

From Megaliths to Temples: Astronomy in the Lithic Record of South India



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Abstract India has a long history of monuments built in stone—from prehistoric megaliths to later religious monuments like stupas, temples etc. covering a period of nearly four millennia. In this paper we discuss the influence of astronomy on the design and layout of some of these monuments, as well as depiction and incorporation of astronomical objects and phenomena in several of these or their components. In several instances, prehistoric rock art features Sun and Moon motifs, which are also seen in later sculptural art in temples, hero stones, etc.

Megaliths, which are mostly the sepulchral and commemorative monuments of the Iron Age, have a variety of forms, ranging from the simple upright stone to relatively complex constructions like dolmens etc. We demonstrate that at least some megaliths have sightlines to astronomical phenomena on the local horizon deliberately incorporated into their layout. It is quite possible that these early monuments evolved into later monumental structures like stupas and temples.

Temple architecture in southern India followed two main evolutionary trajectories that spanned roughly 800 years. Temples often feature sculptural panels of deities, myths and legends on their outer walls. We examine some of the legends, such as the Tripurantaka legend of Shiva, commonly depicted on temple walls, for astronomical symbolism. Heavenly bodies, such as the Sun, Moon and planets, are deified in traditions of the Indic religions, and we examine some of these deities depicted in temple sculptures. We also discuss the *Dikpalas*—guardians of the directions—often depicted to safeguard temple precincts. The phenomena of Sun Temples, depictions of eclipses, zodiacal stones and *navagraha* worship are also dealt with.

Finally, we examine Sun-facing structures, such as rock-cut temples and structural temples, which are designed to interact with the rising or setting Sun on given days of the year.

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1 Introduction

India has a tradition of building monumental structures that spans nearly four millennia. Although the earliest surviving monuments are probably the ashmounds of the Neolithic in the Deccan, the most widespread early monuments are certainly the megaliths, which are concentrated in, but not restricted to, the southern part of the subcontinent (Brubaker, 2001; Moorti, 1994). The ashmounds of the Deccan Plateau date back to the South Indian Neolithic, approximately 3000–1200 BC (Bauer et al., 2007), and are products of episodic burning of large accumulations of cattle dung over vast periods of time (Boivin, 2004). Opinion is divided among researchers as to whether these are the products of utilitarian activities—such as disposal for the purposes of hygiene, or venues of ritual activity. Boivin (ibid.) and Johansen (2004) favour the latter, making a case for these being “. . . monumental forms of architecture and the loci of ritual and ceremonial activity.” (Johansen, 2004: 309). At least in the case of one ashmound, at Kudatini, Boivin (2004) makes a case for astronomical intent behind the location of the ashmound at that site.

The South Indian Neolithic was followed by the Iron Age, approximately 1200–500 BC, to which period most of the megalithic monuments are ascribed (Menon, 2012a; Moorti, 1994), although megalith production might have its origins in the Neolithic itself. Indian megaliths display a wide variety in form, and studies of their design and layout suggest that some of them at least might incorporate deliberate astronomical alignments.

Rock art in India encompasses a large span of time—from the Palaeolithic to Early Historic times. Sun and Moon symbols are commonly encountered in rock art throughout the subcontinent, and might have influenced later sculptural traditions too.

Stone temples in India start appearing in the archaeological record in the early centuries of the Common Era. At least some streams of temple architecture seem to have been influenced by the megalithic tradition, and there is evidence to suggest that some of the early temples too might have been commemorative in nature, like the megaliths (Menon, 2014). At any rate, the evolution of temple architecture under the patronage of various ruling dynasties spans at least 800 years, and these temples provided a medium for sculptors to portray various myths and symbols, some of which have astronomical themes. Temples also had components such as zodiacal stones and deified icons of heavenly bodies such as the Sun, Moon and the *Navagrahas*. Certain temples also incorporated interactions with astronomical phenomena, such as the penetration of direct sunlight on given days along the axis of the construction to fall upon the deity in the sanctum.

In this paper we discuss the influence of astronomy on the design and layout of some of these monuments, both prehistoric and later structures, and also dwell on the depiction and incorporation of astronomical objects and phenomena in monuments or their components.

2 The Earliest Monuments

As has already been mentioned, the ashmounds of the Deccan Plateau are probably the earliest monumental constructions of the Indian subcontinent that still survive. These structures are mounds built up over large periods of time as cattle dung accumulations were burnt at high temperatures at intervals. Initially, they were thought to be attempts by the Neolithic societies which authored them to keep the surroundings of cattle pens sanitized. The domestication of cattle, goats and sheep, as well as agriculture, were developments of the Neolithic and it is surmised that these early agricultural and pastoral societies did not use dung as fertilizer in agriculture. However, later research shows a more complex picture, and the periodic burning of the dung thought to have ritual and ceremonial importance. Little work has been undertaken about the locational significance of these monuments, although Boivin (2004) makes a case for the deliberate choice of location of an ashmound at Kudatini to facilitate a sightline to the setting Sun behind a local hill for a short period of 3–5 days in April as well as September.

No uncertainty exists about the role of megaliths as monuments, though. Megaliths are the burial and other monuments that were widespread during the Iron Age in southern India. Though the distribution of megaliths is not restricted to southern India, with significant pockets of occurrence in the Vidarbha region of Maharashtra, Jharkhand etc., this monumental practice is encountered widely all over southern India (Brubaker, 2001). This is illustrated in Fig. 1. Indian megaliths exhibit a wide variety in their morphology, ranging from single erect stones called menhirs (Fig. 2), to extensive arrangements of menhirs termed stone alignments (Fig. 3), as well as boulder circles (Fig. 4), dolmens (Fig. 5), cists (Fig. 6), etc. For a full understanding of these various forms, the reader is directed to Menon (2012a, 2012b) and Moorti (1994).

The Early Historic period, following the Iron Age, saw the proliferation of places of worship affiliated to the various Indic religions. These varied from rock-cut sanctuaries to stupas, temples etc. The earliest temples might have been built of perishable materials like timber and thatch, followed by brick structures. It was in the early centuries of the Common Era that the stone temple made an appearance. Various styles of temple architecture evolved in different regions, though a straightforward picture of this is simplistic, with guilds of artisans of various schools migrating and intermingling, so that it is not uncommon to see temples of the architectural style of a particular region in other regions as well (Hardy, 2012). In most regions, temple architecture evolved over periods of several centuries, with the southern region of Karnataka alone having a continuous sequence of evolution spanning some 800 years.

The religious monument as an expression of the beliefs and legends associated with the societies that used them, offers important clues to understanding the various facets of these belief-systems and legends. We will examine some of these associated with astronomy and celestial bodies in later sections.

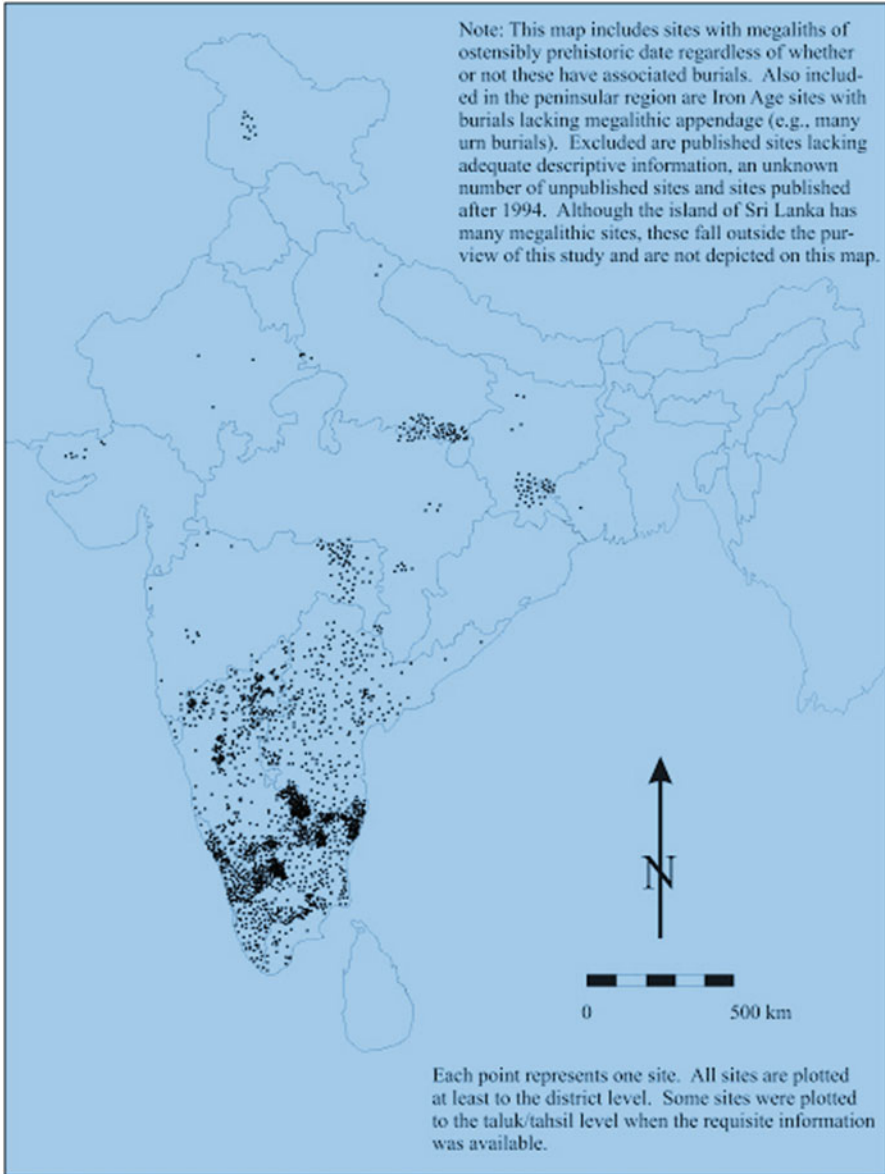


Fig. 1 Showing the distribution of megalithic sites in India. (Courtesy: Professor Robert Brubaker)

Fig. 2 A large quarried slab erected upright at Nilaskal—an example of a menhir. (Photograph: Srikumar Menon)



Fig. 3 More than 2500 boulders are arranged in a diagonal grid at this stone alignment at Hanamsagar. (Photograph: Srikumar Menon)

3 Rock Art and Astronomy

Rock art is ubiquitous in India in space and time.

Depictions in paint on rock surfaces, usually rock shelters, and bruising and engravings on boulders and rock shelters, abound in all parts of the country. Rock art traditions straddle a wide swathe of time—from the Palaeolithic through the

Fig. 4 A boulder circle at Junapani in the Vidarbha region of Maharashtra. (Photograph: Srikumar Menon)



Fig. 5 Dolmens at Hire Benakal in northern Karnataka. (Photograph: Srikumar Menon)



Fig. 6 A cist burial at Chikel Chetti, near Bandipur in Karnataka. (Photograph: Srikumar Menon)



Neolithic, Iron Age and Early Historic period to even medieval times. Themes depicted in Indian rock art are quite eclectic, and range from contemporary activities like hunting, celebrations and dancing, or conflicts like cattle raids, warfare, to more complex themes possibly depicting the world views of the artists. It is not uncommon to see depictions of heavenly objects like the Sun and Moon in rock art,

Fig. 7 A rock art panel at Onake Kindi, near Hire Benakal. (Photograph: Srikumar Menon)



although it is hypothesized that more complex celestial themes like the appearance of a supernova may have been depicted (e.g., see Joglekar et al., 2011).

One of the most enigmatic rock art panels has been reported from a site called Onake Kindi, south of the well-known megalithic site at Hire Benakal in north Karnataka. On a horizontal rock overhang above a vertical rock art panel showing everyday people and cattle etc. is a depiction of what is unmistakably a megalithic burial (Fig. 7). In the centre is shown an interred human body surrounded by grave goods, separated by a ladder-like motif from a depiction of what looks like water. The stones of the boulder circle surround this central depiction and the whole composition is encircled by a ring of petals and rays, which has been interpreted as Sun and Moon symbols by rock art experts (Menon, 2012b). This could be an early precursor of the medieval tradition of incorporating Sun and Moon symbols in hero stones (Fig. 8), signifying that the memory of the persons being commemorated will last as long as these heavenly bodies do.

4 Megaliths and Astronomy

Several megalithic sites have been associated with astronomical sightlines and it has become rather commonplace to attribute astronomical alignments to megaliths, often without any convincing evidence to do so. As the science of archaeoastronomy has matured, the notion of megalithic structures as ‘astronomical observatories’ as advanced by Hawkins (1965), Thom (1967) and others has given way to the more reasonable hypothesis that astronomical alignments were sometimes built into megalithic structures and their layout for symbolic purposes relating to the religions and cosmologies of the megalith-builders (Ruggles, 1999).

Several Indian sites have been linked with astronomical associations, too. Rao (1993) ascribed astronomical intent behind the layout of the stone circles at Brahmagiri, and he also hypothesized (Rao, 2005) that the stone alignment at Hanamsagar (Fig. 3) functioned as a calendrical device. Kameswara Rao and Thakur (2010) advanced similar claims about the stone alignment at Vibhutihalli, also in

Fig. 8 Hero stones near Manipal in Karnataka, showing sun and moon depictions. (Photograph: Srikumar Menon)



north Karnataka. However, my analyses of these sites do not support these claims, with the exception of Vibhutihalli (Menon, 2012a). The stone alignment at Hanamsagar is the most extensive one reported to date in India, and reports of its size range from 1000 menhirs (Allchin, 1956) to 2500 menhirs (Paddayya, 1995). Until the extent and layout of the menhirs are determined through an accurate survey, it is difficult to conjecture about the astronomical purpose of this monument.

However, some megalithic sites do show intentional sightlines to astronomical events on the local horizon. The stone alignments at Nilaskal (Fig. 9) and Byse (Fig. 10) show that pairs of menhirs separated by several meters frame the rising and setting sun at the solstices (Fig. 11). A given menhir pairs up with different menhirs during the spring and autumnal equinoxes to frame the Sun on the horizon (Menon et al., 2012, 2014), as shown in Fig. 12.

5 Megaliths and Later Monumental Traditions

The Indian subcontinent has a rich architectural tradition, with monumental architecture in the form of evolved stupas and stone temples emerging approximately 2000 years ago. Stupas, of course, date back beyond the period of the monarch Ashoka, but the fully evolved stupa with stone cladding and railings emerged slightly later.

Fig. 9 A view of the megalithic site at Nilaskal, showing a few menhirs of the stone alignment. (Photograph: Srikumar Menon)



Fig. 10 A view of the megalithic site at Byse, showing a few menhirs of the stone alignment. (Photograph: Srikumar Menon)



Temples, too, existed even before 2000 years ago, but the early temples were built of perishable materials and we can only infer their form from depictions on stupa slabs etc. (see Fig. 13). The stone temple, which makes a debut in the early centuries of the Common Era in different parts of the subcontinent, evolved via much cross-pollination of ideas through migrations of artisans and the patronage of various dynasties over nearly 800 years.

It is difficult to imagine such traditions in monumental architecture developing over a short span of time. Conventional narratives of monumental architecture do not examine the prehistoric monument-building traditions for potential seeds of later architectural traditions. Nearly a decade of studying megaliths and other prehistoric monuments as well as later monuments provided me with some insight into possible earlier versions of later structures. One of the sites where these connections are evident is the valley of the River Malaprabha, where the well-known temple architecture sites of Aihole, Badami and Pattadakal are located. This region was

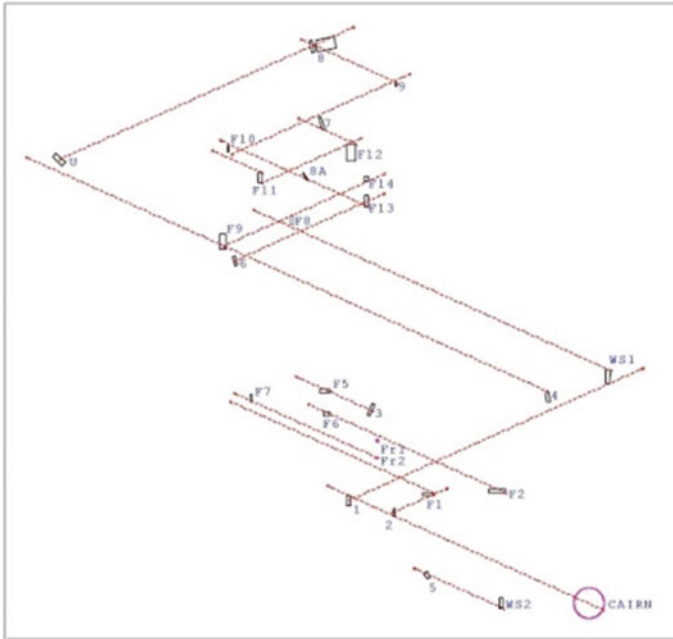


Fig. 11 Plan of the menhirs at Byse showing correlation between pairs of menhirs with the solstice sunrises and sunsets; north is towards the top of the figure. (Plot: Srikumar Menon)

Fig. 12 Two menhirs of the stone alignment at Nilaskal framing the setting sun at winter solstice. (Photograph: Srikumar Menon)



ruled by the Early Chalukya Dynasty for nearly 200 years during the sixth to eighth centuries CE.

However, the region has a history of human occupation that goes much further back in time, with traces from the Palaeolithic, Mesolithic and Neolithic, as well as the succeeding Iron Age and Early Historic periods. This region also has a rich megalithic tradition, generally ascribed to the Iron Age. At several locations, there are temples erected within or very close to megalithic sites. This, as well as evidence for a megalithic structure being modified by temple builders (see Fig. 14), and the existence of memorial temples built over the remains of important persons, points to

Fig. 13 One of the lower drum slabs of the third century Buddhist stupa at Kanaganahalli showing a tree shrine, probably built of perishable materials like timber and thatch. (Photograph: Srikumar Menon)



Fig. 14 One of the temples of the Galaganatha group at Aihole, with a crude megalithic dolmen in the foreground. Analysis of the wedge marks found on the “legs” that prop up the dolmen show that this prehistoric structure was modified by the medieval temple builders. (Photograph: Srikumar Menon)

possible continuity of commemorative traditions from megaliths into later monuments (Menon, 2014).

The similarity in form between cairns and barrows to stupas has been alluded to since early days of research on megaliths in India. It often has been pointed out that



Fig. 15 A panoramic view showing a drum of tightly fitted stone slabs and part of a mound that rose up to the dolmen at the centre of the arrangement, in what is probably an early version of the stupa. (Photograph: Srikumar Menon)

the Buddha himself refers to the practice of building stupas for important person-ages, thus pushing back the antiquity of the memorial mound to pre-Buddhist times. In fact, the form of the fully evolved stupa can be demonstrated to arise from the structural necessities of containment, as the builders strove to make larger and more conspicuous mounds (Menon, 2016). A unique dolmen at the megalithic site of Mallasandram, near Krishnagiri in Tamil Nadu, which is halfway between a megalith and a stupa (see Fig. 15), lends credence to this hypothesis.

This possible continuity in monument-building traditions from prehistoric times to later periods, potentially hold clues to understanding phenomena such as the entry of shafts of sunlight into the sanctum of some temples, which will be discussed later.

6 Temple Architecture in South India

Some of the oldest temples in southern India are the rock-cut as well as structural temples of the Early Chalukyas in the Malaprabha Valley in present-day Karnataka, and contemporaneous structures of the Pallavas in Tamil Nadu (Srinivasan, 1972). These were executed between the sixth and eighth centuries CE and can be considered the advent of stone architecture in the south. However, remains of brick temples have been found elsewhere and even under the foundations of some of these temples, pointing to the existence of temples in brick and probably timber and thatch prior to the advent of stone temples. In fact, Srinivasan (1972: 33–34) speaks of “... a lingering tradition of a taboo on stone for sacred and secular structures, because of its long association with funerary erections ...”, i.e., the megaliths!

Temples in these two geographic regions—the Chalukya- and Pallava-ruled areas—followed different trajectories of evolution over the next eight centuries or so, resulting in a variety of forms, some of which are outlined in medieval texts on the science of temple construction. Hardy (2012) has an excellent introduction to the



Fig. 16 A temple built in the northern ‘Nagara’ idiom, to the left of frame, in close proximity to another in the southern ‘Dravida’ idiom to the right. (Photograph: Srikumar Menon)

classification and development of temple forms in India. The development of temple architecture in the Indian region is a complex subject and over the centuries migrations of artisans from different parts of the subcontinent must have shaped this evolution in the various centers of patronage. For instance, the temple form in the northern idiom called the Nagara and the southern idiom of building known as the Dravida are found alongside each other at the Early Chalukyan site of Pattadakal (Fig. 16), and inscriptional evidence from the sites in the Malaprabha Valley seems to suggest that artisans from different parts of the subcontinent worked here and even collaborated on some temple projects.

Both temples and stupas provided a setting for relief carvings depicting deities, narratives from myths and epics and symbols of religious significance, which is elaborated below.

7 Myths on Temple Walls—The Story of Tripurantaka

From the earliest temples, the incorporation of sculptural panels that depicted various religious themes was part of the design—be it on niches in the external and internal walls, on columns, on lintel beams and on ceilings. The richness of this embellishment also went through various degrees of intricacy, depending on the medium and design considerations. For instance, the outer wall surfaces of the Hoysala Temples of Karnataka took the business of embellishment to a whole new



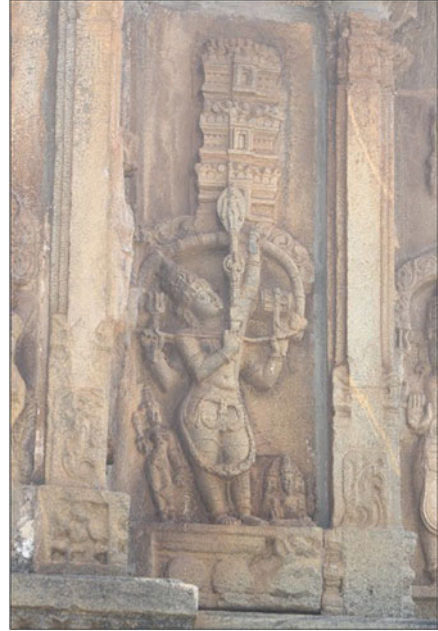
Fig. 17 Part of the exterior wall of the Lakshminarayana Temple at Hosaholalu in Karnataka, built in the Hoysala style, showing how the wall surface is richly embellished with figures of deities, geometrical patterns etc. (Photograph: Srikumar Menon)

level, with dense detail covering entire surfaces (Fig. 17), from plinths and walls to columns, ceilings and towers.

These depictions represented deities, incidents from myths and legends connected with deities, as well as representations of human beings and animals such as elephants, horses etc. One such myth encountered in many temples is that of Siva as Tripurantaka, the destroyer of the triple city of the demons. On most depictions, Siva is shown standing on a chariot, aiming an arrow at three cities which are lined up (Fig. 18). The legend goes that the demons built three great cities—one each of gold, silver and iron, in the sky (Kramrisch, 1981). The great architect Maya completed these cities when the Moon was in conjunction with the asterism called Pusya. It was only when these cities came together in the sky again, when the Moon once more was in conjunction with Pusya that they could be destroyed, by a single arrow. Siva was called upon by the devas to destroy Tripura—the three cities of the asuras, which he did, and the cities fell burning into the western ocean.

Stella Kramrisch (1981: 416) does a detailed analysis of the myth, which has its roots in the Rig Veda, and its transformations over time and comes to the conclusion that originally the myth “. . . had a cosmo-symbolical dimension.” She surmises that the three cities coming together in the sky must have been a triple conjunction of three planets during a Pusya yoga (when the Moon is in conjunction with the asterism Pusya) and that they must have been in one line with the position of Sirius,

Fig. 18 The myth of Shiva as Tripurantaka destroying the three cities of the demons, shown on the exterior wall surface of the Vidyashankara Temple at Sringeri. (Photograph: Srikumar Menon)



which is identified with Rudra-Siva, the archer who brought about the demise of the triple cities. The destroyed cities falling blazing into the western ocean is evocative of the planets in triple conjunction, which must have been brilliant, setting over the ocean.

Kramrisch (*ibid.*) expands on this:

Between this primeval initiating deed (of Rudra shooting an arrow at Prajapati, who was desirous of his own daughter Rohini) and the destruction of Tripura extends the ageless myth of Rudra. Though the destruction of Tripura was enacted in mythical time, cosmic phenomena were adduced as witnesses. The change in scenario of the Tripura myth was linked, it appears, with a particular, observed astronomical phenomenon.”

Using the Indian ephemeris, M. Raja Rao has advanced 2270 BCE or 503 BCE as possible dates for the phenomenon that inspired this myth.

8 Deifying Heavenly Bodies

Traditionally, heavenly bodies are worshipped as deities in most of the Indic religions. Temples to the Sun god are very common, and shrines to the nine ‘planets’ are commonly encountered as subsidiary shrines in many temple complexes. There are guardians to the eight directions, too, usually incorporated as imagery on temple walls or ceilings in the appropriate directions. Zodiacal stones depicting the Sun surrounded by the signs of the zodiac are an integral part of some temple traditions.

Apart from this, motifs symbolizing eclipses are seen adorning lintels, ceilings and outer walls in some temple complexes. These will be elaborated upon below.

8.1 *The Gods of the Directions*

Guardian deities of the world have been known from Vedic times, with early lists having gods for the four cardinal directions, followed by gods for eight directions and later expanded to ten, with the zenith and nadir also included. Wessels-Mevissen (2001) gives a list of these *dikpalas* or guardians of the directions as: Indra for the east, Agni for south-east, Yama for south, Nirrti for south-west, Varuna for west, Vayu for north-west, Kubera or Soma (the Moon) for north and Isana for the north-east, with Brahma for the zenith and Ananta, the serpent vehicle of Vishnu, for the nadir. These gods were believed to afford protection against evil forces according to the religious systems and ritual practices in place during the development of temple architecture between the fifth and eighth centuries CE.

It is understood that a highly developed awareness of space and directions existed in the Indian subcontinent from Vedic times, and some of these concepts were crystallised in the form of representations of these guardians of the directions in sculptural panels when monumental architecture in stone emerged.

The earliest depiction of *dikpalas* are found in the Buddhist stupa at Bharut, assigned to the second century BCE, where two labelled images have been found. Wessels-Mevissen (2001) notes that the depiction of *dikpalas* on temple exteriors is restricted mostly to northern India, where the figures usually are part of the ceiling panels. At the south Indian sites of Badami, Aihole and Pattadakal, in the valley of the River Malaprabha in Karnataka, where the northern and southern idioms of temple-building flourished side by side, there are instances of *dikpala* figures on temple exteriors (Fig. 19) as well as on ceiling panels (Fig. 20).

8.2 *Sun Temples*

Sun worship is commonly encountered at different places in the world in history, including India (Oldham, 1905). In India, Sun worship has existed from a very early period, although the construction of Sun temples seems to have peaked in the ninth to tenth centuries CE. Apart from the well-known Sun temples at Konark, Modhera (Fig. 21) etc., there are many lesser known Sun temples all over the subcontinent. One such temple is the Malegitti Sivalaya at Badami (Fig. 22). This is very picturesquely located atop a large rock, and is attributed to the sixth or seventh century CE, under the patronage of the Early Chalukyas who ruled the region for a large part of the sixth to the eighth centuries CE. Although the temple currently enshrines a Siva linga, on the basis of iconographic details archaeologists and art historians identify it as dedicated to Surya, the Sun god. The *dwarapalas*, or door-

Fig. 19 Kubera, one of the *dikpalas*, on the exterior wall surface of the Papanatha Temple at Pattadakal. (Photograph: Srikumar Menon)

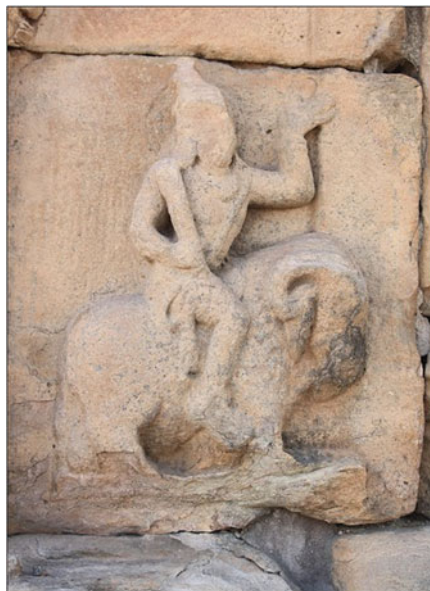


Fig. 20 *Dikpala* figures on the ceiling of Cave 3 at Badami. (Photograph: Srikumar Menon)

guardians, of the temple have been identified as Danda and Pingala—the attendants of Surya (Fig. 23). Also, a figure on the door jamb of the inner sanctum has been identified as Sanjana, the wife of Surya, who, unable to bear the brilliance of the



Fig. 21 The Sun Temple at Modhera in Gujarat. (Photograph: Srikumar Menon)

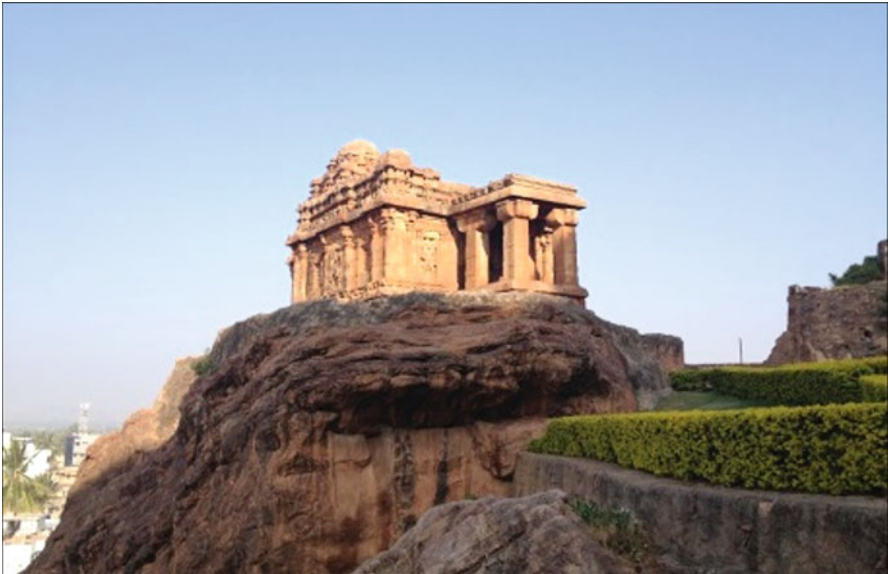


Fig. 22 The Malegitti Sivalaya at Badami, which was originally a Sun Temple. (Photograph: Srikumar Menon)

Fig. 23 The *dwarapalas*, or door guardians, on either side of the entry of the Malegitti Sivalaya, are Danda and Pingala –Surya’s attendants. (Photograph: Srikumar Menon)



Fig. 24 Surya, the Sun God, depicted on the ceiling of the porch of the Virupaksha Temple at Pattadakal. (Photograph: Srikumar Menon)



Sun’s radiation, fled in the disguise of a mare. The story continues that Sanjana’s father, the celestial architect Viswakarma, chisels away an eighth of the Sun’s brightness, enabling Sanjana to return to him.

Another Chalukya structure—the Virupaksha Temple at Pattadakal, from the eighth century CE —has a ceiling depiction of Surya (Fig. 24) which beautifully

illustrates the deification of what is essentially a natural phenomenon. Surya is depicted, as is the convention, standing in his chariot drawn by seven horses, holding two lotus buds in his hands. The chariot is plunging through a cloudy sky and the clouds have been depicted nicely in shallow relief in this carving. On either side of the chariot are two female archers shooting arrows in either direction. They are Usha and Pratyusha—the heralds of dawn and dusk, when it is common to see shafts of sunshine shoot like arrows through gaps in the clouds. This panel, which is one of the finest depictions of the Sun god in the subcontinent, was carved by an artisan named Devaputran according to an inscription in the temple, and is located on the ceiling of the porch of the temple. This panel is also an excellent example of the deification of a celestial body, the iconographic features incorporating what are essentially natural phenomena into aspects of the deity.

8.3 *Navagraha Depictions*

The nine planets featured in the *Navagraha* depictions are Surya (Sun), Chandra (Moon), Mangala (Mars), Budha (Mercury), Guru (Jupiter), Shukra (Venus), Shani (Saturn), Rahu (ascending node of lunar orbit) and Ketu (descending node of lunar orbit). It is interesting to note that the last two—ascending and descending nodes of the lunar orbit—are not physical bodies at all, but are points where the orbit of the Moon intersects the orbital plane of the Earth. It is only when the Moon is at these points that the possibility of eclipses occur. Hence Rahu and Ketu are deified as the upper and lower parts of a demon who was dismembered, so that even when the Moon is devoured (during an eclipse), it comes out of the cut portion of the demon's body.

Each of the planets are given distinct iconographic features. Ketu is often depicted as a snake, a point we will return to in Sect. 8.5 on eclipse depictions. There are temples dedicated to the *Navagrahas* at several places in India, with the largest number being in Tamil Nadu. However, they are most commonly encountered as an integral part of other temples, as subsidiary divinities with the icons of the nine planets usually mounted on a pedestal, either within a shrine or in the open (e.g. see Fig. 25).

8.4 *Zodiacal Stones*

Zodiacal stones seem to have been part of temples erected in the Deccan Plateau in medieval times. It was common to have a lotus motif, interpreted as a Sun symbol, on the floor at the entry to temples since very early times, as in the Ravulaphadi rock-cut temple at Aihole, excavated in the sixth century CE by Early Chalukyan artisans (Fig. 26). Subsequently, the practice seems to have evolved into depicting the lotus figure as the convex top of an ornate pedestal at the entry to temples (Fig. 27). This



Fig. 25 A platform with the *Navagrahas* at the Chandralamba Temple, Sannati. (Photograph: Srikumar Menon)

Fig. 26 A Sun motif, shaped like a lotus, on the floor at the entry to the Ravulaphadi Cave at Aihole. (Photograph: Srikumar Menon)



pedestal went under the name of *Suryakirana* (literally, Sun’s ray), or *Suryakhamba* (Sun pillar) according to Jagadish (2005). Examples from a couple of centuries later show the solar symbol surrounded by signs of the zodiac (Fig. 28).

By far the most elaborate of these is an example from the Amriteshwara Temple at Amritapura, near Shimoga in Karnataka, constructed in CE 1196 and belonging to the Hoysala period. This has an ornately carved solar disk as the convex floor of a dish-like structure, approximately 75 cm in diameter (Fig. 29). The outer edges of the dish, which must have been raised to roughly 15–20 cm high, are now badly broken, but enough survives to show the signs of the zodiac carved at regular intervals on the outside. One of the figures is a depiction of seven horses, symbolizing the Sun, hence it was the Sun surrounded by the signs of the zodiac that was the

Fig. 27 A zodiacal stone or *Suryakirana* at Aihole Museum. (Photo: Srikumar Menon)



Fig. 28 A zodiacal stone, or *Saura Pitha*, at the Chhatrapati Shivaji Museum in Mumbai, from Andhra Pradesh, and dating to about the thirteenth century CE. (Photograph: Srikumar Menon)



sculptural theme. A *pranala* (water spout) suggests that the disk received oblations like the regular *abhisheka* of deities in temples. Cousens (1926) also mentions a similar zodiacal stone found near the Sarveshwara Temple at Naregal in north Karnataka, where the lotus Sun-symbol in the centre is surrounded by the signs of the zodiac on a *pitha* or platform, with *pranala*. However, this stone, is now lost.

8.5 Eclipse Depictions

In Karnataka, a motif of a disk or crescent being nibbled at by a snake or two snakes (Fig. 30) is commonly encountered in the architecture of the Vijayanagara Dynasty and its successors, from the fourteenth century CE onwards. These motifs are seen on various architectural members, such as ceilings of temples and preceding mantapas, beam soffits, temple walls and compound walls enclosing temples etc.



Fig. 29 An elaborate zodiacal stone at the Amritheshwara Temple, Tarikere. (Photograph: Srikumar Menon)

Fig. 30 A motif depicting two snakes (or a snake and an eel) nibbling at a disk, on the compound wall of the Malyavantha Raghunatha Temple at Hampi. (Photograph: Srikumar Menon)



It is clear that the motif refers to the phenomena of eclipses. It is to be recalled that Ketu is often represented as a snake, or a human with the lower portion of the body in the form of a snake.

Raja Deekshithar (2010a, b) has written two papers about occurrence of these motifs in Tamil Nadu. Although he concludes that these representations refer to specific eclipses that were being commemorated or at least recorded, it is felt, based on the observations at several places in Karnataka, that they were probably carved as good luck charms or auspicious symbols. At Hampi, for instance, they are found alongside other motifs, such as fishes, turtles, etc., carved on the compound walls of the Malyavantha Raghunatha Temple, suggesting that they were motifs intended to ward off evil influences rather than commemorating specific eclipse events.

These depictions, as mentioned earlier, show either a disk or a crescent being nibbled by the snakes, or sometimes, eels. It was initially felt that the disk

Fig. 31 A similar motif at the Shikhareshwara Temple at Kavaledurga, showing a deer inside what can be interpreted as the lunar disk. (Photograph: Srikumar Menon)



represented the Sun while the crescent symbolized the Moon. However, in several instances, there is a deer depicted inside the disk (Fig. 31). This suggests that the disk is also representing the Moon, since the black buck is widely regarded as the vehicle of the Moon.

9 Sun-Facing Structures

We have already seen, in Sect. 4, how some megaliths have been oriented to align with sunrise/ sunset on specific days. The act of aligning the structures to directions dictated by the cosmos is humankind's natural disposition to attune their creations to the cosmos they happen to inhabit.

9.1 Rock-Cut Temples and Sanctuaries

The rock-cut temples of Badami in northern Karnataka, are well-known. During the early phase of development of temple architecture in stone in the subcontinent, several magnificent rock-cut temples in the Hindu and Jain faiths were excavated at Badami and Aihole under the patronage of the Early Chalukyan rulers during the sixth to the eighth centuries CE. In addition, there are several minor excavations of the Chalukyans and their successors found in this region.

In general the location and orientation of rock-cut structures are dictated by the nature and situation of the parent rock mass from which the structure is excavated. However, smaller excavations permit more leeway in deciding the locations and orientations of the structures, due to their diminished sizes.

One of the minor excavations at Badami is a small cave, rectangular in elevation, with two ornamental pilasters at its rear corners, cut into the base of a large rock near the Bhutanatha Temple (Fig. 32). The cave faces cardinal east and is 1.9 m in length and the greatest depth of the excavation varies from 0.9 m on the southern side to 1.3 m on the northern. There is a sandstone ridge approximately 30 m high, situated



Fig. 32 The ‘Sunlight Cave’ at the base of a large rock at Badami. (Photograph: Srikumar Menon)



Fig. 33 The view from within the ‘Sunlight Cave’ showing the sandstone ridge to the east. (Photograph: Srikumar Menon)

nearly 150 m to the east of this rock-cut cave (Fig. 33). The cave contains no icon, but has a Sun symbol painted on the rear wall. The local legend is that the rays of the rising Sun strike it every morning. We have simulated the play of sunlight for different times of the year and have found that the cave is lit up by the Sun as it comes over the ridge throughout the year (Fig. 34). Thus it looks like the intention of the builders was indeed to catch the rays of the morning Sun in the structure. There are two temples, possibly memorials, located atop the rock that contains the cave, and the cave may have served some ritual processes associated with commemoration.

Fig. 34 Our simulation of the cave showing light falling inside it on equinox sunrise. The cave is lit up partially even on both the solstices. (Simulation: Srikumar Menon)

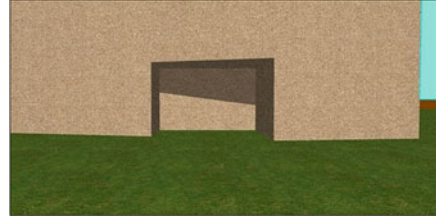


Fig. 35 Photograph showing a shaft of sunlight advancing towards the sanctum with the deity at the Kolhapur Mahalakshmi Temple during *Kiranotsava*. (Photograph: Srikumar Menon)



9.2 Structural Temples and Solar Penetration into Sanctums

Several cases of interaction of structural temples with the solar cycle, with penetration of sunlight into the structure on specific dates, are known (Shylaja, 2007; Vyasanakere et al., 2008).

One such example is the Kiranotsava (literally, festival of the Sunray) at the Mahalakshmi Temple at Kolhapur. The temple faces west (azimuth -256°) and the rays of the setting Sun penetrate to various extents inside the sanctum at two times in a year—between 31 January and 2 February and between 9 November and 11 November (Figs. 35 and 36). The temple is attributed to the seventh century CE, although the present structure might have been constructed as late as the eleventh century. It is not known why these particular dates have been chosen for facilitating the entry of sunlight into the sanctum. Perhaps it has to do with the date of consecration of the deity or some other auspicious date, the nature of which has been lost to us.

Fig. 36 The Sun appearing in the opening of a *mantapa* in the opening of a *mantapa* to the west of the sanctum of the Mahalakshmi Temple during *Kiranotsava*. (Photograph: Srikumar Menon)



It would be useful to study all temples with similar phenomena associated with their structures to determine if there is any rationale behind the choice of dates of entry of sunlight into the sanctum (cf. Kameswara Rao and Thakur, 2011).

10 Conclusions

This paper is intended as a primer to the study of the association of astronomy with stone monuments in the Indian subcontinent, in various contexts. The instinct to orient monuments to cosmic phenomena, such as the extreme risings and settings of the Sun, seems to have prevailed from prehistoric times, exemplified for example by the orientation and layout of the stone alignments at Nilaskal and Byse. This desire to align man-made structures with directions dictated by the cosmos around us is an ancient human instinct that is also manifest in the tendency to orient later monuments, such as temples, so that sunlight penetrates into the dark sanctum on important dates.

Celestial bodies have been worshipped since prehistoric times, and later were incorporated into indigenous religions. Many of the properties of these heavenly bodies were ascribed as aspects of the deities they became in art and literature—as iconographic features and personalities. Astronomy was an integral part of the development of religious thought in the Indian subcontinent, and finds distinct expression in the art of various periods—from prehistoric rock art to the sculptural programmes of temples.

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