussed in the Part 1 (Kumar *et al*. 2021): The Project Introduction, the selection of the rock art replication site is an important decision. The replicated rock art should not have any confusion with the original rock art. Therefore, we selected a rockshelter completely devoid of rock art. It is located on the right side in the quartzite cliff of Bada-Mahadev, about 3 km north of Bhanpura town and nearly 32 km away from Chaturbhujnath Nala rock art site. The 'L' shaped quartzite rockshelter provided more or less the same nature and temperament of the rock surface and envi-

* Director of the Rock Art Replication Project and Secretary General, Rock Art Society of India. Email: girirajrasi.india@gmail.com.
** Ph. D. Research Scholar, Department of Management, Faculty of Social Sciences, DEI University, Dayalbagh, Agra-282005. Email: ramkrishna.gem@gmail.com.
*** Artist and Communication Designer, Rock Art Society of India. Email: hridayshri@gmail.com.
**** MA Research Scholar, Delhi Institute of Heritage Research and Management, New Delhi. Email: gitanjali26aug@gmail.com.

ronment of rock art site. We named it as, 'Replication Laboratory of CBN Rock Art'.

3. Replication of the selected rock art compositions

Replication Processes and observations

We replicated 6 rock art compositions from Stone Age Period I: Mesolithic and 5 chariot compositions from Early Cattle Domestication, Period II. In order to experiment with different kind of pigments and brushes we replicated some of the compositions two or more times. The details of our replication work have been presented in Table 1, with comments on our experience and observations. Two replicated compositions (Fig. 11 and 12) have also been presented in this paper.

Table 1.

S. No.	Composition	Pigment No.	Attempt No.	Brush Used	Remarks/observations
1	**CompositionNo. 1, Running Archers, RS D6-10**	Pigment 7	Attempt 1	Dried palm leaf midrib strip, chewed and flattened	Pigment was dark brown ochre; its residual had fine grainy texture and turned into a paste. Brush bristles were semi soft. It was able to hold a good amount of colour at a time. Getting continued strokes was comfortable.
		Pigment 9	Attempt 2	Thin brush made of tail hair of Languor	Pigment was a shade of yellow ochre; its rough residuals with grainy texture and had coarse particles. It was separating from water. Though the pigment was coarse in texture yet the brush was able to hold enough colour. Bristles were slightly coarse but soft. Getting a continuous and agile stroke from it was easy. It was the most comfortable brush to achieve thin and thick lines with desired control and effect maintain some amount of pigment consistency.
2	**Composition No. 2, Woman in rhythm (Dancing lady), RS F1**	Pigment 8 + Binder (white milky fluid oozes out from Banyan leaf)	Attempt 1 Attempt 2 Attempt 3 Attempt 4	Thin bamboo internode sharpened with blade, chewed and flattened	Pigment was rich dark red ochre; its residual had fine grainy texture, turned into paste. But after mixing with the binder the mixture became sticky and lumpy. It started sticking at the bottom of the container. The brush was not able to hold the right amount of consistency of the pigment. The rock surface was also not holding the pigment, and after drying it was dusting off.
3	**Composition No. 3, Load bearers, RS B4**	Pigment 10	Attempt 1	Dried palm leaf midrib strip, chewed and flattened	Pigment was a shade of yellow ochre; its rough residuals was grainy in texture with coarse particles. It was separating from water. Though the pigment was coarse in texture, the brush was able to hold colour. It was comparatively comfortable to work with the pigment. However, the yellow ochre was not dark enough, hence the composition made out of it was not appearing sharp in contrast to the rock surface.
4	**Composition No. 4, Rhinoceros, RS B4**	Pigment 8	Attempt 1 Attempt 2	Dudhi seed fibre brush	Pigment was rich intense red ochre; its residual was a paste of fine grainy texture. The brush-bristles were too soft, hence were difficult to produce controlled strokes. It might have been better for fine, delicate and small strokes.
5	**Composition No. 5, A buffalo with large broad horns, RS F1**	Pigment 4	Attempt 1	Thick brush of bamboo,	Pigment residual was a paste of fine grainy texture. Bristles were soft. Getting continued strokes with agile movement was possible but with difficulty.
		Pigment 4	Attempt 2	Dhak leaf petiole.	Pigment residual was a paste of fine grainy texture. Bristles were semi-soft, and were able to hold a good amount of colour. Getting continued strokes was comfortable.
6	**Composition No. 6, Free hand colour strokes, RS B7,**	Pigment 8	Attempt 1 Attempt 2	Dhak leaf petiole brush,	Pigment residual was a paste of fine grainy texture. Bristles were semi-soft, and were able to hold a good amount of colour. Getting continued strokes with force was not possible.
			Attempt 3	Dudhi seed fibre brush	Pigment residual was a paste of fine grainy texture. The brush bristles were too soft and held enough colour. Yet, it was difficult to control the strokes with force to get a pointy tip with a thick bottom.

			Attempt 4	Thick brush of fresh bamboo,	Pigment residual had fine grainy texture and turned into paste. Bristles were soft. Getting continued strokes with agile movement was possible but with difficulty. This brush was much better and created the closest desired effect as compared to other brushes for this particular composition.
7	**Composition No. 7, Chariot No. 1, RS B17, A chariot with two charioteers**	Pigment 10	Attempt 1	Dried palm leaf midrib chewed and flattened	Pigment didn't mix with water well. But while using, the brush didn't need to be washed with water frequently and long strokes could be made easily.
8	**Composition No. 8, Chariot No. 2, RS B17, Two chariots, one with four charioteers, another suggestive one**	Pigment 8	Attempt 1	Dried palm leaf midrib strip, soaked in water, chewed to make brush	Before using the brush, it needs to be soaked in water. Its capacity of holding the colour was also less.
		Pigment 8 + binder	Attempt 2	Dried palm leaf midrib, fresh palm leaf midrib chewed and flattened	Binder makes the pigment thick and lumpy. It dried up quickly. The fresh palm midrib brush was curling as it was drying.
9	Composition No. 9, Chariot No. 3, RS B17, **A chariot with two charioteers**	Pigment 4	Attempt 1	Dried palm leaf midrib chewed and flattened	Due to the heavy wind the colour on the brush dried very fast, hence needed to be washed frequently.
10	Composition No. 10, Chariot No. 4, RS B17, **A chariot with four horses**	Pigment .8	Attempt 1	Dried palm leaf midrib chewed. Dudhi seed fibre brush	Continuous use of brush for long time decreases its efficiency. Thin line strokes are easy to make with bristles of Dudhi seed fibres but not suitable for making solid figures. Due to the heavy wind the colour on the brush dried very fast, hence needed to be washed frequently.
11	Composition No. 7, Chariot No. 5, **RS B17, A wheelless chariot**	Pigment 2	Attempt 1	Dried palm leaf midrib chewed and flattened	Due to the heavy wind the colour on the brush dried very fast, hence needed to be washed frequently.
		Pigment 9	Attempt 2	Thin brush made of hair of languor's tail	Pigment has a muddy texture but is still suitable for painting. Brush is fine and smooth, and long strokes can easily be made. It is one of the most convenient brushes to be used.

Table 1. Replication of the CBN Rock Art Compositions and number of attempts made by using different kind of pigments and brushes with comments.

3.2 Observations and understanding after the replication work

3.2.1 Execution

We were not copying the compositions, rather attempting to replicate them.

While replicating we were appreciating different aspects of each rock art composition such as uniqueness, different narratives, communication elements and choice of different information highlighted by different artists.

3.2.2 Locations and execution positions

Different challenging positions to execute the compositions at certain locations was an adventurous and thrilling experience. The thrill and excitement continued even in explaining to someone about the efforts made. It seems to be a part of the activity.

Some spots or angles of the composition demand extreme physical efforts but when one really sit/lie down in the viewing position the experience is rewarding.

The understanding of the nature of rock and its behav-

iour with pigment confirms that the artist was having proper understanding of the nature of rock surface and its behaviour with colour.

3.2.3 Season of rock painting execution

We were replicating the rock painting compositions in the third week of April 2021. The temperature was nearly 40° C and the wind was blowing fast. Hence, the colour dries soon. It means the rock painting compositions were not made in dry summer (April-June). Rather it must have been a venture mostly during winters and sometimes in rainy seasons when the sky was open and climate was pleasant.

3.2.4 Dealing with the mistakes

In the execution of rock paintings on the rough surface of a rockshelter every stroke is a final stroke. The artist could not afford to commit mistake. However, if such a mistake happened, the artist has hidden it very intelligently by overlapping, thus making the lines thick at that particular point.

4. Comments and insights

The skill of the artist, to observe and analyse the three-dimensional environment and his ability to present it on two-dimensional surface in minimal lines and strokes, made the composition very effective, full of dynamism, and it communicates a lot of details. In some cases, he also tried to create visual illusion in the rock art compositions e.g., Composition No. 2.

The artist needs to keep in mind the climate, sun movement, availability of the resources and platform to demonstrate physical capabilities and skills.

The movement and quality of strokes depend on multiple factors like the nature of pigment, its consistency, thickness and quality of the brush, position of the artist to execute the composition, body and arm angles chosen to paint, surface selection and climatic condition. All factors are interdependent on each other to produce a quality outcome.

The form and position of each figure in a composition down to the sequence of the strokes, when to stop or start a stroke, when to dip the brush in the colour again, clarity of visual library one has in mind to execute the composition and the visual hierarchy (highlights) of the composition need micro level planning and strategy.

The process of replication made us to realise that the execution of rock art needs a proper microlevel planning, combined efforts of a team with proper work distribution and hard work. Thus, we learned that the execution of rock art is not a single person's activity, rather it is a team work. One has to rely at many levels on the team members which could be phisical, emotional and social.

It is difficult to make compositions on the rough surface of a quartzite rockshelter and is more difficult to execute figures on its roof. So far, the replication of rock art is a great learning experience; we realised the significance of the scientific vision to study and understand rock art.

The artist must have good understanding of the flora, fauna, seasons and climate, nature and behaviour of the animals and their anatomy, so that he could be able to produce the kind of the rock art compositions of Chaturbhujnath Nala. It is evident from our experience while replication of the selected compositions.

One must be physically fit to grind hard dark-brown pigment nodule (haematite nodule) which needs extra hard effort and time to obtain colour from it. It was a difficult task for even very fit young male member of our team.

The ready colour dries very fast. One must collect it immediately while grinding and needs to used immediately. It is best if one person grinds the pigment and another is assisting to the artist making the composition.

It was more fun to find and select the pigments, making leaf containers, grinding pigment nodules, carry loads of water or get water from the nearby water stream with the group and sharing work and responsibilities.

Though we used to start the day with all the energy and enthusiasm every day, but it used to be very tiresome and strenuous in the afternoon (in the third week of April 2021) when the sun was hard and wind started to blow fast, making most of our energy drained out. In those difficult moments support of each other, light conversations and sharing stories were really uplifting and helpful to keep going on and enjoy the process.

During the lunch time on the site in the afternoon the group discussion and exchange of our observations and ideas really helped to resolve the issues we had with our own work, problem solving and better understanding of the process by learning from each other. Some solutions and ideas worked at individual level and brought us deeper insights on personal preference, comfort and uniqueness of individuality.

Once the shelter had our replicated compositions after working for a week by putting a lot of hard work to it, it developed a sense of belongingness and comfort with the site and the compositions in us. It also looked beautiful and we felt personal belongingness with it, specially sitting on the spots and in the corners where each of us made our respective compositions (like our own room or territory).

The entire process of rock art replication was adventurous and educative, right from collecting and finding pigments, study of the selected compositions on the site, finding the proper site for replication of rock art compositions far away from the original site, every morning climbing the mountain cliff of Bada-Mahadev to the replication site with all our heavy bags and articles, exploring and identifying resources around the shelter during entire replication process in a group, and above all enjoying our work and the discussions. Having no phone connection helped us more to connect with work, with the nature and each other.

Rock art execution must have been a gathering of a group of persons for specific purpose and duration, when resources were in abundance, enough wild fruits and water nearby and sun and wind support in the day. When we worked in a group, sharing workload and task was so helpful and enjoyable. Such kind of

inducive environment and combined efforts are necessary for dealing with a difficult but enjoyable task of the execution of rock art.

This first phase of the project gave us huge insight into the process of making rock art and pre-historic men's cognitive and analytical abilities, his observations and working skills, physical and emotional strengths to execute the artistic projects. This project opened a window to peep in to the creative world of the authors of rock art, their cognitive abilities and cultural development.

5. Concluding remarks

Obtaining suitable pigment nodules, colour preparation, finding proper material for making the desired brushes to make rock art composition(s) and then its execution by an artist is a tiresome job. Therefore, creation of a rock art composition must have some specific purpose. To make all the processes enjoyable it must have been a group activity in which different persons were assigned different tasks and all such activities must have been accompanied with some sort of rituals and singing.

While replicating the compositions we realised that the figures were made by the mature artists with high level of cognitive development, skills and efficiency to execute and express the experienced reality. The lines and curves of the original rock paintings are very powerful and are capable of communicating information and generating a lot of feelings. We could replicate them up to an extent only even after a lot of practice. We missed the crucial curves in the lines and proportion of the figures. It was mostly because of not having the full control on the brush.

The chemical analysis of the rock painting compositions and that of the pigment nodules we have been using for replication, is a must to really appreciate the knowledge and experience of the artist to use the local resources and his cognitive abilities. It will be materialised in the next phase.

We can learn a lot from further scientific and deep study of rock art and the replication of the processes of its production by using multiple methods and material.

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Fig. 1 - Rock art composition replication practice at Agra, India.

Fig. 2 - Rock art composition replication practice at Delhi, India.

Fig. 3 - Pigment nodules collection in front of Chaturbhujnath Temple, at Chaturbhujnath Nala rock art site.

Fig. 4 - Discussion about the pigments on the site.

Fig. 5 - Discussion about the location of the rock art compositions and possible strategies to execute them by their authors at Chaturbhujnath Nala rock art site (CBN).

Fig. 6 - CBN Rock art replication site and its location in the quartzite cliff just about the hut of Bada-Mahadev near Bhanpura (just above the hut).

Fig. 7 - CBN Rock art replication rockshelter, front view.

Fig. 8 - The replication rockshelter, named as CBN Rock Art Replication Lab., Bada-Mahadev.

Fig. 9 - Colour processing from the pigment nodule at the replication site.

Fig. 10 - Replication of the CBN Composition No. 3, the load bearers.

Fig. 11 - Replicated composition no. 1 of Part 2a (no. 1 in Table 1 of the present paper, attempt 1), a group of three archers. Mesolithic, CBN.

Fig. 12 - Replicated composition no. 4 of Part 2b (no.10 in Table 1 of the present paper, attempt 1), a chariot with four horses yoked to it, Period IIb, CBN.