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Inscriptions and Evolution of the Calendars in South East Asia

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Here, we attempt to analyze the evolution of the calendars over the last thousand years as depicted by one of the most reliable sources—the stone inscriptions. These are found all over India as edicts, records of grants and donations and commemorative stones marking heroic deeds. A large collection exists in the form of copper plates preserved by many families. The practice of creating such records extended to South and South East Asia as early as before the Common Era. The time is recorded very systematically and hence, these serve as reliable time markers. The different methods of reckoning time help us to trace the modification from time to time, as also the influence of local systems and other calendars.

Keywords

Calendars, South East Asia, Luni-Solar Calendars, *Śaka* Count of Years, Representation of Numerals, Influence of Other Calendars, Intercalary Months

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I Introduction

Time measurement has evolved at its own pace and in its own space, though governed by the movement of the same sun and moon. Marking the months by the sun's position and the days of the month by the phase of the moon has been the practice in India for over 3000 years as is evident from astronomical and non-astronomical texts. The apparent motions of the sun and the moon through the ecliptic were perhaps the first to be identified with the help of 27 stars (Pai and Shylaja, 2016). which are still being used as time markers even today. However, we cannot pinpoint the exact time frame when the association with the stars became separated from the time measure.

It may not be out of place to recall the names of the months which are derived from the names of the stars (almost) in conjunction with the full moon.

The same 27 stars are used to reckon the position of the sun. They are recognized as "male" stars meaning "rain star." Agriculturists use this nomenclature as is evident in the calendars currently in use.

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Table 1. The names of the lunar months and the stars associated with the full moon

Name of month	star name	identifi cation	corres pondence
Caitra	Citrā	Spica	March–April
Vaiśākh	Viśākhā	δ Libra	April–May
Jyeṣṭha	Jyeṣṭha	Antares	May–June
Āṣadha	Purvaṣādha	σ Sagittarii	June–July
Śrāvana	Śravana	Altair	July–August
Bhādrapada	Purvābhādra	β Pegasus	August–September
Āśvayuja	Aśvini	β Arieties	September–October
Kārtika	Kṛttika	Pleiades	October–November
Mārgaśira	Mṛgaśira	λ Orionis	November–December
Puṣya	Puṣya	δ Cancri	December–January
Māgha	Magha	Regulus	January–February
Phālguna	Uttara Phalguni	Denebola	February–March

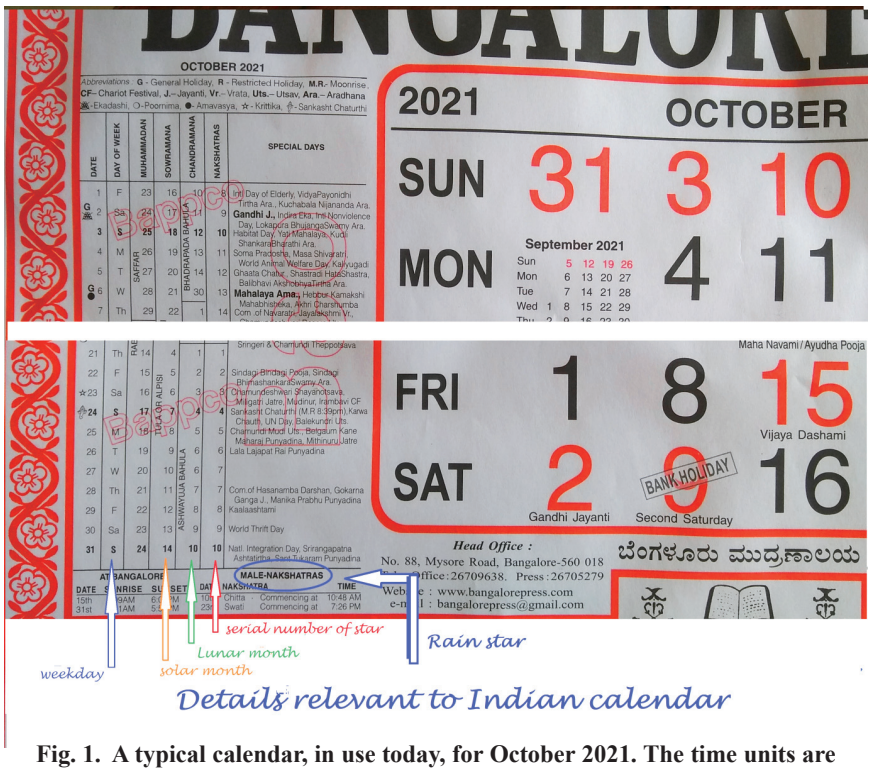

Fig. 1. A typical calendar, in use today, for October 2021. The time units are marked with arrows at the bottom

The evolution of the calendar has been discussed by earlier investigators (Saha and Lahiri, 1992), who discuss the southern regions briefly. The notion of the "rain" star is not included.

Figure 1 shows a typical calendar with the "rain stars" marked for October which is currently in use in the southern region.

We can see the other details from the calendar. Column 2 gives the day of the week. Column 3 gives the month and day according to the Muhammadan System. Column 4 reckons the solar year count, with the name of the solar month incorporated vertically. It may be seen that in this calendar of October 2021, the transition from Virgo (*Kanya*) to Libra (*Tula*) occurs on the 17th. The next column gives the lunar months and days. The month begins on the day after the new moon, and here, it is on the 7th. This serial number gives the phase of the moon. The next column gives the serial number of the stars (from the list of 27). The last wider column gives details of festivals/holidays and the like. We will see that the same system has been used for over 2000 years. A small box below provides information on the "rain" star

(*MALE–nakṣatra*), and the sun in conjunction with the star Spica (*Citrā*) on the 10th and the 23rd with Arcturus (*Svāthi*).

The year count called *Śālivāhana Śaka* is a count from 78 CE. It is called the *Śaka* year and runs to a 4-digit number. For civilian purposes, another cycle of 60 years called *Samvatsara* is used. The current *Samvatsara* is called *Plava*. There is another count called Vikrama Śaka with epoch 58 BCE.

As we will see later, the stone inscriptions reveal that this scheme has been extended to the other regions of Asia and South East Asia.

II Stone Inscriptions

The stone inscriptions seen all over India and beyond are edicts for various purposes. The teachings of the Buddha can be traced back to the third century BCE extending from Afghanistan to Cambodia. (Shylaja, 2018) In subsequent years the deeds of award of a grant for religious and social causes are found to be inscribed. The commemorative inscriptions for heroic deeds like the death of a soldier in a war, or in the act of saving people from attack by wild animals also find a mention. Self-immolation acts like that of a saint trying to achieve salvation or the *Sati* (widow immolating herself with the dead body of the husband) are also recorded (Shylaja and Geetha, 2016a).

The awards of land for scholars immortalize them in these inscriptions revealing some forgotten names. One such name is Shankaranarayan Joisaru whose work has been discovered recently (Shylaja and Seetharama, 2021).

The Archaeological Survey of India is currently publishing the records on inscriptions as new excavations unearth new records. Thus, the publications are classified as per the region and not necessarily in chronological order. In the same village, we find records spread over several hundred years. Sometimes on the same pillar of a temple, we find inscriptions that are decades or even centuries apart.

In all cases, one may see that the date is recorded in the same convention as described with reference to the modern calendar depicted in Figure 1. In many cases parallel counts of years are available. *Kali* era (with the epoch of ~BCE 3100) *Saptarṣi* era (epoch around the fifth century BCE) (Saha and Lahiri, 1992) or from the date of coronation of the reigning king, Islamic calendar counts are some examples.

These meticulous records of time have been used by historians for various purposes. The genealogy of the kings, the expansion of culture and traditions, trade and commerce practices, studies related to linguistics have all flourished with this vast treasure of records of more than 2000 years. Solar and lunar eclipses chosen as the date of inscription for grants and awards offered a very good source for verification. The same eclipse recorded from different geographical locations can be used for correcting the errors and/or finding the missing links. Such studies extended across the globe, for example, one record from India and another from China have yielded very interesting results related to the variation in the speed of rotation of the earth (Tanikawa et al., 2018).

Typical inscriptions are shown in Figure 2. It consists of approximately three parts. The act for which the record is being made is inferred from the bottom panel—a war scene for a soldier, a scene of a fight with a wild animal (Fig. 2a) for a heroic deed, the upheld arm of a lady (Fig. 2b) for the Sati event, fire and the act of self-immolation and so on. The next panel will have the depiction of the hero presumably being taken to heaven by divine dancers and the one above him in the abode of God. The inscription will be in the top portion at the eye level of the beholder. Such stones have been discovered in big cities like Bengaluru as well as abandoned villages. The land grants will not have any drawings but only plain text as in Fig. 2c. They are usually found in open spaces like the courtyards of temples.

The copper plates are in the safe possession of families who revere them as inherited treasure. Their unwillingness to part with them had made them inaccessible for study. In the last few decades, many enthusiasts collected them by almost begging from door to door. Thus, a small number are now available in museums and archival study centers. Some have been recovered from demolished structures.

The language used may be Sanskrit, Prakrit, Kannada or any regional language. In the majority of cases, the

a. A war scene for a commemorative stone

b. A hand held upright symbol for a lady

c. Plain text of a grants/donations deed

Fig. 2. Typical stone inscriptions

same sentences are written in two or three different languages. The text gives a very lengthy description that includes the heroic deeds and the genealogy of the donor (king) followed by the greatness of the ~~donor~~, donee, (one who receives the donation) praising his scholarship and genealogy. The date can be anywhere in the text, and therefore, one has to read the entire passage which may run to several pages.

The citation of the date begins with *Śaka* year/years after coronation, the name of the *samvatsara*, the month, the *thithi* (phase of the moon), and the day of the week. The other items of interest for astronomers are the mention of eclipse or of equal declination called *vyatipāta* (Shylaja and Geetha, 2016b). The winter/summer solstice dates are recorded in terms of the phase of the moon. Generally all of them will have a symbol of the sun and the moon on the top. Epigraphists opine that it implies the sanctity of the grants/donations mentioned therein lasts as long as the sun and the moon.

III Depiction of dates in stone inscriptions

The date in the inscription is recorded in sentences; the numbers are generally written in words or abbreviations, followed by numerals. As mentioned earlier, the year count is counted from the year of the coronation of the King or *Sālivāhana Śaka* (epoch 78 CE) or (*Vikrama Śaka* 58 BCE). On rare occasions, the other systems are also written providing an excellent scheme for comparison of calendars. The numbers are written in words coined specially. This scheme called *Bhūta sankhya* (*bhūta* = object, *sankhya* = number) is very common and was quite popular because it was foolproof. Number one is represented by the earth; eyes correspond to two, fire corresponds to three (there are three sacrificial fires); four is represented by *Veda*s (these are four sacred scriptures) and so on. The digits are to be read from the right side, as we see in the example below. The name of the *Samvatsara* in the cycle of 60 years is mentioned. The name of the month, with the fortnight—*Śukla* (bright, ending with full moon) and *Kṛṣna* (dark, ending with the new moon) is mentioned. The phase of the moon is indicated as *thithis*.

Not all inscriptions may give the time of the day, but the sub-units of a *thithi* called *yoga* and *karaṇa* are given in some cases. In one or two examples we see the declaration of the ascendant (*lagna, this term implies the zodiacal constellation rising in the east at that instant*). If there are other celestial events such as eclipses, solstices, planetary conjunctions, they are also mentioned.

We will understand this with a couple of examples.

One of the earliest records gives (Epigraphia Indica Vol. 1 number 1) Śaka as 388 and the name of the month is *Māgha* and the star is given as *Svāthi*. Thus the year is 388 +78 = 466 CE; the full moon near Regulus (*Magha*) occurs in June. Furthermore, the mention of conjunction with *Svati* (Arcturus) refines the date to June 7th.

Another inscription (Epigraphia Carnatica Vol. X, Hulikere no. 131) gives *Śaka khadyaya shikhi Shashi, kalayukti, marge, parve, somagrahane*. The numerals are *kha dvaya* (zero twice), *śikhi* (3), *śaśi* (1). They are to be arranged from the right side so the number is 1300, which corresponds to 1378 CE. The name of the *Samvatsara* is *kālayukti*. The month is *marge* (full moon near Betelguese, December) and the lunar eclipse. The date is, therefore, December 3rd, 1378.

The mention of eclipses has, thus, helped in fixing some errors, which arise due to the confusion on the name of the year which may be current or elapsed. Many stones are often damaged so that all the details are not legible.

The scheme for assigning the name of *Samvatsara–Phālguṇādi* (beginning from *Phālguṇa*–Feb/March) or *Kārtikādi* (beginning in October/November) appears to have changed over centuries. The month may be in the scheme of *Amānta* (ending with the new moon) or *pūrṇimānta* (ending with full moon). The stone inscriptions provide data for establishing the scheme as relevant to that year and place. The parallel counts of years include the *Kaliyuga* system, *Chālukya Vikrama Śaka*, *Śālivāhana Śaka, Buddha Nirvāṇa, Mahāvīra Nirvāṇa*. During the reign of Hyder Ali and Tippu Sultan, (in the second half of the eighteenth century) we find the *Hizri* and *Fasli* counts also included in South India. Likewise, the ones in the eighteenth and nineteenth centuries include the count as per Common Era.

Here is another example where the year could be fixed with the help of other inscriptions citing an eclipse.

“After the sake years senses, eyes, arrows and moon, has passed, while the cyclic *śōbhakrit* was current, in the month of Phālguṇa, on the brilliant tenth thithi of the bright fortnight, in *Puṣyaka*, Thursday in the auspicious *lagna Mithuna*—at the divine order of the sage Cārukirthi, the sun of the firmament of the Dēśigaṇa, (and) the moon in milk-ocean of the pontificate of the town named Belagola—he, who was named Timmarāja, the ornament of the family of Cāmuṇḍā, the son-in-law of the glorious Rāyakuvara, the victorious son of king’s sister, the great queen named Pāṇḍyaka, the younger brother of prince Pāṇḍya, consecrated and set up the Jina named Bhujabalin, at the town of Enūru.”

This is to be read as follows:

After the *śaka* years (measured by the objects) senses (5), eyes (2), arrows (5) and moon (1), had passed, while the cyclic *śōbhakrit* was current, in the month of *Phālguṇa*, on the brilliant tenth thithi of the bright fort-

night, in (the *nakṣatra*) *Puṣyaka* (combined with) Thursday in the auspicious *lagna Mithuna*—at the divine order of the sage Cārukirthi, the sun of the firmament of the Dēśigaṇa, (and) the moon in milk-ocean of the pontificate of the town named Belagola—he, who was named Timmarāja, the ornament of the family of Cāmuṇḍā, the son-in-law of the glorious Rāyakuvara, the victorious son of his sister, the great queen named Pāṇḍyaka, the younger brother of prince Pāṇḍya, consecrated and set up the Jina named Bhujabalin, at the town of Enūru.'

The year is *śaka* 1525 and the name of *Samvatsara as śōbhakrit*, the 37th in the list of 60.

The month was *Phālguna* (full moon of this month near the star β Leo or Denebola) corresponding to February–March.

Brilliant, bright fortnight, 10th day after the new moon, the moon being near the star *Pusyaka* (d Cancri).

It was a Thursday; Ascendant was Gemini (*Mithuna*). This fixes the time to about 2 hours before sunset.

This fixes the year as 1603. However, we found from other eclipse inscriptions of the same *Sobhakrit* that it refers to 1604. Therefore, here, the name may be that of the elapsed year.

A *Samvatsara* commences on the day after the new moon around the vernal equinox and concludes on the same new moon next year. *śōbhakrit* is the 37th in the list (Shylaja, 1997).

The inscription number Epigraphia Kannada Univer sity Vol. V Part I, no. 345 gives *śaka 1524 śubhakrit māgha ba śivaratri*—equivalent to February 23, 1603.

The inscription EKU Vol III Appendix no 87 gives another record *śaka 1526 Krōdhi Puṣya ba 3* as *Makara Sankranti* equivalent to December 28, 1604.

It may be seen that there is a disagreement in the conversion of *śaka* to CE. It is noticed that some inscriptions mention the current *śaka* year and some the past one. Since we have to accommodate *śōbhakritu* (37) in between the two above, we can say *śubhakrit* (36) was current between April 1602 to March 1603, and *Krodhi* (38) from April 1605 to March 1606.

Therefore, we can take the duration of *śōbhakrit* as extending from April 1604 CE to March 1605 CE. Thus, the date of the inscription under study can be fixed as March 17, 1605. This turned out to be a very valuable argument in assigning the description to the 1604 supernova seen as "a fire in the ocean of the Milky Way" by translating the word *nishakara* as the camphor. The epigraphists had translated it as the moon (Shylaja, 2019).

The winter solstice or *Uttarāyaṇa* was an important event. The confusion in fixing its date arises because the civilian calendar is lunar, and solar events like equinoxes and solstices are expressed in the lunar system. The earlier scholars perhaps had very little scope to evaluate the lunar system and would adopt the European system to fix solstices. Here is an example (from Venkatasubbiah, 1918) for *Śaka* 1052, *Sādhāraṇa*, the day of *Makara Sankrānti* (transit of the sun in to Capricorn). Various interpretations are possible as shown by the following seven options.

i. For *Śaka* 1047–December 23rd, 24th, 25th (and 26th also?), 1125 AD.
ii. For *Śaka* 1048– December 23rd, 24th, 25th and 26th, 1126 AD.
iii. For *Śaka* 1049– December 24th, 25th and 26th, 1127 AD.
iv. For *Śaka* 1050– December 23rd, 24th and 25th, 1128 AD.
v. For *Śaka* 1051– December 23rd, 24th, 25th and 26th, 1129 AD.
vi. For *Śaka* 1052– December 23rd, 24th, 25th and 26th, 1130 AD.
vii. For *Śaka* 1053– December 24th, 25th and 26th, 1131 AD.

The tropical event can be any of these days of the same year—December 13th, 14th, 15th, 16th, 17th, or 18th, 1130 AD. It has been found that there are not many instances where tropical *Sankrānti* is used. This statement appears as a footnote by Venkatasubbaiah the author ("*I have not met with any instance of solar months being made to begin with the tropical sankrānti.*"). However *thithi* (phase of the moon) mentioned therein fixes the date without any ambiguity.
We found that this scheme offers a possibility to extract the correction for precession also.

The mention of *Uttarāyaṇa* (winter solstice) along with the lunar *thithi* thus clears up all confusion. If we

can trace a record of an eclipse, for the same year the correct date can be fixed without error. There are very few records citing the solar month and day in India (but common elsewhere, for example Cambodia). For example, a record of 1178 AD gives "*Simha*" (Leo) as the month and 27th solar day. The third year of reign of *Kulōttunga Chōḷa III* has been used to fix the year. The dates may be,

A.D. 1178–August 21st, 22nd, & 23rd.

A.D. 1179–August 21st, 22nd, & 23rd.

A.D. 1180–August 20th, 21st, 22nd, & 23rd.

A.D. 1181–August 20th, 21st, 22nd, & 23rd (Venkatasubbaiah, 1918).

The ambiguity will be solved only when another event like an eclipse is recorded with the same notation, preferably in the same year.

One of the greatest advantages of the Indian luni-solar calendar scheme is the introduction of intercalary months, whose rigid rules constitute a major part of the astronomy texts. In the inscriptions, we find the mention of "*Dvitīya*" (meaning second) corresponding to an extra intercalary month introduced for the said year, which is of great help in assigning the date.

As mentioned earlier, we have many inscriptions with identical text in two languages. This is of great help in comparing the two schemes if they are different, for example, one may have an Islamic calendar in Persian/ Urdu.

Here is an example from Epigraphia Carnatica Vol. VII record no. 43 in Kannaḍa as well as in Persian. The Kannaḍa part gives *Śālivāhana Śaka Varusha* 1575, *Vijaya Samvatsara, Bhādrapada śu* 5, Thursday and *Svāti Nakṣatra* leading to either August 18th, 1653 or September 7th, 1643 as two options. The Persian inscription provided states AH 1064 which began from November 12th, 1652 AD and ended on November 2nd, 1653 AD (Venkatasubbaiah, 1918 gives weight to *Svāti nakṣatra* and Thursday and this settles the date to August 18th, 1653).

Thus, we find that the mention of moon phase or lunar *thithis* and/or eclipse events resolves all the ambiguity associated with the different calendar systems *Chaitrādi* (beginning with a new moon in March), *Aświnādi* (beginning with a new moon in September), *Mēṣādi* (tropical *Sankrānti* of Sun into Aries), *Simhādi* (tropical *Sankrānti* of Sun into Leo).

IV Comparison with inscriptions from South East Asia

The calendar systems recorded in other countries follow the same system implying the strong influence of Sanskrit (Hindu) scholarship. The tradition of writing in two or more languages has continued in other countries as well.

The inscriptions from Nepal have been traced from about the third century BCE (Agarwal, 2010). *Salivahana Śaka* is mentioned after the first century CE. Most are administrative edicts with no special emphasis on the choice of events like eclipses for producing an inscription. The phase of the moon and the lunar month are available. The numerals are written in a different style—for example, 341 is written as 300 40 1. The day of the week is not mentioned, hinting that the usage was not popular. Even on the mainland inscriptions of the days of the week appear much later, by about the sixth century or so.

Asokan edicts constitute the content of the inscriptions in Sri Lanka, with the earliest record traced to 183 BCE. The year count from the nirvana (demise) of Buddha, named Buddha year by epigraphists (Muller, 1883), is followed in most of the inscriptions. There is no mention of the day of the week. The lunar calendar month and the phase are noted (Epigraphia Zelenica Vols. II and III).

The inscriptions from Cambodia offer a wealth of information as shown by the mammoth study by Cedes (1968) and Majumdar (1953). Most of the inscriptions are bilingual in Sanskrit and Khmer. They cover a variety of topics and hence, have been exploited by linguistic experts, sociologists, and historians. The calendar system found in these inscriptions follows the Śaka count for the year as well as the luni-solar calendar system. Both the names of the zodiacal constellations and the 27 stars find a place in these details. The astronomical details are flawless; the positions of the lunar node, planets and ascendants are recorded in both languages so that the time can be fixed quite precisely. One

example discussed exhaustively, points to a new name for a planet that has been debated as a comet or the node (Beer, 1967); the possibility of a pre-planetary nebula brightening also is discussed (Shylaja, 2017). Here is another example in inscription number K 926 from Inscriptions du Cambodge Vol. 20 (translated by Eade, 1995) as "*Ketu and Jupiter being in Aries, Mercury and the sun in Taurus, Venus in Gemini, Rahu in Scorpio, Saturn and Mars in Leo, moon in (naksatra) Hasta in the year (l'anĕe çaka rĕvolue) marked by 5 senses, 4 on a dice, 6 seasons and 10 waxing Jyeshta.*" Here, Rahu is the ascending node and Ketu is the descending node.

There are some examples where the Chinese names of the year are also recorded. For example, *Śaka* year 961, equivalent to 1039 CE, is called the year of the tiger. In another inscription, 1514 CE is called the year of the dog.

A small number of records have been traced in Thailand—they resemble the ones from Cambodia (Prapandavidya, 2010).

The inscriptions from Myanmar, (Burma), use the sasana year, which appears to be a combination of the Buddha year of epoch 544 BCE and the *Śaka* of 78 CE. This is called the *dodorasa* (do = 2 do = 2 rasa = 6) era in Myanmar, a mnemonic for 622 (which is given by 544 +78), the number of years deducted in the *sāsana* year 624 to introduce the new era. The calendar of the North Indian Gupta dynastic era (c. CE 319–550), beginning in CE 319. The use of the Śaka calendar of CE 78 is seen in many inscriptions. The Burmese Myanmar Era calendar which starts in CE 638, is known as the *khachapanca* (*kha* = 0, *cha* = 6, *panca* = 5) era, a mnemonic for 560, as it was supposedly introduced by eliminating 560 years from the Śaka era in AD 640 so the new era would begin, as had the dodorasa (Eade, 1995).

V Discussion

A study of these inscriptions brings out several important aspects related to calendars and techniques of notation. The year count of *Śaka* has established uniformity in all countries. The representation of numerals by the *Bhūta sankhya* system and the place value system (Katapayadi, which uses the syllables themselves to represent numbers, in some rare cases) are carried forward from the mainland. The Buddha year count is, however, an exception since it is rarely found on the mainland.

The dual-language system is used in these inscriptions in all countries. This has an added advantage. It can trace the cross-correlation with the local calendar, if any. Very little effort has gone into this area since those languages are on the verge of extinction.

In the oldest records we find the names of the days of the week are missing. They first appeared in about the fifth century but were not popular until about the ninth century. The numbers are specified as hinting at the experimentation with a place value system. Therefore these inscriptions serve as the right sources to study the evolution of the numeral notation with a place value system as well as a dot for zero. With the help of inscriptions. the introduction of the notation of zero as a dot is traced to about the third century in the northeast region of India (https://www.assamtimes.org/node/8091), the seventh century in Cambodia (https://www.smithsonianmag.com/history/origin-number-zero-180953392/) and the ninth century in Gwalior, India (https://gwalior-plus.com/directory/chaturbhuj-temple/).

It is interesting to see the process of assimilation of the solar calendar. The introduction of the names of the zodiacal constellations for planetary positions is seen by about the seventh century in Cambodia. However, in India, they are seen by about the eleventh century. There are only a handful of examples of *Sankramaṇa* (transit of the sun from one zodiacal constellation to the next) in the first millennium but their use to refer to the name of the month was not popular till about the eleventh or twelfth centuries.

Similarly, we also note that the names of the days of the week appear by about the fifth century in a few isolated cases; by about the ninth century, they were absorbed into the calendar. It is yet to be established how and when this (7-day week system) was assimilated into the calendar.

In the inscriptions later than the seventeenth century, we see the influence of the Islamic calendar system. The rulers were introducing the Fasli or other counts along

with the local tradition (Shylaja, 2021). These declarations in the dual system have been immensely helpful in dating them since the Islamic lunar calendar accumulates 11 days of offset year after year.

VI Conclusions

Stone inscriptions found all over South East Asia have been of great use for historians. We see that the details provided on these rocks lying in the open for thousands of years offer a wealth of information on the evolution of calendars. The inscriptions serve the purpose of the mode of transmission of knowledge from East to West and vice versa. Parallel development of indigenous calendars is also traceable by the dual-language method adopted in these records.

Eclipse records have proved very useful in addressing several uncertainties. In some cases, we have several records of the same eclipse from different geographical regions which is of great help in fixing the variation in the rate of the rotation speed of the earth.

Although they offer scope for detailed studies in other fields like the representation of numerals and zero, for the study of the evolution of calendars they are the most reliable sources. The process of assimilation of ideas like the days of the week, the zodiacal constellation names for the month can be traced through these sources. Later, historically, the influence of Persian/Arab methods can also be traced.

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