



A Study on Ancient Artifacts Around Badami Hill and Their Correlation with the Natural Rock Arch of Sidlaphadi

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SHORT REPORT

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ABSTRACT

The Badami hill of Bagalkot district, Karnataka, India, houses a large rock arch termed “Sidlaphadi” that was used as a shelter by primitive man. The hill was searched to find any prehistoric artifact that would act as a directional marker towards the arch. An interesting structure was noted in one of the natural caves near the southwestern part of the hill at 15°55’06”N latitude and 75°41’02”E longitude. A miniature replica of the arch was carved onto the floor of the cave. The axis of the miniature bridge made an angle of $28.5 \pm 1.5^\circ$ with the 75°41’02”E longitude. The axis, upon extension eastwards at the defining angle reaches the northern slope of Sidlaphadi. The authors also located a megalithic stone arrangement in the northern part of the hill that had a pointed capstone and was thought to be oriented towards the rock arch. The stone arrangement was in the same latitude as that of the Sidlaphadi site, but the capstone was oriented 22°E towards the winter solstice sunrise at 112.5° azimuth.

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The Badami hill of Bagalkot, Karnataka, India, lies between latitudes 15°58'N and 15°54'N and rises to a height of 700 meters from sea level. It mostly resembles a small plateau with a central ridge running in the east-west direction. The hill is primarily made of sandstone rocks and shows signs of water and heat erosion. The town of Badami is built on the western side of the Badami hill. **Figure 1** shows the location of the important aspects of Badami. A series of cave temples dedicated to Hinduism and Jainism have been carved into the south-western border of the hill by the Chalukya kings. The presence of a lake and a seasonal waterfall in the vicinity of the caves increase the aesthetics of the location. Nestled within the northern borders of the hill, diagonally opposite to the caves, lies the enigmatic rock-arch/natural-cave site of Sidlaphadi.

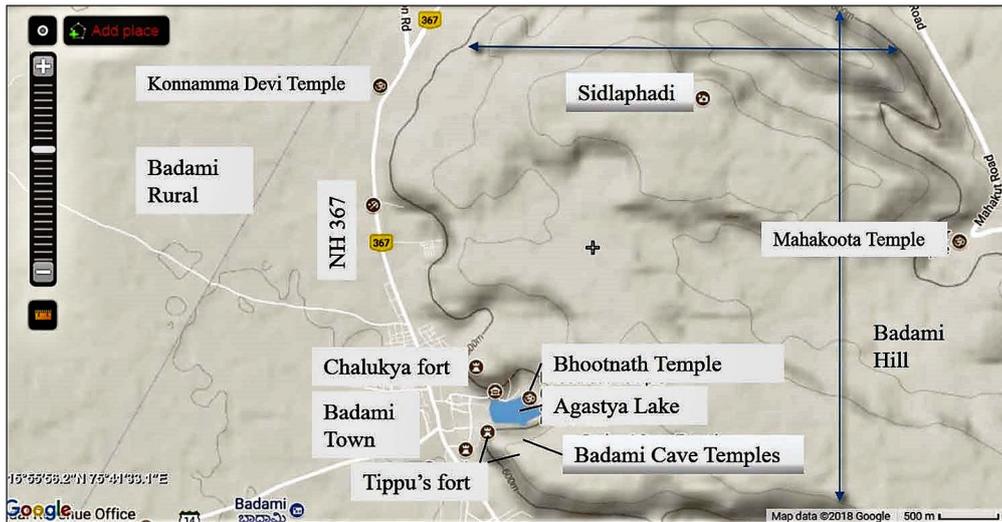


Figure 1 Spatial location of Badami hill comprising of the Badami cave temples and the mesmerizing rock arch of Sidlaphadi. Photo from Google Earth.

SIDLAPHADI AND ITS SURROUNDING AREAS

Located 2.7 km from the Bagalkot State Highway 57, the colossal site of Sidlaphadi remains immaculate. The name springs from a local legend that the rock took its present form after being struck by lightning. The site has been exclusively studied by Sundara and identified as a dwelling place for the prehistoric man (Mohana 2018). It is located between the latitudes 15°56'40"N and 15°56'35"N and the longitudes of 75°42'03"E and 75°42'06"E. It lies at a height of 690 m and is close to the peak of Badami hill. The bridge spans an average length of 41 m and is 19 m wide. **Figure 2A–D** depicts the bridge as visualized from multiple viewpoints. The ceiling shows a solution pan type erosion that have resulted in two gaping holes (**Figure 2E**), the reason behind the lightning myth. The cave contains faint paintings (**Figure 2F**) that are difficult to identify (Sundara 1975). The rock arch houses two smaller caves on the north eastern side. An adjacent hillock on the eastern edge of the hill also houses multiple caves.

On the western side, the arch is surrounded by a canyon, spanning 200 m, running parallel to the arch and beyond its length (**Figure 3A**). The canyon possibly arose due to water erosion and as a result, its walls have formed natural grottos in multiple locations. In fact, the arch and its surrounding area show numerous signs of water erosion. Two large potholes were located about 1.5 km westwards of the site (**Figure 3B** and **3C**), adjacent to the northern edge of the hill. A large solution pan was also observed near one of the potholes (**Figure 3D**).

Sidlaphadi and its adjoining areas were important habitation sites for ancient men (Pappu 1981). These caves possibly served as protection against the harsh weather at the dawn of mankind. It would have been an important source of inspection and introspection for the later kingdoms too. The authors wondered if the Badami hill had any marker that pointed towards Sidlaphadi to make ancient wanderers aware. The authors found two such artifacts that could fit the criteria. The first was a structure crafted on to the floor of a natural cave near

the southwestern border of Badami hill and the second one was a pile of rocks arranged in a megalithic fashion with a sharp capstone pointing towards the east. This paper attempts to analyze the spatio-temporal importance of these two artifacts.

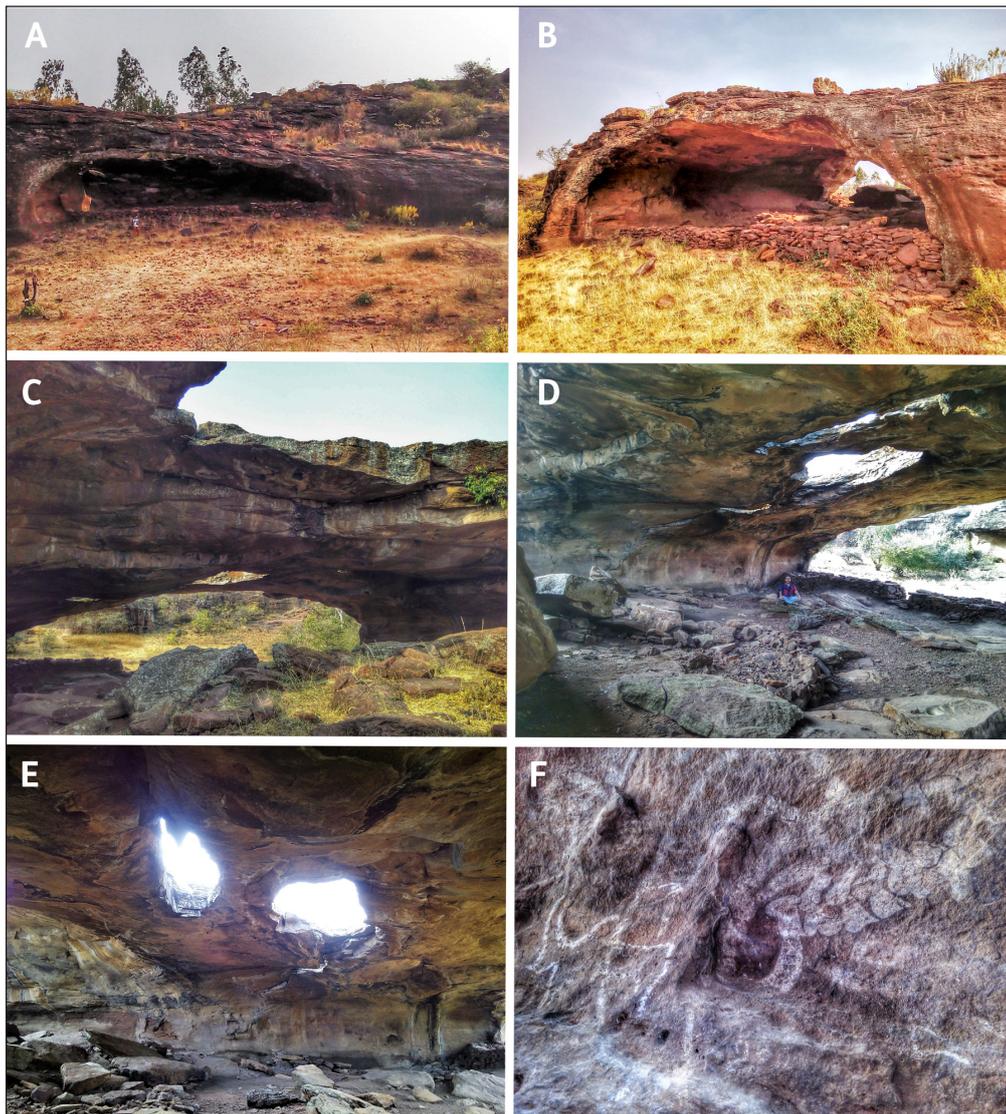


Figure 2 Sidlaphadi site and its surrounding area. **(A)** Top view of Sidlaphadi bridge as visualized from Badami hill. **(B)** The bridge as visualized from west. **(C)** The bridge as visualized from east. **(D)** Spacious compartment underneath the bridge. **(E)** Solution-pan erosion pattern on the Sidlaphadi arch/bridge. **(F)** Cave paintings carved on the walls underneath the bridge.

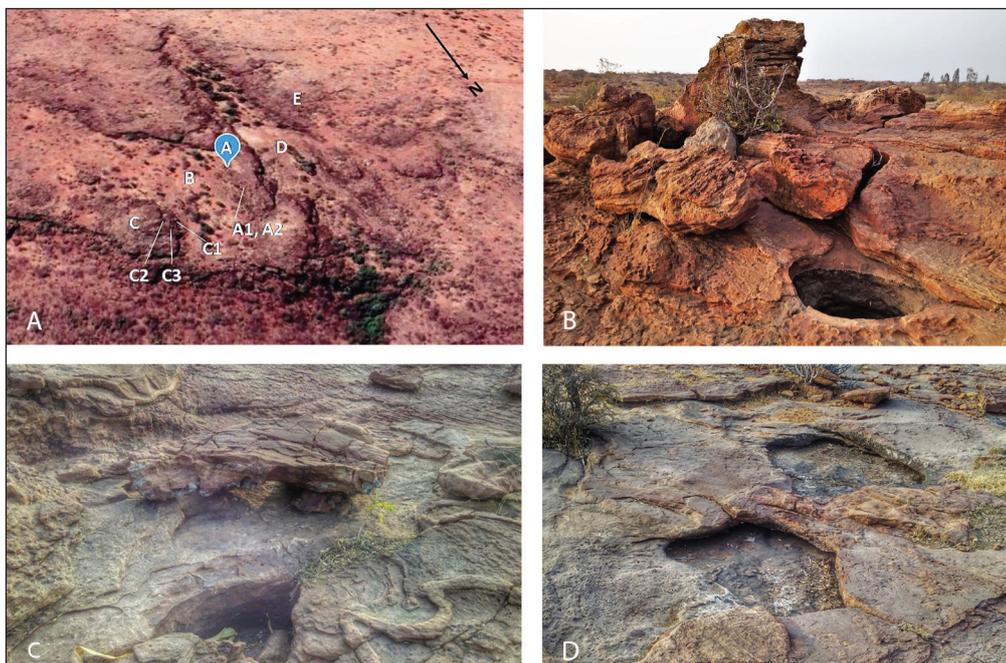


Figure 3 **(A)** The site of Sidlaphadi (designated as A) and its corresponding neighborhood. Area B and D represents the east and the west of the arch respectively. A small hillock east of the arch (represented as C) houses three caves big enough to hold people, designated as C1-3. A1 and A2 represents caves in the northern part of the arch. Area E indicates rocks with wave like erosion present around canyon D. **(B)** Pothole and associated channels formed by water erosion (15°56'45"N, 75°41'52"E). **(C)** Pothole formed by water erosion (15°56'45"N, 75°41'49"E). **(D)** Solution-pan structure formed due to water erosion.

ARTIFACT ONE: REPLICA AT BADAMI NATURAL CAVE

The ancient capital of the Chalukya Dynasty, Badami encompasses four cave temples dedicated to the Hindu and the Jain faiths (Tarr 1970; Reddy 2009). Apart from these, two natural caves can be identified while ascending from cave I towards cave IV. Since these natural caves are not numbered nor mentioned in the brochure, they will be referred to as Cave 5a and 5b. The bottom cave, termed as cave 5a, lies between caves 1 and 2. **Figure 4A** gives the location of this natural grotto. It is triangular, with a flat floor that houses a fissure. The cave is about 3 m in length and 4.5 m in width. The southern part of the cave wall has a large crack which has become an adobe of bats, a possible reason for tourists to avoid this cave. There is no staircase to reach it, unlike the other caves and it can be accessed only by climbing. The cave houses an interesting sculpture on the floor about 1.5 m from the entry point. The sculpture comprises of an oval-shaped depression of about 40 cm diameter (long edge) and a bridge-like structure connecting two opposite short ends (**Figure 4B**). Possibly this was a natural formation that was augmented to the present shape by artificial means. Prominent pounding marks are visible on the wall of the oval-shaped depression. Interestingly, the bridge looks like a miniature replica of the ancient Sidlaphadi rock arch. A comparison is shown in **Figure 4C**. The bridge is approximately 22.5 cm in length and its axis runs in NE to SW direction. The location of this artifact is at 15°55'05.8"N and 75°41'06.4"E.

Cup-shaped depressions or cupules have been carved on the right-hand side of the structure as shown in **Figure 4D**. A total of 13 cupules are observed in two parallel lines, each with a diameter ranging from 1 to 1.5 cm. The ones closer to the structure contain 6 cupules while the other, seven. The two lines form an acute angle with the axis of the bridge-like sculpture, forming an arrow-like shape that points towards the northeast. The parallel line of cupules represents an ancient board game of Karnataka termed “channemane” and was possibly made later (Mohana 2014). About 60 cm west of the structure lies a natural channel with a depth of 8 cm. This starts from the interior of the cave and moves towards the entrance of the cave. The channel becomes deeper as it approaches the mouth of the cave and ultimately opens as a fissure. Cupule shaped depressions are observed on either side of this channel. However, the channel side cupules are larger with a 5 cm diameter.

Figure 4 (A) The arrow points to the location of cave 5a which is situated between cave I and cave II. **(B)** A petroglyph present in cave 5a which comprises of an oval shaped depression with a bridge like structure, similar to the natural site of Sidlaphadi. A natural channel with two large cupules can be observed towards the west (top of the image). **(C)** Comparison of the miniature site/replica (left) with the original arch (right). **(D)** A series of cupules carved around the replica of Sidlaphadi.



The placement of the miniature arch is such that the axis of the bridge points towards the northeast. A line drawn through the axis of the bridge extended to move through two rock projections and towards the eastern corner of the northern hill fort. It was suspected that this line possibly could extend to the actual site of Sidlaphadi. Together, the bridge replica and the channel would thus serve as a miniature map and a marker to locate the rock arch.

The authors measured the longitude at the coordinates of the carved structure. Followed by measuring the angle formed by the bridge axis and the longitude. Multiple measurements were taken as the arc/bridge did not follow dimensions of an exact cylinder. The average value of the angle turned out to be $28.5 \pm 1.5^\circ$. A line following this angle was redrawn on Google Earth images and it was seen that it touched the northern border of the Sidlaphadi rock arch (**Figure 5**). Thus, it could be concluded that the miniature model was possibly created to pinpoint the location of the rock arch.

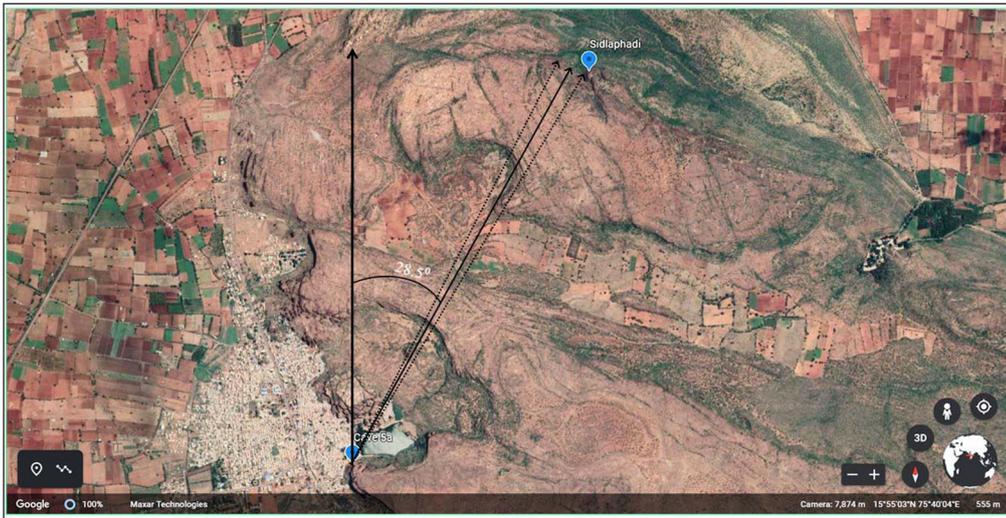


Figure 5 An imaginary line drawn through the axis of the petroglyph points towards the northern border of the Sidlaphadi arch by an angle of $28.5 \pm 1.5^\circ$.

The cave 5b had an unfinished relief of *Avalokiteshwara* surrounded by the *astamahabhaya*, the 8 ailments travelers suffer from (**Figure 6**). The cave was devoid of any directional petroglyph.



Figure 6 The statue of *Avalokiteshwara* with the *astamahabhaya* as identified in cave 5b.

ARTIFACT TWO: BOULDER ARRANGEMENT DIRECTED EASTWARDS

The second artifact was found near to the meandering track connecting the plains of Badami to Sidlaphadi. The artifact was located 1.2 km west of the rock arch at 15°56'36.7"N and 75°41'24.4"E. It comprised of a megalithic arrangement of rocks that was positioned such that the arrow-like capstone pointed east, towards the rock arch. However, measurement of the axis of the capstone revealed that the megalith was possibly pointed towards a celestial event.

SPATIAL ANALYSIS OF MEGALITH SITE LANDSCAPE AND ENVIRONMENT

The section deals with describing the landscape on which the monument lies along with an analysis of the neighboring environment. The monument is in the northern area of Badami hill (15°56'36.7"N and 75°41'24.4"E). The landscape is typically composed of red sandstone along with some arid vegetation. *Figure 7* shows a cross-section of the Badami Hill following the same latitude of 15°56'N. The total distance plotted is about 4.06 km. The hill rises towards the east for 1.69 km and opens to a flat plateau-like area for few meters following which it shows a gradual rise to the highest point at 706 m. The terrain gently slopes down towards Sidlaphadi. Further east, a sharp decline is noted. The megalith, as seen in the *Figure 7* lies at the intersection of two zones, a steep slope to its west and a flat plateau-like area to its east. The placement was possibly deliberate as is common with directional megaliths. Often, megaliths have been erected at meeting places of two different geographical zones. The megalith of Pallikonda, Tamil Nadu stands at a point which divides the agricultural plains and the hill of the Pallikonda (Banerjee 2016). Here the megalith has been erected just after the slope of Badami hill flattens to a plateau-like area, possibly for easy determination of the location.

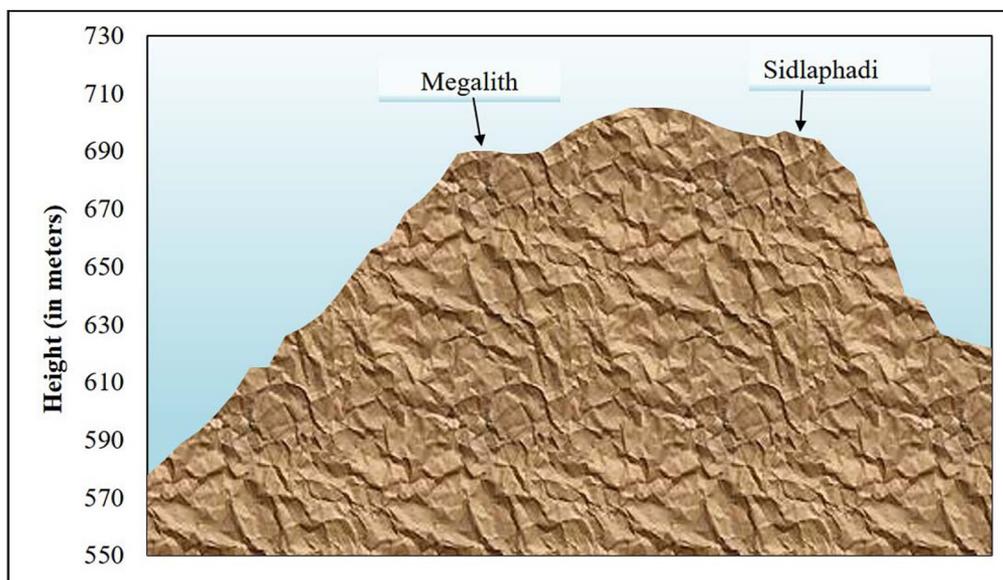


Figure 7 Cross-section of Badami hill along the 15°56'N latitude showing the spatial location of the megalith and Sidlaphadi arch.

The southern side of the structure displaced scattered rocks and sparse vegetation. However, the northern side depicted rock outcrops that had formed small caves due to erosion.

MEGALITH TYPE AND STRUCTURE

The megalith was made from sandstone, a common rock found in this area. The pile constituted one large flat rock supported by three comparatively smaller rocks, two on the southern side, and one on the northern side. Numerous small rocks were seen scattered around the site.

A good way to distinguish an erected monument and a natural pile of rocks would be the arrangement itself. Majority of the rocks in Badami hill showed characteristics of both block and water erosion patterns. As a result, most rocks had a broad base and were tapered at the

top, sometimes with the top disintegrating into smaller boulders but keeping the shape intact. However, in case of the artifact, this arrangement is reversed, hinting deliberate placement.

As seen from **Figure 8A**, the capstone was triangular with a length and thickness of 1.1 m and 85 cm respectively. The supporting rocks for the capstone are designated as A, B, and C. Rock A is situated on the northern side and has the dimensions of 30 cm × 40 cm × 10 cm (length × width × thickness). Rock B and C acts as supporting figures from the southern side. The rock B has dimensions of 45 cm × 35 cm × 45 cm, while rock C is of 55 cm in length and 30 cm in thickness.

VISIBILITY

Viewshed analysis: A viewshed is a 360° analysis of the terrain surrounding the megalithic. The site, by virtue of being in a barren area, offers high visibility that is obstructed occasionally by shrubs. As seen in **Figure 8B** the eastern view was dominated by the upward slope of the Badami hill. The rock arch was not visible from this point. The initial part of the route and the adjoining village areas could be seen on the western side. The northern side was open for about 60 m after which the curvature of the hill blocked the view. The southern side had an unobstructed view for a few kilometers, exhibiting mostly rocky surfaces and shrubs.

Reverse viewshed analysis: The reverse viewshed was determined by moving towards the megalith from the four cardinal directions. The monument, despite being in a comparatively empty area offers low visibility due to its smaller size. The view of the site is blocked due to the presence of a larger rock while looking from the northern side. The altitude is mostly consistent in all the other cardinal directions with shrubs and bushes being the only obstructions.

MONUMENT ORIENTATION IN SPACE

The arrow-head shaped capstone was positioned such that the axis of the arrow pointed east as seen from **Figure 8C**. The axis of the capstone made an angle of 22° with the latitude

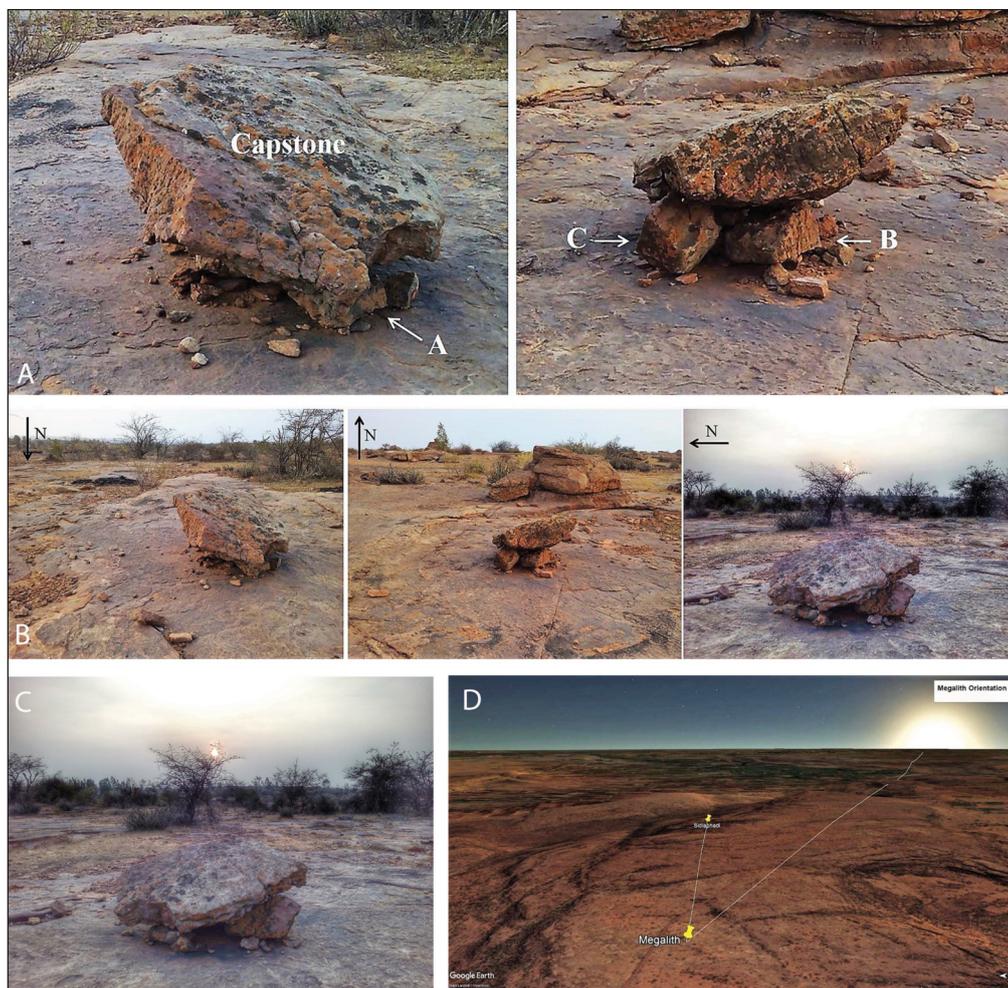


Figure 8 Spatial analysis and astronomical correlation of megalithic site. **(A)** The arrangement of capstone and its supporting rocks (A–C) which forms the megalith. **(B)** Viewshed of megalithic site as visualized from different cardinal directions – north (left), south (middle) and west (right). **(C)** Orientation of the pointed capstone directing towards the winter solstice rising sun. **(D)** Correlation of megalithic site pointing towards winter solstice sun with the site of Sidlaphadi.

15°56'39.8"N. The azimuth of the sunrise was calculated from the megalith coordinates. The winter solstice sun rises at a declination of 22°E with an azimuth of 112.5°. An imaginary line drawn through the axis touches the horizon and the rising point of the winter solstice sun.

The megalith rested in between the parallels 15°56'36.7"N and 75°41'24.4"E, while the arch lies along 15°56'37"N latitude and 75°42'04"E longitude. The capstone axis forms a 22° angle with this latitude. So even though the structure pointed towards the east, it does not point towards Sidlaphadi (*Figure 8D*).

The entire structure is placed on top of a large bedrock, as is generally done for most megalithic arrangements. No cupules were observed on the megalith, but multiple cup-like erosion marks were observed on a nearby large rock. Many megalithic structures are known to be oriented towards celestial events. A megalithic fence present in Aihole, Meguti Hill has been discovered to line up with winter solstice sunrise and sunset (Banerjee & Bajaj 2020). The stone circles of Brahmagiri, Karnataka are also identified to have astronomical importance (Wheeler 1948; Rao 1993). Many stone alignments which are directed towards winter and summer solstices have been discovered at Burzahoma in Kashmir, Baise in Karnataka and at Vibhuthihalli and Nilurallu in Andhra Pradesh (Sharma 2000; Rao & Thakur 2010; Rao, et.al. 2011; Menon & Vahia 2011). Megaliths with archaeoastronomical significance have also been identified near Nabta in Egypt and in Northern Ireland (Burl 1987; Malville, et. al. 1998).

CONCLUSION

The rock shelter at Sidlaphadi and its surrounding caves comprise a large housing area for the prehistoric man. It would not be too far-fetched to expect that there would be erected markers that point towards this archaic spot. A petroglyph replica of Sidlaphadi was noted in a natural grotto in the south west corner of the hill. The creation of the miniature replica could be attributed to the earliest society that existed in Badami, who possibly used it as a directional marker to find the rock arch. The stone monument located in the north-western part of the hill fit the criteria for a directional marker, but it was specifically oriented towards the winter solstice sunrise. The surrounding areas of both artefacts failed to provide any further clues as to the time when these artefacts were built. Many megalithic sites in South India have been identified to act as ancient markers with social and celestial significance, and the artifacts described in this paper possibly serve a similar purpose. There is a possibility of other such artifacts scattered among nearby areas awaiting their discovery.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

Dr. Pradipta Banerjee and Mr. Mayur Bajaj were involved in locating the artefacts and performing the necessary calculations to understand their significance. Both the authors were involved in manuscript writing.

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