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# Environmental Forces Shaping Settlement and Subsistence of Ancient Civilization: Tracing the Patterns in Marayoor, Western Ghats, India

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**ABSTRACT**

Megalithic monuments in the form of dolmens, cists, and menhirs are reported from different parts of the Western Ghats, and many studies have attempted to portray these monument's sociological backgrounds. Marayoor of Idukki district, located in the southeastern part of the Western Ghats, has preserved many imprints of ancient civilization, primarily as dolmens and rock arts. The name of the place 'Marayoor' was derived from the two words of Tamil language, viz., '*marai*' (shadow) and '*ooru*' (land), since it is located at the rain-shadow region of the Western Ghats. After evaluating the rock arts of Marayoor, the scientists share the insight that this civilization existed from 3000YBP (years before present) to 1500YBP and hence accounted for a unique Iron Age record of South India. These rock arts are mainly confined to the rock shelters/caves. Besides, there are hundreds of dolmens in Marayoor, either as clustered or non-clustered. These dolmens are made with large slices of rock, and such slices are extracted by applying primitive technology. Though there have been many studies for unraveling the structure and distribution of ancient megalithic monuments and the engravings in the rock art locations to get a detailed description of geometric designs and motifs, seldom are remained answered regarding the environmental factors that influenced the civilization. The present work is envisaged to discuss the significant influence of certain environmental factors like climate, climatic amelioration, lithology, weathering, etc. on the ancient civilization of Marayoor.

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## 1. INTRODUCTION

The distribution of Megalithic monuments can be seen in various parts of the world, while Western Europe is an example of the best-known ones, having ages between 7000YBP and 3500YBP. Chronologically it harmonizes with the age of ancient civilizations of Egypt, India, and the Middle East (Forde, 1930). Though presumed widely that the dolmens are tombs or burial chambers, it remains conjecture since three relevant questions, when, why, and by whom these structures were made, required a more scientific approach to unravel the mystery. Moreover, it is challenged that though human remains or artifacts in a dolmen allow scientific dating, it is impossible to prove that these archaeological remains date back to the time when the stones were set in a place (Scarre, 2010). Besides, it can be seen that the selection of a particular area to build these structures was made not only by considering the shared cultural and social elements but after making a better understanding of the environmental factors as well as systematic planning and coordination also (Banerjee, 2016; Kumaran and Saranya, 2015).

The systematic studies on the megalithic imprints have acquired prime importance from long ago

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(Haimendorf, 1943; Kaelas, 1967; Noble, 1976; von Fürer-Haimendorf, 1945). Many researches put forward that the megalithic practices in the Indian subcontinent during the Mesolithic, Neolithic and Chalcolithic periods were associated with ritual traditions of some tribal communities (Allchin et al., 1982; Devi, 2004; Hutton, 1922; Kumar et al., 2017; Kumar and Nihildas, 2014; Mendaly, 2016; Mohanty and Selvakumar, 2002; Renjith et al., 2016; Sudyka, 2010). The megalithic monuments of India bear a close similarity in architecture with that of Europe (Das, 2018), the Middle East, Korea, Indonesia, etc (Poyil, 2013).

Some of the studies of the world have brought geoarchaeological perceptions while portraying the ancient civilizations (Gillmore et al., 2009; Maghsoudi, 2008; Maghsoudi et al., 2014, 2012). Influence of seismotectonic in the ancient civilization of Hajiarab alluvial fan of Iran (Quigley et al., 2011) and palaeoenvironmental significance in Holocene human settlement shift of Central Iranian plateau (Gillmore et al., 2011; Schmidt et al., 2011) are worthy of mentioning. Another important study by (Rezaei and Basafa, 2019) revealed that a massive climatic catastrophe during the second millennium B.C. had destroyed the settlement in Shahrake Firouzeh of Iran. In India, the factors like socio-political considerations (Kurian, 2015; Mortazavi and Negari, 2010), religion (Aswani and Kumar, 2018; Sujatha et al., 2013), territorial and astronomical reasons (Banerjee, 2016), political ecology (Bauer et al., 2007) and the relationship between environment and cultural change within an interpretive framework of dependency or adaptation (Dhavalikar, 1984; Fuller et al., 2001; Fuller and Korisettar, 2004; Harvey and Fuller, 2005; Kingwell-Banham et al., 2018; Mendaly, 2015; Paddayya et al., 1995) in early human civilization are well portrayed. Besides, evidences are drawn to reveal that the South Indian Neolithic village settlements were positioned away from the significant drainages and the civilization practiced rain-fed agriculture and pasturage (Fuller et al., 2001; Korisettar et al., 2001), while the Iron age settlements were spatially diverse, specialized in economic production and utilized reservoirs and other water and soil retention features, which enabled intensified agriculture (Johansen, 2003, 2004), Though there had been demand for the requirement for studies regarding the understanding of the material culture changes that attended the Neolithic transition as well as the subsequent transition from the Neolithic to the Iron Age (Brumm et al., 2007), surface collections are often made un-systematically and critical features such as associated topography, geology, and palaeontology go virtually unmentioned or are understudied (Chauhan, 2007) and seldom has been discussed regarding the role of environmental factors influenced the ancient civilizations of the Western Ghats. Hence the present paper discusses the significance of environmental factors that restrained the settlement and subsistence pattern of the ancient civilization of Marayoor, a place in the rain-shadow region of Western Ghats.

## 2. LOCATION AND REGIONAL SETTING

Marayoor (N 10°16′34.39″, E 77°09′39.90″) is located in the rain shadow region of the Western Ghats. The area forms part of the Southern Granulite Terrain (SGT) (Naqvi and Rogers, 1987; Radhakrishna and Naqvi, 1986). Geomorphologically, Marayoor is formed by the combined effect of fluvial, denudational and tectonic processes during the geological past (Soman, 2002; Suresh et al., 2018). The geological formations are the Pre-Cambrian metamorphics represented predominantly by granitic gneiss and followed by charnockite, hornblende-biotite gneiss and migmatites and the intrusive granites (Pradeepkumar, 2015). The combination of such old rock and tropical rainfall has resulted in developing a peculiar soil mantle, characterizing the rain shadow slopes of the Western Ghats. The region is drained by the river Pambar and its tributaries. The region's climate is controlled by southwest monsoon (June-September) and northeast monsoon (October-November).

## 3. OBSERVATIONS

According to (Gurukkal and Varier, 1999), the human inhabitancy of the Idukki district of Western Ghats dates back to 8000YBP. It is extracted from the ancient Tamil literature of Sangham writings that the Marayoor is on the route that existed in the olden days from Kodungallor to Madurai, which Kannagi used to flee after burning out Madurai in her anger against the then Pandiyan King (Mani, 2012). The Marayoor is archaeologically important for its rock arts and megalithic structures. The Marayoor Grama Panchayath covers an area of about 108 km$^2$. The observations are made from different locations of dolmens (Plate 1 & 2) and caves in and around Marayoor (Fig. 1).

Plate 1. Dolmen.

It is vital to consider the locations of caves with rock arts and hence presented as Table 1. Apart from those listed in Table 1, there are 16 other rock art sites reported from the outskirts of the Marayoor region (Gurukkal, 2011; Kurian, 2015; Nihildas, 2014; Pradeepkumar, 2015). Out of these 24 rock art sites, four sites are exclusively for petroglyphs. For paintings, red and white pigments were widely used, where the majority of them were red-pigmented, and the superimposition of the white over red, as seen in some sites, revealed the initial and long-term usage of red pigments. Petroglyphs are non-figurative motifs (Kurian, 2011). The dolmens of the study area were made of heavy granite (more precisely granite gneiss) slabs, and the dolmens are seen as either individuals or clusters. Each dolmen has orthostatic stones and capstone. Stone slabs have a thickness of 12 to 15 cm. The dolmens made before the Iron Age could easily be recognized since no tools were used to dress the granite slabs. In some locations, orthostatic stones are seen erected and packed with debris in the basement. There is no specific orientation for the orthostatic stones as well as the capstone. Details of 129 dolmens from 58 different study area locations were collected, tabulated, and analyzed. The salient features are given in Table 2.

Three dolmen sites have only orthostatic stones that too in a distorted condition. The above results show that the dolmens are of varying size, and hence the capstones also are of a variable size capable of covering the orthostatic stones. Besides, the lengthwise orientation of the dolmens concerning the cardinal directions was recorded and presented by a rose diagram (Fig. 2). Apart from that, 29 dolmen sites were recorded for specific basements either with debris or with well-shaped rock pieces and earth material. Twelve of them with accessibility were selected for collecting earth material from the basement. The samples were analysed using International Pipette Method. The results were tabulated (Table 3) to draw the textural features of the material used in the construction of the basement.

Another essential aspect noticed in the study area is the weathering pattern. As stated earlier, the most common rock type of the area is granite gneiss (Pradeepkumar, 2015). Mineralogically, it contains plagioclase, quartz, pyroxene, amphibole, biotite, opaque minerals, etc. Since the region occupies

 

Plate 2. Dolmen with a platform of shaped rocks.

the rain shadow zone, the physical weathering dominates, and there has always been extensive exfoliation/spalling of granite gneiss (Plate 3). Weathered and exfoliated rock can be detached and sized using even primitive technology (Plate 4). Hence, the location has favoured the availability of megalithic stones.

## 4. DISCUSSION

In India, the locations of rock arts and the expressions of motifs are well-explained (Bednarik, 1990; Chakravarty and Bednarik, 1997; Kumar et al., 2017; Lalhminghlua Sarkar, 2017; Mendaly, 2016; Mohana, 2018) and especially for those recorded from Peninsular India (Brumm et al., 2007; Gokhale and Dalal, 2018; Gurukkal and Varier, 1999; Kumar and Pradhan, 2008; Kumar et al., 2020; Kurian, 2015, 2011) and hence there is no need to explain the distinctive features and expressions of each motif. As described earlier, the study area has many caves with rock art. The present study reveals that the rock art surfaces of the area have no preferred orientation with respect to geographical direction. Hence, such influence of religious components while imprinting the motif was negligible. However, the motifs were indeed the components of their language through which the ancient civilization intended to reveal their environment. The names of the location of caves end with either ‘ala’ or ‘patti’, and according to the present inhabitant tribal communities, ‘ala’ means shelter, and ‘patti’ means cattle pen or corral (Nihildas, 2014). Then the most important question arises, why did the ancient civilization prefer caves?

Similarly, studies on Dolmens worldwide have even discussed its architecture, resources, and uniformity (Cummings and Richards, 2014). A myth that prevailed in the Marayoor region, as revealed from the folklores of Malapulaya (an ethnic group) occupy

 

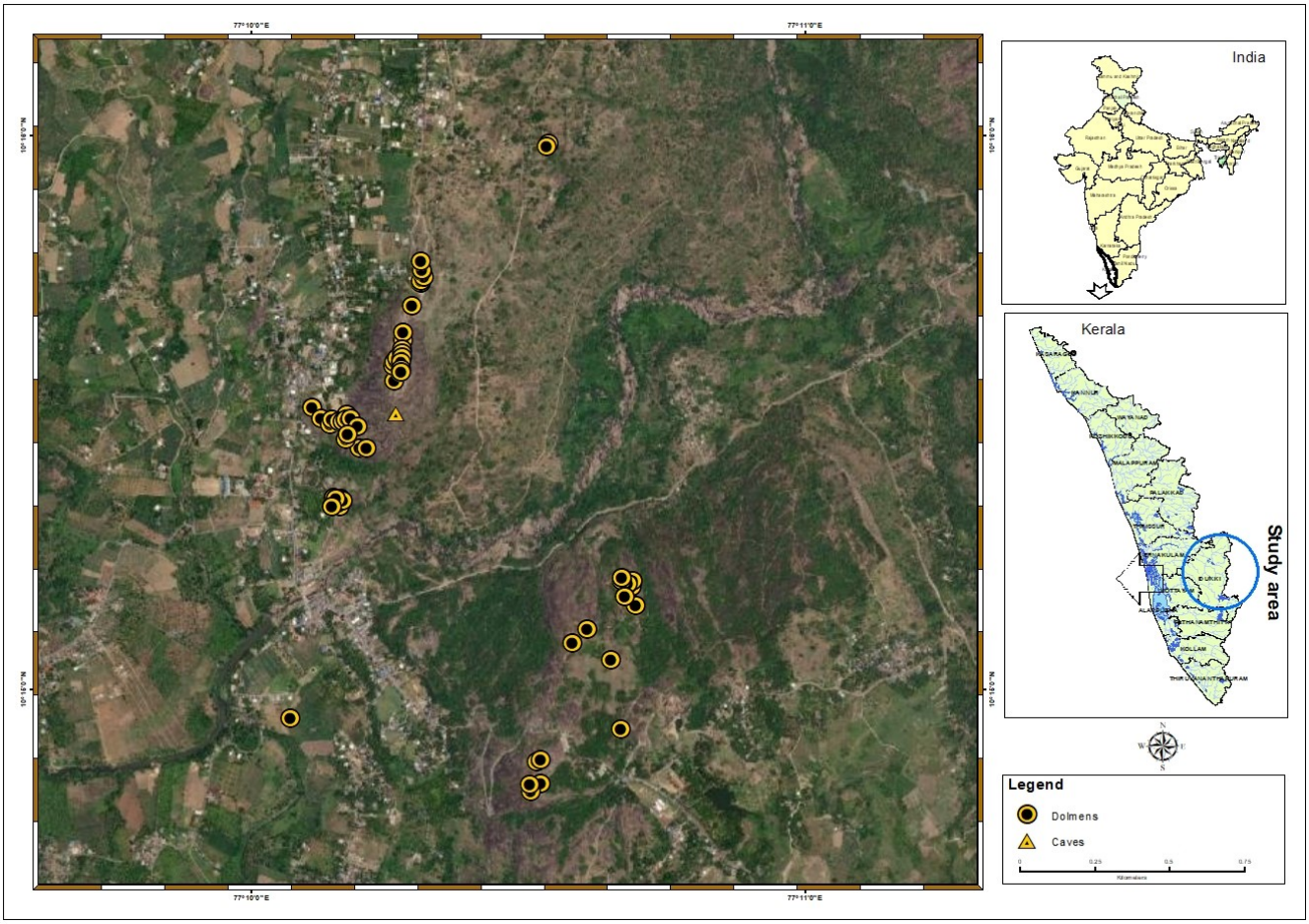


Fig. 1. Study area showing sampling location.

here, was well explained by (Kurian, 2015). It tells that there was God's curse on the ruler of Pandyan-Chondyas and the God-sent stone rain (kalmazha) to destroy the farmers' crops. To escape from the stone rain, the people constructed 'kalkudil' (Dolmen), and the Malapulaya call them by the name 'Pandyasperu'. After stone rain, God sent rain of fire, and at that time, the people went underground by building cists and urns and the Malapulaya call them as 'Nilaperu' (Kurian, 2015). Suresh et al. (2018) observes that the dolmens or '*muniyara*' in Marayoor were built by saints called '*muni*'s for shelter and meditation. Though the folklores convey the myth, the questions relevant to the circumstance arise: why did the ancient people construct a megalithic structure like dolmen as part of their culture? Why did the dolmens locate away from stream channels? Why did the dolmens position on elevated areas? Is there any specific direction in arraying the dolmens? Why did the dolmens located above the ground have basement either with debris or well-shaped rock pieces and earth material?

Answers to the questions of the above two paragraphs require specific interpretations. Irrespective of classifying as sepulchral or non-sepulchral, the dolmen architecture needed an evaluation, especially when chambered monuments were encased by a circular or rectangular packing of stones, and earth material types are not reported from midland and coastal areas of Kerala (Nihildas, 2014). Due to the peculiar weathering pattern of the region, the civilization utilized the exfoliated rocks by *in situ* quarrying using primitive technology. The quartz/pegmatitic veins in rocks provided tools of the Stone Age. The earth material found in the basement of the dolmens was supposed to be for strengthening the foundation of the orthostatic stones. The result in Table 3 revealed that though the area experienced many episodes of rainfall after the erection of these megalithic structures, the earth material used for strengthening the basement of the dolmens still has significant clay content. The material was used to support the erected orthostatic

 

Table 1. Locations of caves with rock arts.

| Sl. No. | Name of the Place | Geographic position | Remarks |
|---|---|---|---|
| 1. | Alampetti - Madathala | N 10°18′43.20″ E 77°11′26.40″ | Paintings are seen on the wall and the projected boulder wall, both facing towards the east. Picture of a trapped animal is on the shelter wall, and pictures of three animals are seen on the boulder face. Apart from that, faded paintings are also seen. |
| 2. | Alampetti - Maanala | N 10°18′43.30″ E 77°11′26.20″ | The cave wall has pictures of some animals and a human. The images of the human having stretched hands and another figure with a broad head are seen. Besides, some signs are also seen. |
| 3. | Jellimala cave | N 10°18′36.40″ E 77°11′26.60″ | Geometric designs and other motifs are seen here. The most important rock art is of an animal and a human near to it. The human figure holds something in both the hands. |
| 4. | Vaimala cave | N 10°18′36.70″ E 77°11′26.80″ | Located on a cliff, Vaimala has two caves, one small and another is large. The small cave has rock arts of palm impressions. The large one has paintings on the roof as well as on the sidewall. Motifs of two animals are seen on the top, while the sidewall has the picture of a ladder. |
| 5. | Attala Cave | N 10°15′08.20″ E 77°08′25.20″ | Located at an elevation of about 1550m above the mean sea level. About 94 painted motifs are visible. Most of the paintings are abstract designs, while few figures of humans and animals are also seen. The most conspicuous figure is that of a man chasing an animal with a stone chisel. The rock art faces east. An abandoned cave near this rock shelter was used as a passage to reach the bottom. |
| 6. | Ezhuthala or Ezhuthuguha | N 10°16′37.50″ E 77°09′10.40″ | Located at an elevation of 1080m above mean sea level. About 90 painted motifs are seen. The rock art faces west. It is an amphitheater-shaped one, and the Department of Archaeology protects it. |
| 7. | Muruganpara | N 10°15′29.80″ E 77°10′15.60″ | Located at an elevation of about 1000m above mean sea level. About ten motifs are seen here. The rock art faces south. |
| 8. | Kannimari Oda | N 10°18′47.10″ E 77°11′12.10″ | It is a semi-cave-like feature, where several figures of animals, social gatherings, and human inhibition are portrayed. This shelter is positioned near a stream channel. |

Table 2. Salient features of dolmens of the study area.

| Sl. No. | Characteristic features | Observations |
|---|---|---|
| 1. | Single chamber dolmens | 26 |
| 2. | Dolmens with two chambers | 12 |
| 3. | Dolmens with three chambers | 09 |
| 4. | Dolmens with four chambers | 04 |
| 5. | Dolmens with five chambers | 06 |
| 6. | Dolmen with six chambers | 01 |
| 7. | Locations with packed debris at the basement | 29 |
| 8. | Dolmens under ruining | 03 |
| 9. | Dolmen with an inner length between 1m – 2m | 02 |
| 10. | Dolmen with an inner length between 2m – 3m | 37 |
| 11. | Dolmen with an inner length between 3m – 4m | 63 |
| 12. | Dolmen with an inner length between 4m – 5m | 14 |
| 13. | Dolmen with an inner length between 5m – 6m | 09 |
| 14. | Dolmen with inner length >6m | 01 |
| 15. | Dolmen with inner width <1m | 48 |
| 16. | Dolmen with inner width between 1m – 2m | 78 |
| 17. | Dolmen with inner height <1m | 07 |
| 18. | Dolmen with an inner height between 1m – 2m | 114 |
| 19. | Dolmen with inner height >2m | 05 |

stones and prevent external objects, including water, from entering naturally into the dolmen and going out.

The observations of Nihildas (2014) are relevant to discuss. It has been observed that there is no homogeneity between the colour paintings and the typology or architecture of the dolmens. At Muruganpara, red ochre paintings are seen with refined dolmens, while in Alampatti, red ochre and kaolinite paintings are seen with low-type chambered dolmens. Hence, it is evident that the cave civilization and dolmen architecture represent different ages. Kurian (2011) and Nihildas (2014) suggested that this may indicate the cultural succession of two distinct periods. From the geological point of view, the secondary oxidized iron mineral haematite is the main

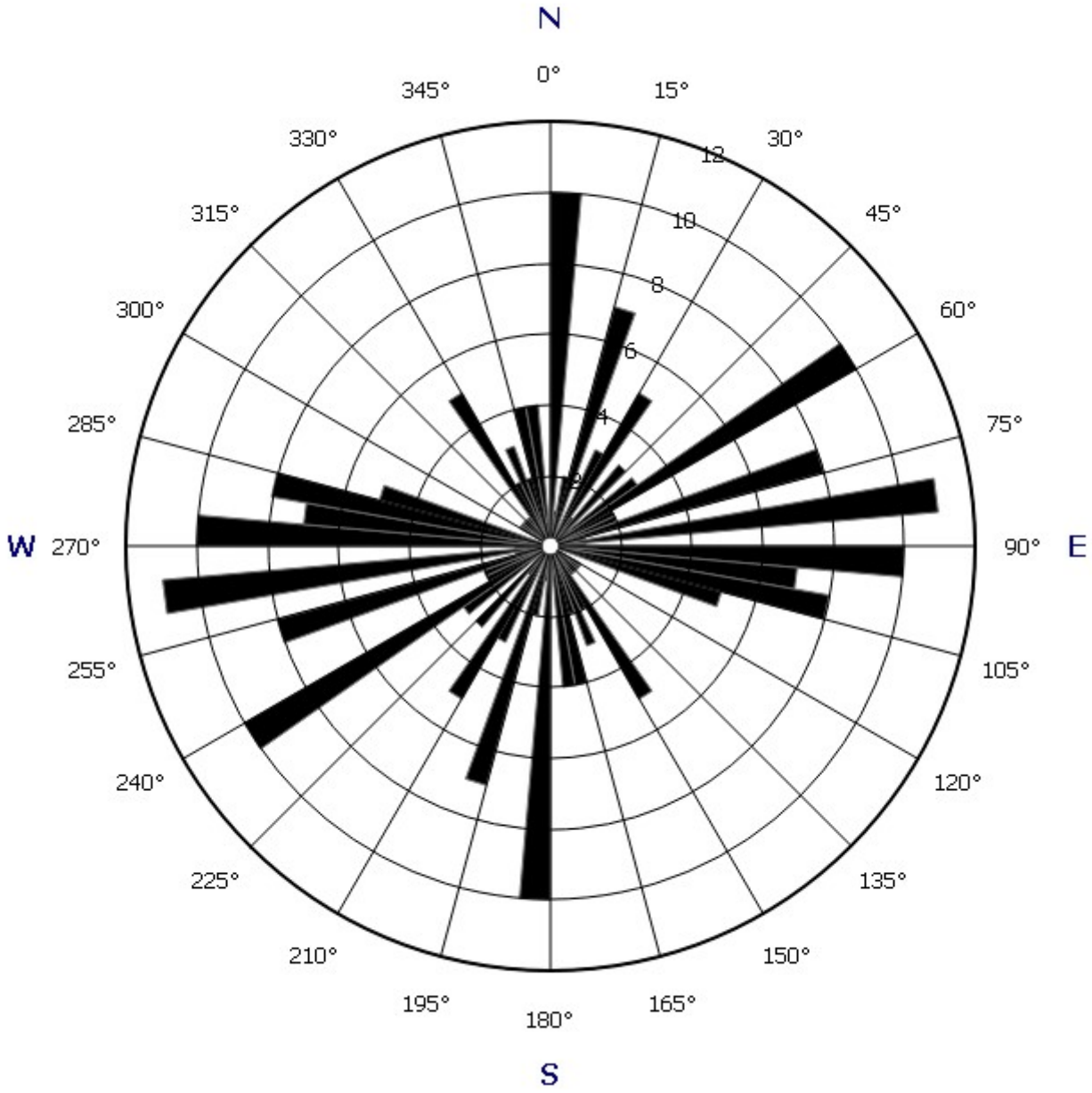


Fig. 2. Rose diagram of the orientation of dolmens.

Table 3. Textural characteristics of the earth material used in the construction of the basement.

| Location No | Sand (%) | Silt (%) | Clay (%) | Texture |
|---|---|---|---|---|
| 1. | 32 | 36 | 32 | Clay loam |
| 2. | 31 | 47 | 22 | Loam |
| 3. | 33 | 36 | 31 | Clay loam |
| 4. | 22 | 40 | 38 | Clay loam |
| 5. | 17 | 52 | 31 | Silty clay loam |
| 6. | 29 | 36 | 35 | Clay loam |
| 7. | 25 | 34 | 41 | Clay |
| 8. | 38 | 31 | 31 | Clay loam |
| 9. | 30 | 47 | 23 | Loam |
| 10. | 32 | 30 | 38 | Clay loam |
| 11. | 35 | 31 | 34 | Clay loam |
| 12. | 28 | 30 | 42 | Clay |

 

Plate 3. Rock spalling or exfoliation

Plate 4. Spalled-off rock is detached using simple technology.

component of red ochre, probably derived from pyroxene. At the same time, kaolinite is a product of humid tropical weathering. Kurian (2011) and Nihildas (2014) also report that the rock shelters and dolmens have a direct visual link with Pambar and its tributaries. At the same time, they ask why the civilization left out the rock shelters located in the foothills. For discussing further, a comparison of geological and historical periods is necessary, and hence a comparison is drawn as given in Table 4.

There are many studies regarding the strengthened Asiatic Monsoon during the middle Holocene (Neolithic period). It is evident that the cave civilizations of the Neolithic period are attributed to the

Table 4. Comparison of geological and historical periods for the last 11000 years.

| Age in Years Before Present (YBP) | Historical period | Geological period | Inference |
|---|---|---|---|
| 11000 | Mesolithic | Early Holocene | The period after Younger Dryas. Climate gradually shifted to warm and humid conditions |
| 10000<br>9000<br>8000<br>7000<br>6000 | Neolithic | Middle Holocene | Climate was changed entirely to a very warm and humid phase. Strengthened monsoon and high-intensity rainfall events in the Northern Hemisphere. Time of Holocene Climatic Optimum. The emergence of Indus Valley civilization. Civilization was reported from Edakkal caves, South India. Suggestive of cave civilization under strengthened monsoon. |
| 5000 | Chalcolithic | | Post Climatic Optimum. Climate amelioration. Shifting of the climatic regime to a drier phase. |
| 4000 | | Late Holocene | Neotectonism. Increased aridity. End of Indus valley civilization. Time of Holocene Thermal Maximum |
| 3000 | Iron Age | | Imprints of ancient civilizations from many parts of South India, including Marayoor. Strengthened Asiatic monsoon. Shift in Cauvery river channel. |
| 2000 | Early Historic | | Increased aridity with intermittent spells of high rainfall. Civilization utilized reservoirs and depended on water and soil retention techniques. |

(Modified after Baiju et al. (2015)).

strengthened Asiatic Monsoon, and the best example reported from South India is the Edakkal caves of Wayanad. Since the civilization of the present study is related to the Iron age, we discuss the environmental factors related to that period only. Hence, it is vital to discuss the studies on intensified Asiatic monsoon around 3000YBP. Earlier studies showed that the Asiatic monsoon had its intensification over Mongolia (Wang et al., 2009), Southern China (Wang et al., 2007; Zhang et al., 2000, 2013), east-central India (Singh et al., 2008; Yadava and Ramesh, 2005) and the Southern Peninsular region including Sri Lanka around 3000 YBP (Ajaykumar et al., 2010; Gadgil, 2003; Kumar et al., 2017; Ramasamy et al., 2006; Sarkar et al., 2000; Staubwasser et al., 2003; Staubwasser and Weiss, 2006; Veena et al., 2014). Among the above studies, the observations made by Baiju et al. (2015) and Divya et al. (2016) concerning few locations of Western Ghats are very relevant due to the proximity to Marayoor. The intensified Asiatic monsoon around 3000YBP had influenced the cave civilization and the megalithic architecture of Marayoor. Cave civilization, motifs including petroglyphs on walls, the position of the dolmens in elevated areas well away from stream channels and the megalithic design of well covered cap stone over orthostatic stones, where the capstone slightly dipped and the orthostatic stones erected and strengthened using earth material having significant clay content are capable to reveal that extreme rainfall events also had a significant role in the subsistent pattern of the ancient civilization.

## 5. CONCLUSION

Caves are used as natural dwellings from Palaeolithic times. The primitiveness and the extreme climatic conditions also forced the ancient civilization to utilize these rock shelters irrespective of historical periods and became places of artistic expressions of early humans. The above observation and discussions suggest that the primary function of caves and dolmen was not as tombs, where the climatic influxes played a vital role in defining the purpose. At the same time, the study equally postulates the possibility of subsequent utilization for other purposes, as suggested by Ard et al. (2016). The most remarkable thing is that the dolmens have continental counterparts. Such resemblance is suggestive of a common element of consideration while designing the dolmen architecture. That might be a global phenomenon like the Holocene Climatic Optimum. According to Kumar and Nihildas (2014), the subsistence pattern of the megalithic communities was not uniform in a given period.

The result of the present study depicts that the dolmens are of different dimensions. Very large dolmens with a length of more than 6 m and a height of about 2 m are reported, along with very small ones. There is a conjecture that these were burial sites, which is merely based on some human remains buried at the sites. The dating technique utilized these remnants for determining the age, but that need not represent the exact time of erection. Hence, it is suggested in tune with the observations of Joglekar et al.

 

(2012) to have thorough investigations to portray the extent of the possibility of the secondary reuse of these sites. The diversity in the orientation of the dolmens is another key factor to substantiate the above observations. It is hard to believe that all the dolmens were functioned as tombs, especially when evidenced of the rock art inside dolmens of Anakottappara. Besides, inappropriate to the reports from some other parts of South India, many study area sites have no floor slabs but are filled with mud and have encircling stone packing with earth material and cairns covering the chamber, even sometimes piled up to the capstones. The enclosure wall is constructed using dressed stones, placed perfectly without any cementing material. The used earth material is a filler and has a substantial amount of clay to provide strength and water expulsion. Another critical observation is a culturally bound one. Though it appeared in simple structure, the erection of a dolmen requires site selection, detailed planning, workforce, coordination, and implementation. The peculiar thing is that the megalithic people had chosen rocky surfaces for erecting dolmens. The dolmens do not have any specific orientation. And hence the erection and utilization might be related to surpass the environmental thrust, especially the influence of strengthened Asiatic monsoon around 3000YBP in order to fulfill a variety of purposes including ceremonial (as to provide place of meditation by saints), crematory, precautionary (as to prevent spreading of epidemics), isolation and care (for those were physically challenged/injured), etc.

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## CONFLICT OF INTEREST

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