Principles and Application of Pigment Trace Element Method for Dating of Rock Art in India

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Summary
Development of suitable technique and methods for dating is most urgent and essential for understanding the chrono-cultural milieu of rock art in regions. In India, occurrence of rock art is most frequent in the rock shelters where the walls and sometimes even the overhang ceiling display rock art imagery. The principle of the present proposed method indicate that during its course of painting on the rock surface, some evicted drops and droplets of paints are accumulated on the floor and in its vicinity. Such in situ preserved evidences of droplets of paint are basic sources to relate the pigments, paint or both to a particular stratum or sealed layer of a floor deposit, which may be enriched with tools, artifacts and other biotic as well as cultural remains of the respective period.

Riassunto
Lo sviluppo di tecniche e metodi per la datazione sempre più efficaci è essenziale per comprendere il contesto crono-culturale dell'arte rupestre. In India, l'arte rupestre è riscontrata con frequenza nei ripari sottoroccia, sia sulle pareti che sul soffitto. Nell'articolo si esemina come durante la realizzazione dei queste pitture in riparo, alcuni pigmenti colorati percolino sul pavimento, spesso occupato da oggetti di cultura materiale. La presenza di questi pigmenti è stata fondamentale per mettere in relazione le espressioni figurative con gli strati del deposito piano, che può essere arricchito con utensili, manufatti e altri resti biotici e culturali della rispettivo periodo.

In the field of rock art research in India during last 140 years excepting very few exceptions, all attempts have been made to determine the antiquity of rock art mostly from techno-stylistic considerations and in the view of iconic study. Archaeological excavations in the rock art sites or in the neighbouring region producing varied artifacts from layers of different periods were also a potential source for determining the antiquity of rock art. Although, in such attempts relation between rock art and archaeological periods were mostly guesswork and so created much controversy among the groups of researchers of different periods.

Indian rock art scholars like Gordon (1939-40), Wakankar (1976), Pandey (1990, 1993) etc.; had suggested chrono-cultural evolution of rock art on the basis of certain morphic criteria such as style, use of colour and superimposition. But the stylistic development can hardly be traced uniformly in actual situation within the entire region. So, for the present purpose priority is given on the quantitative classification of the motifs prevalent in the region.

The principle of the present proposed method indicate that during its process of painting on the rock surface, drops and droplets of paints could have been accumulated on the floor and in its vicinity. Such in situ preserved evidences are basic sources to relate the pigments, paint or both to a particular stratum or sealed layer of a floor deposit, which may be enriched with tools, artifacts and other biotic as well as cultural remains of the respective period. Therefore, to follow this method, primarily a trial trench is essential to dig on the floor exactly below the surface of the painted part of any rock to trace the drops and other remnants from the prepared paint. It is possible that a portion of such trace element containing at least some nano-samples from the paint could be recovered.

Possiblity for finding of such trace element could be further enhanced by series of experiments. Several such experiments already conducted has revealed that the stone nodules, boulders and angular gravels etc. that generally remain spread over the floor in actual situation are more potential sources to contain and preserve the drops or splashes left from the paint, brush or both. Rather, the drops of paint left on sand and other granular particles of the deposit could not be separated or detected from its sandy and granular matrix.

For determining absolute chronology of rock art, particularly from its components of paints and related ingredients such as brush and other applicators, the primary crisis is to trace the unaltered pure and ideally preserved sample of paint prepared during the past. Usually, the sample of paint which we may collect today from the rock canvas, are already altered or in the process of gradual modification due to exposure within an open forest environment. Periodic climatic influences including either direct or indirect effect of moisture from various sources, wind, sunlight, dust and other rigorous exposure to biotic factors such as pollens, lichens, fungal colonies and encroachment by insects – altogether such wide ranged and interlinked

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factors damage or transform the basic paint once used for rock art imagery. Sometimes, due to percolation of rainwater and other natural physical and chemical processes for weathering active in nature, a protective filmy thin layer of silicon or other chemical patination cover the paint. In such instances, the painted images become indistinct and become more clearly visible when painted lines are moistened or washed by water. The above facts reveal that why direct dating from the paint is practically problematic as it is by nature is available in open condition. Therefore, the collected sample is basically contaminated. Such context of rock art is somewhat different from its European context where at least in some selected sites, rock art galleries are protected within underground tunnels almost in sealed condition without much exposure. Such state of preservation of samples with minimum contamination of sample is ideal for collection and analyses.

It is also relevant to mention that in the proposed method, it is always recommended that that the comparable samples of paint both in rock art images and as drops and stains on the floor or on the bedrock must be confirmed as originated from same sources. It is experienced from actual field situation that sometimes the colour shade as visible in the rock art may not be identical to the marks of spots and drop found immediately below on the rock floor. The factors for weathering on the rock canvas may not be same in its immediate below the ground level. Although both spaces are closely located. In such cases, where considerable variation in colour occurs between two such samples, chemical composition of each sample could be verified and successively compared by simulation using spectroscopy and such other chemical analysis.

Use of strokes of crayon or lumps of solid pigment directly on the rock surface by rubbing was another method implied in early rock art tradition of Central India. Such method of drawing resulted some specific features such as – irregular contour lines to represent figures. When figures are technically represented as solid – bodied or block figures, the colour pigment is filled within a space bordered by contour lines. In such application, the colour filled within the space is unevenly arranged with discontinuity. Such linear markings are relatively blunt in contrast to sharp lines formed by liquid-base paint applied by using brush or any other applicator.

Mathpal's (1984) study on Bhimbetka has documented the presence of few drawn motifs by using solid crayon method. The drawn motifs by using crayons cannot be useful for analysis by the present proposed dating method. Rather, the fragments of used crayons or such other pigments or similar lumps of calcium etc. could also be dated when remains of such used pigments, usually nodules of red ochre or haematite could be recovered from the deposits underlying the floor of the rock shelter. Some parts of bedrock near to painted part of wall were used as a palette for preparation of paint before its use.

The present proposed method of relative dating is more suitable in central India, as in this region, maximum rock art images are only paintings and the technique involved is by using paste –like liquid – base paint rather than the use of crayons. The present method is not applicable to date the petroglyphs that are relatively more common in the southern peninsular region if India.

It is also proposed that a to-scale photo-documentation of the excavated and exposed part of the floor containing marks of drops and droplets from paint is essential. The colour image of the floor is to be printed on a transparent sheet arranged with graphical coordinates. Then another similar graph-sheet containing the entire panel of rock art is to be prepared. Finally, two sheets of transparencies marked with graphic coordinates are to be superimposed on each other keeping the coordinates of axis of both images align together. Such technique may identify that exactly which rock art image on the ceiling is connected to the marks of drops or droplets of paint marked on the floor. Using this technique, exact figure of rock art could be identified to a particular cultural assemblage allocated to a specific period. Presence of different colours and variation of shades are also important to trace the association between particular rock art imagery on the top and the marks of droplet from the paint deposited below on the bedrock or other substances at its base.

It is observed during field study that such pouring down of drops from paint which causes its marks on the floor are least visible when the distance between the ceiling and its base is extremely narrow. In such occasion due to shortage of space, the painter during painting activity either had to lay or stretch out on the floor or to keep the body in inclined position resting on the floor. The possible reason identified for absence of any marks of paint on the floor is that – the painter could manage his activity for painting only in lie down posture. Then the drops of paint directly falls on the body of the painter rather it touches the floor. In doubtful instance, spectroscopy, componential analysis and other chemical analysis could confirm whether both samples had derived from a single source.

The proposed method being discussed here is based on two major observations that are:

Selection of the rock canvas for painting, particularly the degree of sloped surface for painting; the smoothness of the rock surface; the nature and selection of the applicator or brush and finally the thickness of the liquid paint-all are factors responsible for possibilities for pouring down of drops from the prepared paint. When the rock surface is inclined, due to gravitational forces, the possibility for pouring the droplets are more. Therefore, logical assessment reveals that for painting directly on the ceiling possibility for occurrence of dripping from paint became maximum. During painting on the ceiling at the top, such drops of paint will fall on anything just below it. Therefore, in such condition only a specific and selected space on the floor need digging and a limited trial trench may be necessary to locate the drops of paint, if any left its mark on the floor. Generally the scholars of rock art become more involved in documentation of the painted part of the

galleries ignoring the contextual evidences and marks left on the floor part of the shelter or of a cave.

Application of the proposed simulation method in actual field situation has been attempted preliminarily in a relatively well-preserved and excavated site. The site is located in Pachmarhi, Mahadeo Hills, namely Dorothy Deep rock shelter which was excavated by Hunter (1935) between the year 1932 and 1935. Dorthy deep rock shelter is situated in the north western corner of Pachmarhi town, and about 2 km further north from Belle View. The rock paintings of this site was initially studied by Gordons and then Hunter excavated it and successively published one interim report (Hunter 1935) followed by a final report (Hunter 1936).

Dorothy deep site is primarily a wide rock shelter along a spacious hall-like chamber inside. In Pachmarhi, Mahadeo Hills the site is located about 200 feet above jambudwip nala- a hill stream that flows from east to west direction through the forestland and steep georges of about 200 feet in height in both sides of the narrow valley. The floor of the rock shelter is about 70 feet at its greatest length and extended from east to west direction. The depth inside the shelter is 30 feet in average along from north to south direction. G.R.Hunter – an European administrative officer had excavated the rock shelter between the years 1932 and 1935 and found the existence of two successive occupational layers rich in artefacts and other associated finds. Three Human skeletal remains were recovered from the deposit including two of children and one of an adult. There two successive layers were found by Hunter (1935, 1936) during the course of his excavation. The earlier lower strata reveal a pre-pottery microlithic stage where skeletal evidences along with hearths, pieces of animal bones, animal teeth; ashes; shell, charcoal, shell of crab, ivory ;pigment and profuse debitage flakes were recovered from the lower layer along with Tardenoisian type of microliths. The upper strata containing relatively thin layer include fragments of pottery. No evidence of pre-Mesolithic occupation is available in the rock shelter. Any sterile layer in between the two or overlapping of the two stages is not found there. The uppermost pottery – bearing layer is totally absence of any metal implement.

Within a total number of 81 motifs in this rock art site, the maximum is of anthropomorph and material culture (54; 66.67%), other categories are lower, zoomorph (10; 12.35%), anthropomorph (8; 9.88%), material trait (3; 3.70%), unidentified (2; 2.47%), zoomorph and anthropomorph (1; 1.23%), zoomorph, anthropomorph and material culture (1; 1.23%), and non-figurative motif (1; 1.23%). In style of execution, majority of the motifs are block or solid body (711 87.65%). Other categories are fewer and with a body filled pattern (3; 3.70%), contour line (1; 1.23%), and hollow-body, partly filled (1; 1.23%).

Within a total number of 81 images maximum (58; 71.60%) are viewed fronto-laterally. Other represented views are : profile (12; 14.81%), unidentified (6; 7.41%), front (4; 4.94%) and front or back (1; 1.23%).

Among morphic forms, Naturalistic figures are preponderant (76; 93.83%) while stylized (3; 3.70%) and linear motif, sign etc. are very few (2; 2.47%). Majority of paintings are small (53; 65.43%) and few others are in medium (26; 32.09%) and large (2; 2.47%) categories. The monochrome figures are found in majority (75; 92.59%) and only 6 (7.41%) are bichrome, painted in vermilion red and white.

Most of the human figures are represented as warriors holding weapons, as stick, club, sword, shield and quiver. Archers with bow and arrow motifs are represented in larger dimensions. Warriors riding horse and elephants and holding weapons are not rare. Combinations of two or several types of weapons are more frequent.

The zoomorph is represented as elephant (1), horses (2), deer(2), bovid (1), lion (1) and unidentified quadruped (4).

The fragments of recovered human bones have not been properly studied and so its racial identification is still unknown. According to Khare (1934) the human skeletons recovered from the deposit are of two children and one adult. The racial features of the skeletons are similar to the indigenous tribal population of the area.

Hunter's excavation reports (1935, 1936) show graphical illustrations representing plan of both vertical and horizontal sections and coordinates of the surface-contour of the entire floor which was excavated entirely upto the bedrock level at the bottom. Following the measurements of the deposit in both horizontal and vertical directions, as viewed in the reports the datum line and level was identified and marked accordingly. Ultimately, following the graphic coordinates of the grid markings at equal intervals in all directions, the pre-pottery and its overlain level were reconstructed throughout the contour line along the rock wall.

It is significant to note that further detail scrutiny along the borderline of the walls (particularly inner part of the shelter) has revealed the presence of some linier arrangement of faded spots of white paint that were the remnants of drops and droplets of paint left during painting activity.

Detail observation on the marks of drops from prepared paint suggests that only white paint was applied in the rock art imagery where thematically majority of figures were battle scenes and horse riders. Such association between two sets of markings are compatible. Thus the white spots that were almost in sealed condition embedded within the uppermost part of deposit on the floor, could be directly connected to the paintings of battle scenes emerged in later period. Any other similar connection between rock art and earliest occupation level during pre-pottery microlithic stage could not be established by using same principle. Because such marks of paint could hardly be traced in any part of the wall below 18" inches from the surface-level. Any corresponding mark on the surface of the rock wall could only justify the relation between the two evidences as of same period.

Knowledge on formation of stratigraphic layer follow Geological principles of superimposition. Such principle could be applied for analysis of cultural materials unearthed from the layer. The proposed technique and

its related method in totality is considerably simple, manageable and inexpensive too for its application. Availability of such direct evidence may not be possible from all rock art sites. In this method, there is extensive scope for relating a particular type of rock art imagery, its style, theme, technique to a distinct cultural period. Such period could be determined from the already established palaeo-climatological stages substantiated by geological record applicable to that region. A regional model for development of art practices could also be feasible by employing such methodology. So that, the periodic development of rock art and its relation with the regional cultural history could possibly be reconstructed more successfully by utilizing such proposed new methodology for dating. This proposal, at this stage is more a conceptual framework for developing a suitable methodology and technique for valid chrono-cultural reconstruction of rock art. Rock art is only an indispensible part of socio-cultural fabric and its associated relics are equally important to retrieve the same cultural fabric in its successive sequential order. This method is not restricted only to Indian context, rather it is universally applicable to determine chrono-cultural setting of rock art.

Further experimentation and scrutiny in varied condition is essential before final application of this method for indirect chrono-cultural determination of rock art. In the field of rock art, absolute dating from sample of paint or pigment can only be a source to indicate the beginning for a passage of a physical entity. When rock art act as a part of living tradition and continued for generations, it can never be limited within a specific period. Rather, it influences its successors as a source for inspiration and transmits codified messages through visual symbols and narratives even to its viewers beyond any boundary of time and space.

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Fig. 1 - Natural entrance of the rock shelter, Dorothy Deep; Pachmarhi.

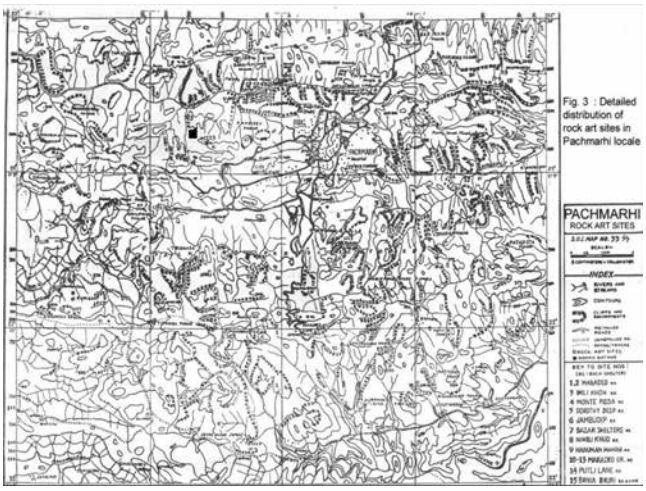

Fig. 2 - Topo-sheet of Pachmarhi locating the distribution of rock art sites.

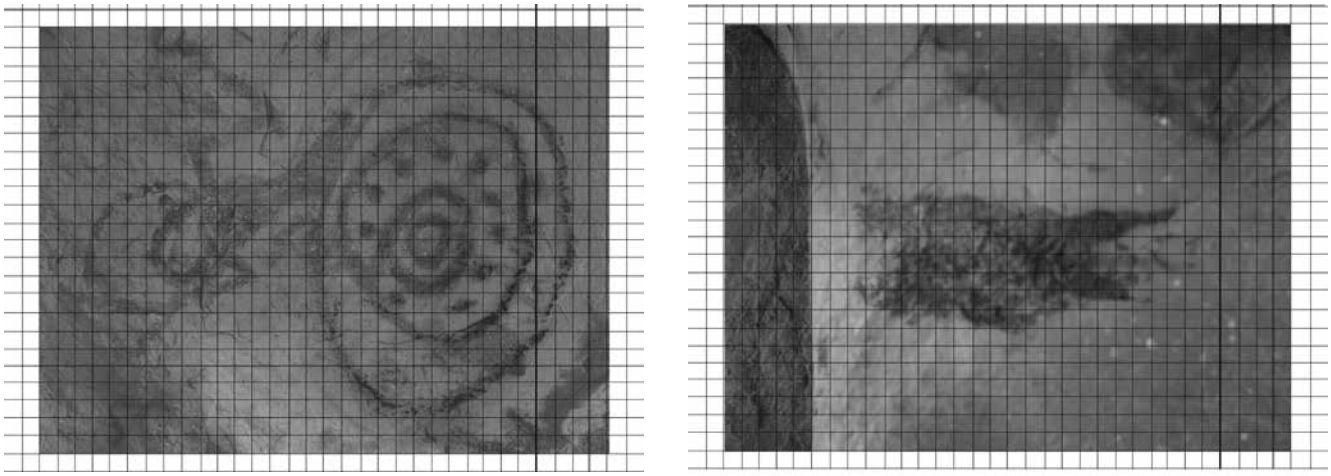

Fig. 3 - Painting on the ceiling (a) and mark of paint on the exposed bedrock of the floor (b). The colour image of the floor is printed on a transparent sheet arranged with graphical coordinates. Then another similar graph-sheet containing the entire panel of rock art on the ceiling is prepared. Finally, two sheets of transparencies marked with graphic coordinates are superimposed on each other keeping the coordinates of axis of both images align together. Such technique may identify that exactly which rock art image on the ceiling is connected to the marks of drops or droplets of paint still visible on the bedrock of the floor.

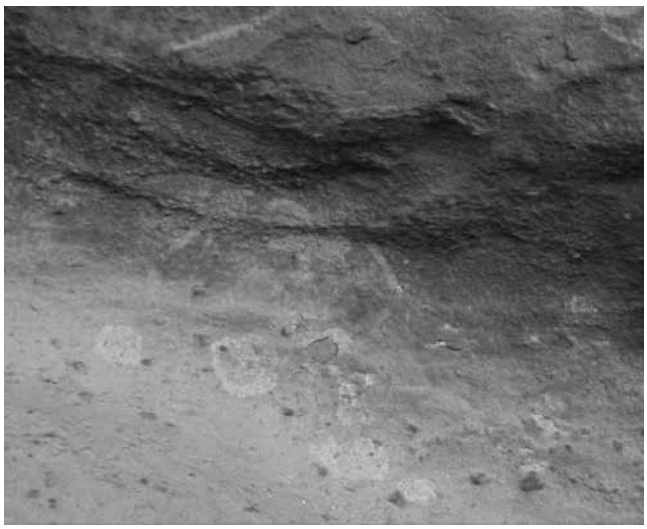

Fig. 4 - Fig : 6 White patches of paints fallen below the painted surface of the rock are visible.

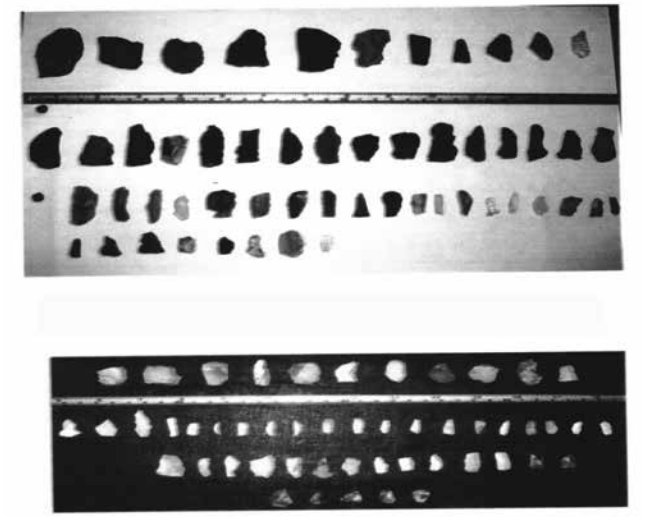

Fig. 5 - Fig : 7 Microliths – including geometric and non – geometric types were collected from trenches of Dorothy Deep rock shelter.

Fig. 6 - Figure of an archer in white superimposed on a large figure of a quadruped animal painted in bichrome.

Fig. 7 - Excavated parts of the rock shelter showing the accumulated white paint just below the painted surface. Such white marks were embedded within the floor deposit and became exposed only after the clearing of the entire deposit during excavation.

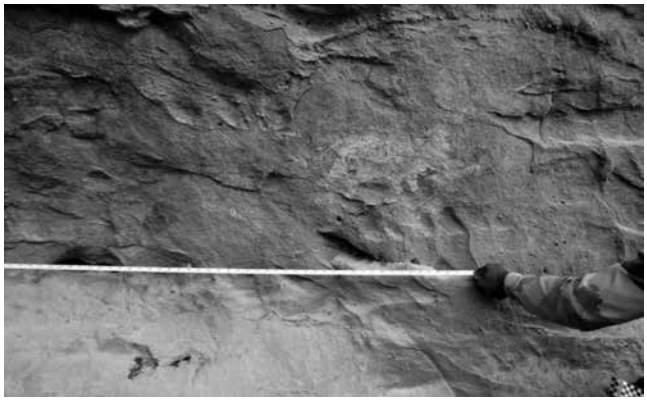

Fig. 9 - The rock surface indicated below the line of measuring tape contain wider patches of fallen white paint.

Fig. 10 - Microliths and debitage flakes are accumulated on the surface of the floor deposit in the rock shelter.

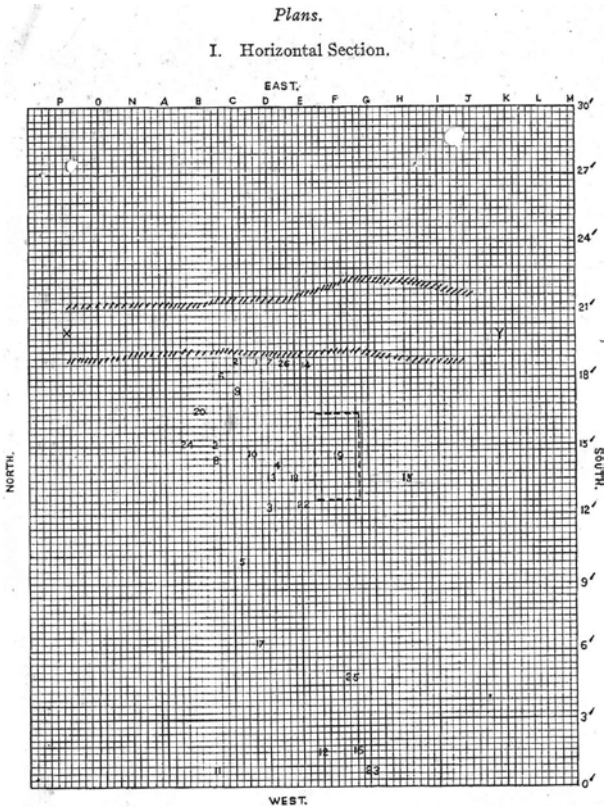

Fig. 8 - Floor contour drawn during excavation.

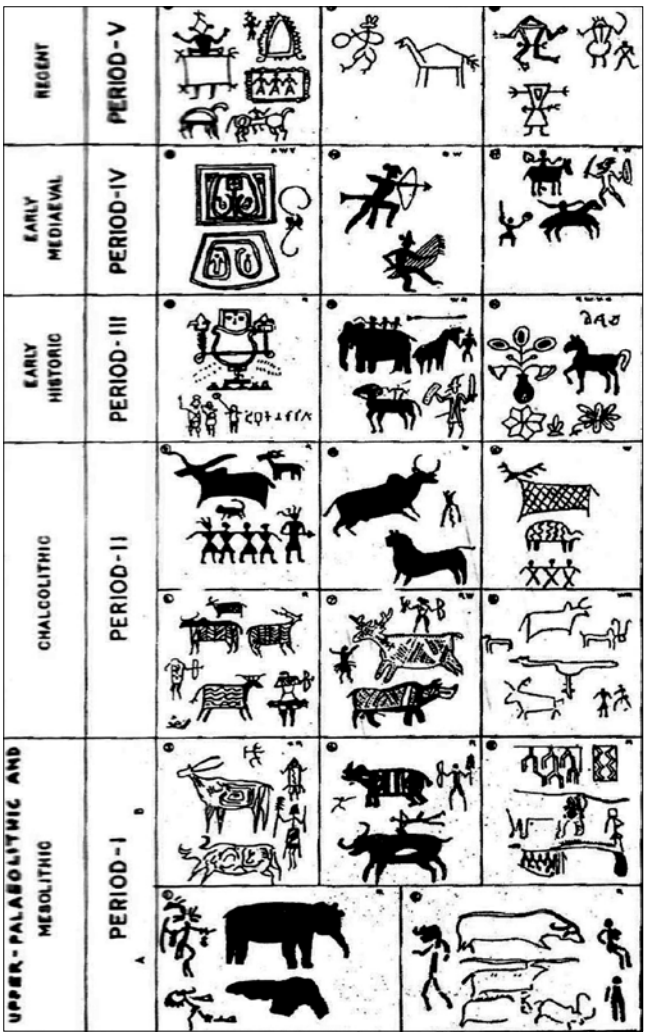

Fig. 11 - Chronological and stylistic development of rock painting in Central India. (Wakankar, 1975)