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# ASPECTS OF OBSERVATIONAL ASTRONOMY IN INDIA: THE VIDYASANKARA TEMPLE AT SRINGERI

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**Abstract:** The *navaranga* in the medieval stone temple of Vidyasankara at Sringeri, built around A.D. 1350, has twelve zodiacal pillars arranged in a square with the zodiacal signs carved on them. It has been claimed that the morning sunrise lights up the pillar that corresponds to the zodiacal constellation in which Sun is located at that time, so the temple can be used as an instrument to predict calendar days. We carried out observations to investigate this aspect by monitoring both sunrises and sunsets, and found that the correspondence between the illumination of specific pillars and the zodiacal sign of the Sun could only be maintained if the epoch for such an arrangement was around 2000 B.C. The implications of this finding are discussed in this paper.

**Key words:** Observational astronomy, medieval temples, zodiac, equinoxes, solstices, sunrises

## 1 INTRODUCTION

Observing and recording positions of the Sun, Moon, planets and stars as objects of wonder, and further, realizing that their movements were repetitive, was a major step in the intellectual growth of ancient man. In India some of the efforts to trace the progress of observational astronomy from ancient times rely upon old structures and monuments, like the megalithic alignments (see Rao, 2005; Rao and Thakur, 2010). In later periods, Hindu temples also became time-keepers. It is of interest to see how such temples in India have been utilized to monitor the passage of time, including the seasons, the year, the month, etc. Some examples are the Sun temples at Modhera and Marthanda (Rao, 1996). The light of the equinoxial sunrise is made to fall on the central deity in several Sun temples that were constructed even as early as the sixth to seventh centuries A.D. The Sun temple at Arasavalli in the Srikakulam district of Andhra Pradesh, which was probably constructed by rulers of early Ganga Dynasty, shows such a feature (although the present rebuilt structure shows the sunlight falling on the Sun god a few days earlier that the spring equinox and later than the autumnal equinox due to a slight misalignment of the windows). A unique temple which is said to illustrate in detail the monthly changes in the Sun's position during the year is the Vidyasankara Temple at Sringeri.

Sringeri (originally known as Rushyashringagiri) is located in the north-western part of Karnataka in the ghats and is well known as a religious centre where one of the four Sankar Mathas[1] is located. Adi Sankara (A.D. 788–820) is supposed to have established this Mutha and appointed one of his chief disciples as the first pontiff. The Matha maintains uninterrupted continuity in its activities from its origin to the present. The Vidyasankara Temple is part of the Sankar Matha complex (see Figure 1), and was built on the banks of the Tunga River by Sri Bharati Tirtha and Sri Vidyaranya, pontiffs of the Matha, during the period A.D. 1338-1350 as a memorial to their teacher, Sri Vidyasankara Tirtha (A.D. 1228– 1333), who also was an earlier pontiff of the Matha (Shrinivas Ritti and Gopal, 2004; Venkataraman, 1976).[2] Sri Vidyaranaya is also credited with providing the inspiration and motivation for the establishment of the Vijayanagara Empire by Hrihara and Bukka.

The Vidyasankara Temple has a unique architectural plan and is built entirely of granite. The plan is almost elliptical (Figure 2), formed by the apparent union of two opposed apsidal parts (or *chapa*) which meet at their open ends, with the curved ends at their eastern and western extremities. The apse on the western side (towards the top in Figure 2) contains the *vimana* part of the temple, while shrines in the eastern apse comprising the *makhamandapa* enclose the *navaranga*, with its twelve distinctive zodiacal (rasi) pillars.

The two parts are connected by an intervening north-south corridor (or transept). With its principal entrance at the eastern apse end and a similar entrance at the rear on the west, "… the orientation of the *vrittayata* structure is of the end-on type." (Srinivasan, 1976: 5). The main interest astronomically is the *navaranga*, whose unique aspects have been commented on as follows by two famous archeologists:

> The Navaranga which is a structure having twelve highly ornate pillars of the Dravidian type. On the rear side, of each pillar has an ornamental pilaster raising out of a Kalasa and bearing one of the twelve signs of the Zodiac. It is said that the sunlight falls upon the Ram pillar during the month of Aries and on the Bull pillar in the month of Taurus. (Krishna, 1936: 293).

> Each of these twelve pillaikkals bear the image of a sign of the zodiac or rasi after which the pillar itself is called. It is said that sunlight falls in the early mornings upon the appropriate rasi pillar, during each of the twelve months of the solar year … As stated before these twelve rasi pillars are so arranged that the morning Sun's rays fall on one of them, through one of the three openings in the order of the twelve solar months, named after twelve rasis or houses which the Sun is said to occupy (aspect) in the course of the year according to Indian astronomy the rasichakra … The floor itself is marked by shadow lines in conformity with the Sun's movement round the twelve rasi pillars. (Srinivasan, 1976: 35).

Figure 1: The Vidyasankara Temple at Sringeri as seen from the east. The eastern doorway is in the front.

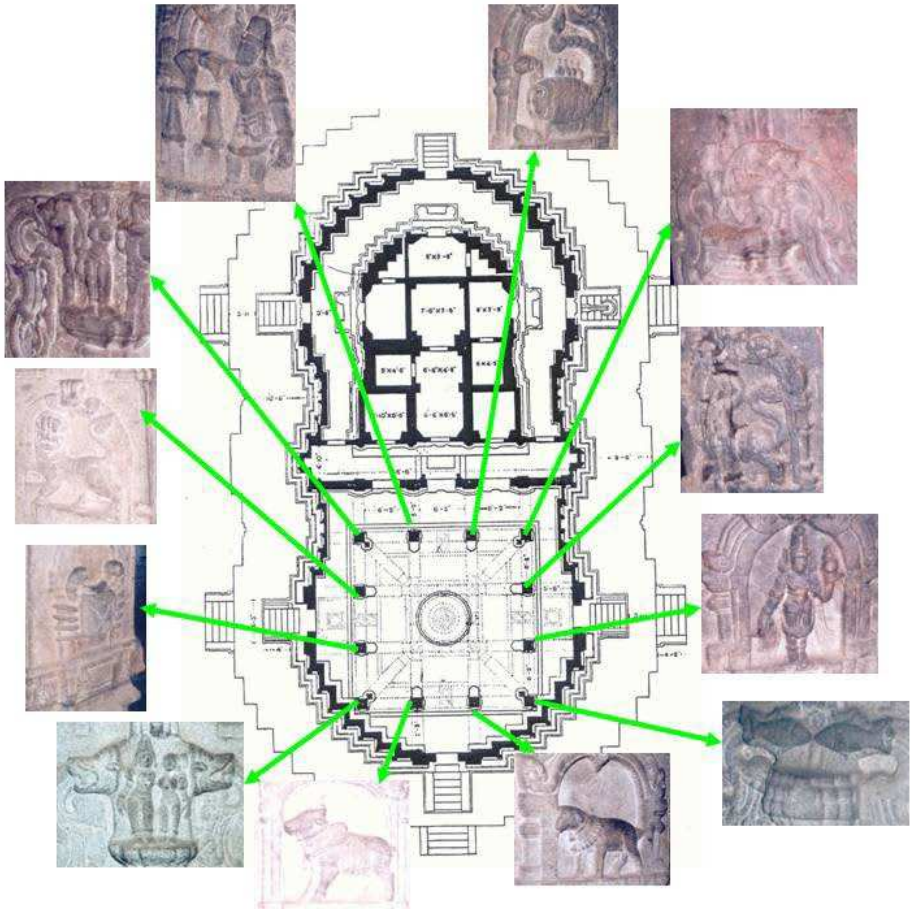

Figure 2: Plan of the Vidyasankara Temple (with north to the right). The arrangement of the zodiacal signs on the backs of the pillars in the *navaranga* is also shown.

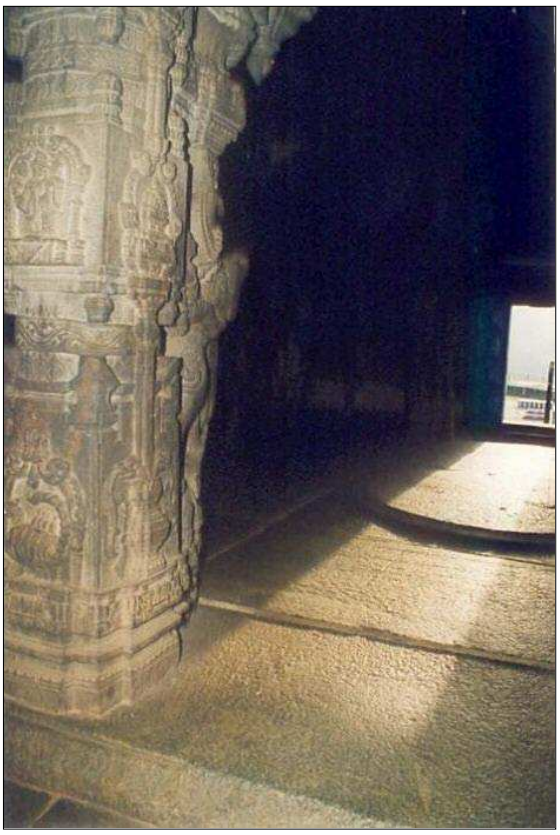

Figure 3: The beam of morning sunlight near the Scorpio pillar in the Vidyasankara Temple on 21 September 2002.

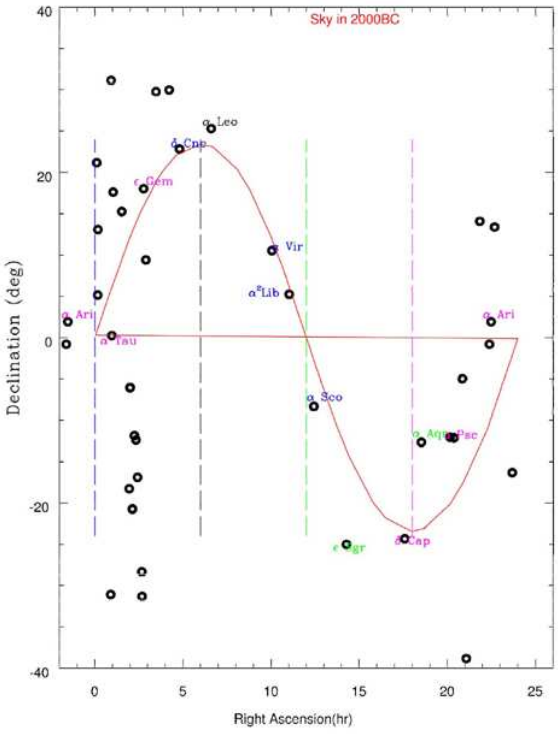


Figure 4: The sky in 2000 B.C. Positions of some bright stars, mainly in zodiacal constellations, are shown to illustrate Sun's path. Note that the position of the Sun around the autumnal equinox is in between Libra and Scorpio and at the spring equinox it lies between Aries and Taurus. The positions of the equinoxes and solstices are shown by dashed vertical lines.

In other words, the *navaranga* is devised as a calendrical device (or instrument) that can mark any particular day or season, etc. This is indeed a unique device if shown to be true, and this is precisely the aspect that we wanted to investigate by monitoring the sunlight on the rasi pillars. Recently Subbarayappa (2008: 258) re-emphasized this aspect:

> Apart from its importance for appreciating the artistic tradition from Chalukyan to Vijayanagara, this temple illustrates the application of astronomical-astrological symbolism to temple architecture. It has a pillared hall (mandapa) supported by twelve pillars, each pillar representing the related sign of the zodiac of twelve signs (rasi-s). It is believed that the pillars are positioned in such a way that when the sun rises in the corresponding sign of the zodiac, its rays are supposed to fall on the related pillar, the shadow of which can be observed during that particular month. How far is it true needs a critical examination. However, the twelve pillars appear to be intended for portraying in a way the twelve solar months in the context of the twelve zodiacal signs.

As a national monument, the temple is under the control of the Archaeological Survey of India (ASI). We asked ASI to provide us with photographs of sunlight on the equinox day, 21 September 2002, which they kindly did (Figure 3). As this photograph shows, the beam of morning sunlight came close to, and almost touched, the Scorpio pillar, suggesting that the Sun was in the constellation of Scorpio at this time—if we accept the above-mentioned statements by Srinivasan and Krishna. However, on 21 September 2002 the Sun was actually in the constellation of Virgo, not Scorpio, an angular difference of about 60°, which does not agree with what has been asserted by Krishna and Srinivasan. On the other hand, if we ask when could such a situation arise so that the Sun was located in the constellation of Scorpio and also illuminated the pillar with the sign of Scorpio, the answer turns out to be in about 2000 B.C. (Figure 4), well before the construction of the temple.

In the fourteenth century, Indian astronomy was sufficiently well developed for astronomers to know (and be able to predict) the Sun's position on the zodiac. The builders of the temple were well versed in astronomy (see Srinivasan, 1976), and thus would have been aware of the Sun's position. It appears therefore that the mismatch of the observed sunlight on the rasi pillar and the corresponding position of the Sun in the sky was deliberate. Maybe it was not meant to be functional, but rather a ceremonial exercise. We therefore decided to investigate how consistent the movement of sunlight is with respect to the zodiacal pillars. Is it in the same order as the movement of the Sun in the sky (and on the horizon) in 2000 B.C.? How much use was made of practical astronomy? In the following sections we describe our observations as we monitored the beams of sunlight on the rasi pillars.

## 2 VIDYARANYA AND THE PLAN

The Vidyasankara Temple was constructed during the fourteenth century but no records or architectural plans (or inscriptions relating to them) currently exist (Sastry, 1976; and personal communication). The genius of two sages, Bharathi Krishna Tirtha and Vidyaranya, along with the skill of the architect, Jakkana, was collectively responsible for the construction of the Temple. Both gurus were supposed to have been very well versed in

Vedic and Upanishadic principles and practices. Vidyaranya, in particular, wrote several commentaries and literary works relating to the Vedas and the Upanishads. He was supposedly a great teacher, and as an exponent of Vedic knowledge was second only to Adi Sankara (see Shrikantaya, 1990; Venkataraman, 1976). The plan of the Vidyasankara Temple is said to contain a synthesis of various architectural and religious traditions which were moulded into a unique structure (Srinivasan, 1976). The style of architecture was

> … a fine blend of two major traditions of the south, the Calukyan, as it had evolved till the time of Hoyasalas, and the Pallavas, as it had evolved till the days of the later Pandyas of Tamilnadu, with a sprinkling of some of the features of north Indian styles. (Venkataraman, 1990: 217).

The Temple stands on a platform ~1.5 meters high called the *upapitha*, on top of which exists another structure, the *adhisthana*, that raises the basic level of the Temple to a height of ~2.5 meters. This level is reached via a series of steps which lead up to the six doorways of the Temple, three on the eastern side (leading to the *navaranga*) and three on the western side, which contains the superstructure housing various shrines, the center of which is the Sri Vidyasankara *lingam* (Figure 2). Almost every part of the Temple has carvings or sculptures, the details of which have been described by Srinivasan (1976), Venkataraman (1990) and Alagaraja (2003).

In the present context, where the focus is on the *navaranga* and the morning sunlight, it should be noted that the doorways are at sufficient height such that the morning sun rising over the eastern horizon in this hilly region reaches the interior of the *mukhamandapa* without any problem. The north-eastern horizon has had structures built on it in recent years, and in addition there are now some coconut trees in front of the Temple which prevent the sunlight from reaching the shrine until the Sun attains an altitude of about 7°. On the western and northern sides of the Temple there are now various structures and other temples, and consequently the horizon in these directions cannot be seen. The setting Sun can only be seen when it is above 11°.

The *mukhamandapa*-apse, or the eastern half of the temple, contains three entrances, which are on the eastern, northern and southern sides. The eastern entrance is the primary entrance from which the central shrine is seen, as well as the rising Sun's direct light. The *navaranga* has the twelve massive monolithic pillars called *aniyottikkals* or *citrakambhas*, with large animal sculptures on their centre-facing sides, all placed on a slightly raised platform. These pillars depict elephants trodden upon by large lions (*vyalas*), with riders on top of them holding on to some sort of a bridle. In addition to the zodiacal signs, each pillar also has an *adhidevata* (the presiding deity), and a planet in human (anthropomorphic) form, depicted on it. As an example, the Leo sign has Surya as its *adhidevata.* These pillars are the main objects of the present investigation in relation to the morning sunlight. The central part of the *mukhamandapa* has a large, slightly elevated, stone circle with some line markings on it which are supposed to indicate the path of the sunlight. According to Alagaraja (2003, "The floor itself is marked by shadow lines which are cast in conformity with the sun's movement around the twelve rasi pillars." The western side the *mukhamandapa* also has two small shrines, one on each side of the central shrine. The southern one has the god Ganapathi and the northern one the goddess Durga, with their *dwara- palakas* (celestial guardians of the doors).

The direct sunlight comes mainly through the eastern doorway, but also partly through the southern and northern doorways. There are also a few small gaps in the outer wall which allow the sunlight to enter, but whether this was intentional or not is not clear.

## 3 MONITORING THE SUNLIGHT

Even though observations to monitor and image the path of morning sunlight started in 2002 and continued until 2008, progress was slow because of cloudy and rainy days in any given month plus restrictions due to the religious and other functions of the Temple. Thus, most of the observations were obtained during 2008. In the following section we present some of these observations as the Sun moved on the eastern horizon from summer solstice (*dakshinayana*) to winter solstice (*uttarayana*) and back.

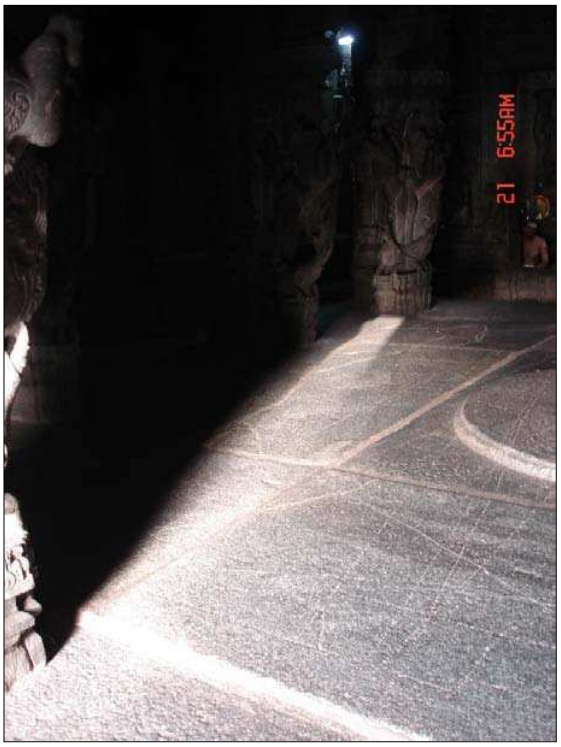

Figure 5: The beam of sunlight on 21 June 2008 at 6:55 a.m (IST) just touches the Leo pillar, on the left, and also extends to the Virgo pillar (in the background). .

### 3.1 From Leo to Aquarius

The morning sunlight on 21 June 2008 seemed to touch the base of the Leo *(Simha)* pillar, as shown in Figure 5. This was very close to the summer solstice (which actually occurred on 21.0 June U.T and 5:30 IST). The light also extended to the Virgo pillar.

Moving clock-wise to the next pillar, the sunlight first touched the base of the Virgo *(Kanya)* pillar on 14 May 2008, but was seen more prominently touching the pillar by 19 May (Figure 6) when part of the light extended to the entrance to the Sri Ganapathi shrine.

Figure 6: Sunlight touching the Virgo pillar on 19 May 2008 at 6:48 a.m.

Figure 7: Sunlight in the central shrine on 23 March 2004, at 6:42 a.m., close to the equinox.

On 9 April 2008 the morning sunlight touched the right side of the base of the Libra (*Tula*) pillar. Observations on 22 and 23 April 2004 and 2005 showed that the sunlight illuminated the left of the base, suggesting that the pillar was centrally illuminated around 15 May. Similarly, observations made on 24 August 2004 also showed that the morning sunlight fell on the base of the Libra pillar, slightly to the right of centre.

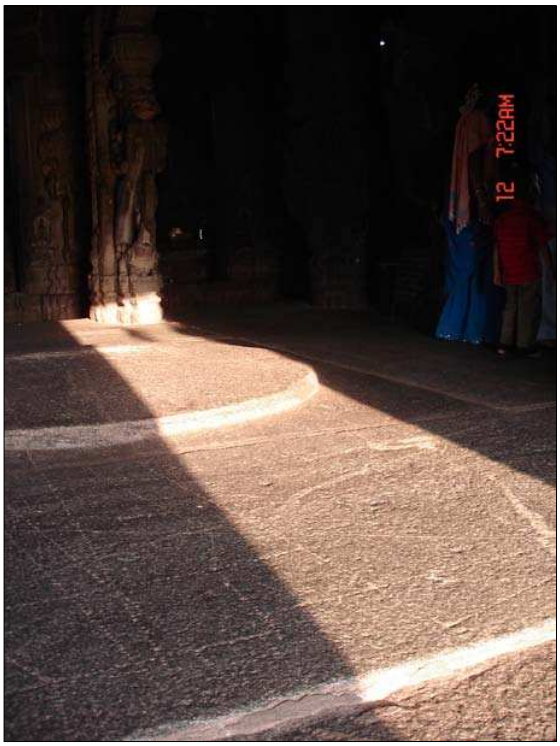


Figure 8: Sunlight on the Scorpio pillar on 12 March 2008 at 7:23 a.m. Note that the lines on the ground do not show any connection with the sunlight zone.

The light from the equinox sunrise, which occurred around 21 March 2003, was seen falling directly on the Sri Vidyasankara *lingum* in the central shrine, and passing in between the Libra and Scorpio pillars (Figure 7).

The base of the Scorpio (*Vrischika)* pillar was touched by the sunlight on the morning of 12 March 2008, slightly to the right of centre, as shown in Figure 8. It was expected to illuminate the centre of the pillar by 15 or 16 March. Figure 8 also shows marked lines on the floor which do not seem to have any association with the direction of the sunlight.

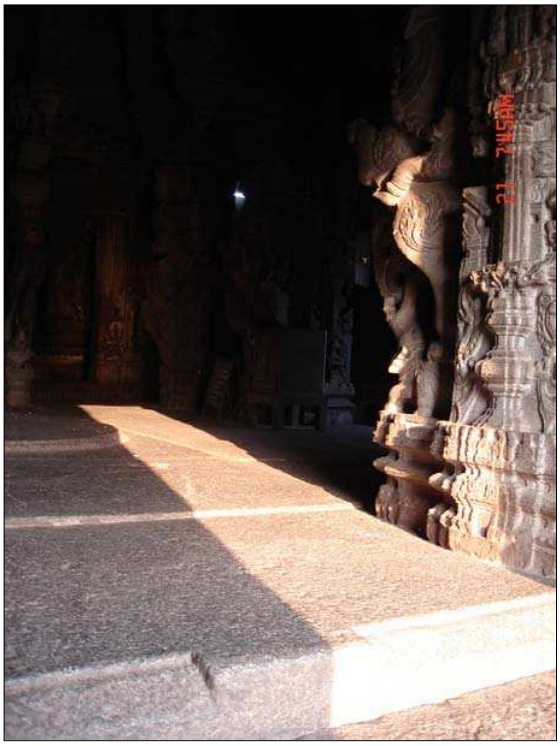


Figure 9: Sunlight close to the Sagittarius pillar on 21 February 2008 at 7:45 a.m.

On 21 February 2008 during the Sun's journey northward (*uttarayan*), the outer edge of the beam of sunlight through the eastern door came very close to the Sagittarius (*Dhanus*) pillar, located to the right of the Scorpio pillar, as shown in Figure 9. Similarly, on 2222 October 2005 as the Sun moving southward (*daksh-nayan*), the rising Sun cast a similar beam pattern, close to the Sagittarius pillar.

The Capricorn (*Makara*) pillar was touched by the beam of sunlight on the morning of 22 January 2003, as shown in Figure 10. The width of the beam coming through the eastern door gets narrow because of the angle of the Sun and also because part of it falls on the Aries (*Mesha*) pillar. A similar beam of sunlight was observed on the morning of 21 November 2005 approaching the Capricorn pillar as the Sun was moving to the north after passing through the winter solstice.

As shown in Figure 11, on 22 December 2004 the beam of sunlight through the eastern door moved in the

direction of Aquarius (*Kumbha*), with the winter solstice occurring on 23 December. The beam of sunlight retraced its path after reaching the winter solstice. Thus, the systematic motion of the Sun from north to south on the horizon was traced by the beam of sunlight from Leo to Aquarius, and the occurrence of the beam on the respective pillars suggested that the Sun was entering that constellation. Thus, the duration of any month in the year could be monitored as the sunrise point moved along the horizon by tracing the position of morning sunlight on the different rasi pillars. However, this motion corresponded to the Sun's position among the constellations in about 2000 B.C., not at the present day.

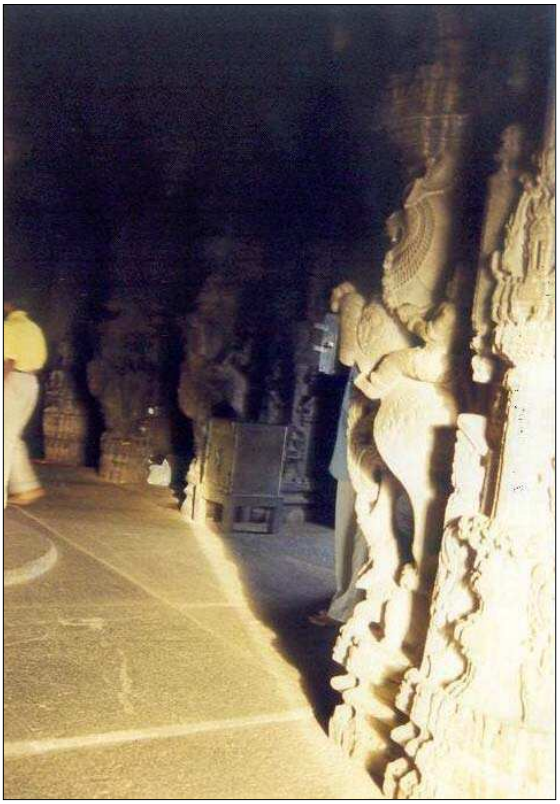

Figure 10: Sunlight on the Capricorn pillar (in the background) on 22 January 2003 at 8:01 a.m.

### 3.2 The Sky in 2000 BC

We have computed the positions of several bright stars for the epoch of 2000 B.C. using Hipparcos proper motions as given in ADS (Simbad) using a programme written and developed by A.V. Raveendran to trace the sky around the zodiac of that time. Figure 4 shows the position of the ecliptic on the sky in 2000 B.C. The summer solstice occurred when the Sun was in Leo and the winter solstice when it was in Aquarius, while it was between Libra and Scorpio when the autumnal equinox occurred and between Aries and Taurusat at the time of the Spring equinox.

### 3.3 Other Zodiacal Constellations

Of the remaining five zodiacal constellations, Aries and Taurus are associated with the eastern entrance. In the course of more than one month the beam of sunlight falls on these pillars as it moves to other pillars in the Temple. The Aries pillar was illuminated from October to February by morning sunlight. Figure 12 shows the

Figure 11: The beam of sunlight is directed towards the Aquarius pillar on 22 December 2004, at 8:51 a.m.

sunlight on 22 February 2005 touching the southern side of the pillar, just like on 22 October 2005. The beam of sunlight was just able to graze the side of the Aries pillar before it moved away, around 25-27 February. This movement of sunlight was consistent with the Sun's motion in the sky in about 2000 B.C.

The Taurus pillar is on the opposite side of the Temple from the Aries pillar with respect to the eastern entrance. Our observations showed that the sunlight first grazed this pillar on about 9 May 2004. Observations made on 23 April 2004 showed that the beam of sunlight was still some distance from the pillar. This position of the Sun in Taurus at early May is not inconsistent with the epoch of about 2000 B.C., although it might be considered the outer boundary for this constellation.

Figure 12: Sunlight falling on the Aries pillar on 22 February 2003 at 9:30 a.m.

Figure 13: A narrow beam of sunlight enters the Temple through a hole in the wall, and falls on the Pisces pillar (centre left).

For the three constellations of Cancer, Gemini and Pisces, it appeared that the beam of direct morning sunlight would not reach them as the Gemini and Pisces pillars were at the southern and northern corners of the *navaranga*. However, we discovered that there is a small hole in the wall and sunlight seeped through it on 19 May 2008, and fell on the Pisces pillar (see Figure 13). We observed the sunlight falling on the Pisces pillar even in October.

A similar situation may also be true for Gemini, but no observations were made. There is also a possibility that on certain dates the setting Sun will illuminate the pillars for Cancer and Gemini, as there are gaps in the pillars so that the western sky could be seen through the southern door.

### 3.4 The 2000 B.C. Epoch and the Arrangement of the Pillars

With the exception of just two or three pillars, the correlation between the Sun's location in a particular constellation in the sky and the occurrence of a beam of sunlight on the associated pillar seems to have been consistent for the epoch of about 2000 B.C. It would seem that the zodiacal ordering of the pillars and their positioning was carefully determined in order to be consistent for the epoch. We calculated the azimuths of the Sun's position and the positions of the pillars at the time of our observations. The pillars have base widths of between 0.5 meters and 1.0 meter while the beam of sunlight entering via the eastern door has a width of between 0.12 meters and 0.9 meters, thus providing an uncertainty in the determination of 2°–4°. Within these uncertainties the azimuth of the sunlight and the positioning of the pillars appear to match (see Table 1).

Table 1: The azimuth and altitude of the Sun on various dates, and the temple pillars illuminated.

| Day, Month, Day, and Time of Observation (IST) | Azimuth (°) | Altitude (°) | Illuminated Pillar |
|---|---|---|---|
| 21/06/2008, 0655 | 68.22 | 10.75 | Leo |
| 19/05/2008, 0648 | 71.77 | 9.70 | Virgo |
| 09/04/2008, 0701 | 83.67 | 8.31 | Libra |
| 12/03/2008, 0723 | 95.15 | 9.19 | Scorpio |
| 21/02/2008, 0745 | 104.45 | 12.29 | Sagittarius |
| 22/01/2003, 0801 | 114.61 | 13.69 | Capricorn |
| 22/12/2004, 0851 | 124.52 | 25.49 | Aquarius |

There is another feature in the arrangement of the pillars that is an indicator of the epoch. Conventionally, depiction of zodiacal constellations in an Indian context starts with Aries and proceeds clockwise. Figure 14 shows this arrangement on the ceiling of another Indian temple. One would expect a similar arrangement in the *navaranga* of the Vidyasankara Temple. From the main (eastern) entrance one would expect Aries to be on the left, and Taurus etc. to follow in a clockwise direction, but the actual arrangement in the Vidyasankara Temple is not like that. From the main entrance Aries is on the right and Taurus is on the left, creating a break. It appears as though the arrangement starts with Taurus, and the entrance is between the two constellations. In 2000 B.C. the vernal equinox was between Aries and Taurus, very similar to the arrangement here, suggesting that the eastern doorway represents the vernal equinox of 2000 B.C.

Figure 14: A conventional depiction of the zodiacal signs, as seen on the ceiling of the Thiruvisanallur Temple.

It is obvious that the rasi pillar arrangement was not meant to be functional at the time the Vidyasankara Temple was built (circa A.D. 1350). Rather, it was intended to be ceremonial, and was probably adopted from an older sacred (maybe Vedic) arrangement. So it was a replica of an earlier calendrical device, and with some minor changes to the arrangement—like the presence of a western entrance, to allow for sunsets—the present *navaranga mandapa* would have been a good functional calendrical device in 2000 B.C. Rao and Thakur (2010) have shown that the much earlier megalithic square stone array at Vibhuthihalli also acted as a calendrical device, and that both sunrises and sunsets played a role. Since the builders and promoters of the Vidyasankara Temple were renowned Vedic scholars and practitioners it is likely that they adopted a Vedic sacred or ritual platform which had astronomical, and hence calendrical, significance. In Section 4 we discuss

one such example which might be relevant in this context.

## 4 VEDIC ALTARS

According to Kak (1995), "The central idea behind the Vedic system is the notion of connections between the astronomical, the terrestrial and the physiological." while many of the myths described in *vedas* and the *Brahmanas* deal with astronomical events (Kak, 1993). Many Vedic rites were performed for a full year and they were clearly meant to mark the passage of time. Apparently a considerable part of the *Satapath*a *Brahamana* deals with altar construction in the *agnicayana* rite. This rite is about a representation of the reckonings of the year. Kak (ibid.) also describes how the representation of the passage of time was organized in terms of sacred altars, a bird alter being one of them:

> Time is represented by the metaphor of a bird. The months of the year were ordinarily divided into six seasons unless the metaphor of the bird for the year was used when *hemanta* and *sisira* were lumped together. The year as a bird had the head as *vasant*, the body as *hemanta* and *sisira*, the two wings as *sarad* and *grishma*, and the tail as varsha. (ibid.; see Figure 15).

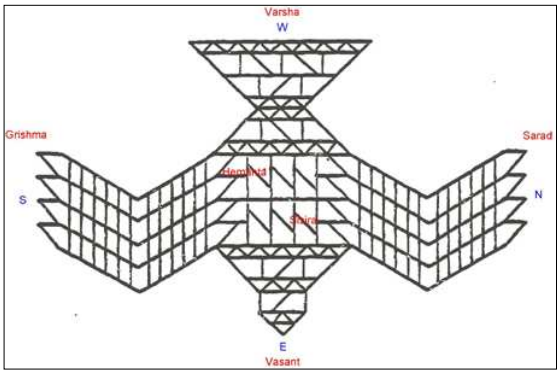


Figure 15: Drawing of a Vedic bird altar representing the passage of a year. Corresponding Indian seasons are also shown (after Kak, 1993).

Each Indian season consists of a period of two months, and this system has been in use since Vedic times (Abhyankar, 1993; Kak, 1993). *Vasant* consists of March and April, *grishma* May and June, *varsha* July and August, *sarad* September and October, *hemanta* November and December and *sisira* January and February, similar to the order of the zodiacal pillars in the Vidyasankara Temple. While adopting the representation of the year by seasons and reflecting this in their sculpture, the fourteenth century architects of the Vidyasanka Temple used zodiacal signs (which by then were an integral part of Indian astronomy) to represent seasons on a month-by-month basis.[3] It is likely that the Vidyasankara temple-builders adopted one of these altars, like the bird (falcon) altar which was a real calendrical device, to represent the passage of time in the *mukha-mandapa*.

## 5 DISCUSSION

It is obvious that the builders of the Vidyasankara Temple deliberately planned the arrangement of the zodiacal pillars. Despite the statements of some archaeologists (e.g. see Srinivasan, 1976), the morning sunlight falling on a particular zodiacal pillar does not indicate the constellation in which the Sun is located, either at the present day or at the time when the temple was built. Sidhanthic astronomy was well developed in fourteenth century, more than enough to recognize this fact. The builder of the Vidyasankara Temple, Sri Vidyaranya, was acknowledged as one of the great astronomers of that era (see Venkataraman, 1990), and the rasi pillar arrangement was adopted as a ceremonial structure rather than as a functional one. The calculations of *panchangas* (Indian almanacs) were done regularly. The inscriptions of that era, and earlier, usually mentioned the year, the month, the *thidhi* (phase of the Moon), the *vara* (day of the week) and the *nakshtram* (the asterism closest to the Moon on the given day), and maybe the *yoga* (the sum of the longitudes of the Sun and Moon in the *nirayana* system converted into minutes of arc and divided by 800) and the *karana* (half a *thidhi*). For further details see Balachandra Rao (2000). The squarish arrangements are often used for divine or celestial things.

The geometrical proportions of the pillar arrangement in the Vidyasankara Temple and the time taken for the beam of morning sunlight to move from one pillar to the next (about a month) matched very well the positions of the zodiacal constellations in 2000 B.C. Furthermore, the angular displacements of the sunlight towards the solstice directions on the northern and southern sides are smaller than on the western (equinoxial) side. This was not an *ad hoc* adoption of a pattern but rather a well-designed construction which was probably duplicated from an earlier design dating to 2000 B.C. That one half of the temple features this construction vouches for its importance and the sacred role that it played in the over-all scheme of things. The outer wall friezes (termed *bahya bhatti*) have several anthromorphic images that related to astronomy (e.g. the Moon and the planets), and even *Prajapathi*, the Lord of the Year) is represented. Thus, astronomy and the passage of time played a substantial role in the design of this temple. The Vidyasankara Temple thus illustrates a calendrical arrangement that dates from 2000 B.C., and one that may have been adopted from Vedic literature.

## 6 CONCLUSIONS

The recent monitoring of morning sunlight on the rasi pillars in the *navarang* of the Vidyasankara Temple revealed that they do not indicate the position of the Sun in the zodiacal constellations of the present epoch but rather they match the zodiacal sky of 2000 ± 300 B.C. Although the temple was supposedly built around A.D. 1350, it is suggested that the rasi pillar arrangement might have been adopted from an earlier 2000 B.C. sacred calendrical device (or a Vedic altar).

## 7 NOTES

1. These are religious centres to teach, preach and practice advita philosophy. They were established by Adi Sankar, a great *guru* and sage.
2. However, Michel (1995) thinks the temple dates much later, to the sixteenth century.
3. The zodiacal signs were only standardized in Indian astronomy at a later date, through interactions with Greek astronomers.

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