

A Note on The Five-Year Yuga of the Vedāᅅga Jyotiᅅa

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1 Introduction

Vedāᅅga Jyotiᅅa (VJ) is the general name by which one refers to the earliest codified texts of astronomy of ancient India, known as the ᅅgijyotiᅅa (ᅅJ), the Yājuᅅajyotiᅅa (YJ), and the Atharvajyotiᅅa (AJ). The authorship of the first two is ascribed to Lagadha, whose disciple Śuci composed and preserved the knowledge codified by his celebrated teacher, while the author of the third is unknown. The ᅅJ consists of 36 verses, the YJ of 44 verses and the AJ of 162 verses divided in to 14 chapters. The ᅅJ and the YJ recensions are both well known with some variations in readings and have about 30 verses in common. Several scholarly studies of the two recensions have been published¹, as also detailed comparative tables of the corresponding verses of both the recensions². In this note we will concentrate only on the ᅅJ, using the general term VJ also to mean only ᅅJ, because, it is the oldest and is of immediate relevance to our purpose. The ᅅJ preserves the Hindu traditional knowledge of astronomy essential for Vedic sacrifices in a codified form akin to the style of the *sūtras*, easy for memorization but sometimes difficult for understanding. It packs a wide range of astronomical topics in its 36 verses, some of which are quite obscure. It is more like a pocket reference and gives, among other things, the rules for the determination of proper times for the performance of Vedic rituals. In fact, Śuci declares in ᅅJ (verse 2), that he is expounding on the science of time, involving the concept and measurement of time at different levels.

One of the distinguishing features of VJ is the use of a period of five years called *yuga*, which is different from the much larger period also called *yuga*³, but which came into vogue much later in Indian astronomy in the Siddhānta period. The five-year *yuga* of VJ consists of 62 *candramāsas* (synodic months), 1830 days and 1860 *tithis* (1/30th part of a synodic month) and was taken to commence at the winter solstice. At the time of VJ, winter solstice occurred at the beginning of the first *tithi* of the *śukla pakᅅa* of the month of Māgha. There are two *adhimāsas* (intercalary months) in a *yuga*. The sun and the moon are supposed to occupy the same position at the beginning of each subsequent *yuga* and all the happenings would be repeated in the subsequent *yugas* in the same way. The astronomical system of VJ was still being followed in India long after the time of Lagadha, although the winter solstice was placed in Śravaᅅa at the time of Jain astronomy.

¹Weber, A., *Über den Veda-kalendar namens Jyotisam*, Abhandlungen d. Akad. d. Wiss. (Berlin, 1862); Thibaut, G., "Contributions to the explanation of the jyotiᅅa-vedāᅅga", *Journal of the Asiatic Society of Bengal*, xlv, pp.411–437, 1877; Dvivedin, S., (ed.) *Vedāᅅga-Jyotiᅅ, with Somākara's commentary* (Benares, 1908); Shamastry, R., *Vedāᅅga-Jyotiᅅa with commentary and translation*, (Mysore, 1936); Sastry, T. S. K., *Vedāᅅga-Jyotiᅅa of Lagadha*, (New Delhi, 1985); Yajnik, H. M., *Vedāᅅga-Jyotiᅅa*, Ahmedabad, 1985; Sen, S. N., in: *A concise history of science in India*, Bose, D. M., Sen, S. N., and Subbarayappa, B. V., (ed.), New Delhi, 1971.

²Dixit, S. B., *Bhāratīya Jyotiᅅśāstra*, (Prayag, 1957); Yajnik, H. M., *Vedāᅅga-Jyotiᅅa*, (Ahmedabad, 1985). The list of topics is condensed from Yajnik, H. M., "Vedāᅅga-Jyotiᅅa", in: *Issues in Vedic Astronomy and Astrology*, Pandya, H., Dixit, S., and Kansara, N. M., (ed.) (Delhi, 1992), p.52.

³In current parlance, one *mahāyuga* consisting of *kᅅta*, *tretā*, *dvāpara*, and *kali yugas* lasts for 4,320,000 years.

VJ has often been criticized⁴ for using this *yuga* period of five years as being “...extremely crude.” The accuracy of VJ is a much discussed affair and it has been argued⁵ that VJ suffered from two main defects. There are actually 1826.2819 days in a *yuga* of five solar (sidereal) years, and not 1830, as stated in VJ. Therefore, the winter solstice would start four days earlier after each *yuga*. Furthermore, there are 1830.8961 days in a period of 62 lunar months and not 1830. Hence, there would be a deficit of about one *tithi* in a *yuga* of five years. It appears as a mystery why the Indian astronomers continued to use such an absurd system for thousands of years. Is it possible that the ancient Indian astronomers were not aware of these “defects”? Some scholars have indeed assumed just this possibility and have leveled their criticism of VJ, and of Indian astronomy as a whole, on this basis. An extreme example of this type of criticism is found⁶ in the following: “... the acceptance of this cycle by Indians for a period of six or seven centuries or even more demonstrates among other things that they were not interested in performing the simplest acts of observational astronomy.”

This harsh criticism of ancient Indian astronomy in general, and VJ in particular, seems to be a case of uncritical application of current scientific ideas to a work so ancient that some parts of it are still obscure. One may also recall the statement of Whitney regarding VJ: “... and when we come to add that Jyotiṣa (i.e., VJ) has no definable place in Sanskrit literature or relation to the Vedic ceremonial ... we shall see that this famous datum, which has seemed to promise so much, has caused so much labor and discussion, ... is nothing but a delusive phantom.” This is in spite of the fact that VJ itself declares that it is for the purposes of determining the proper times for the Vedic ritual *yajñā*! One should try to understand VJ in its own contemporary context, i.e., in the context of the actions of the Vedic people, their motivation, and the conceptual background of their work.

The purpose of this note is to point out that the concept of the five-year *yuga* period is much older than VJ itself and was not chosen by Lagadha⁷. It is intimately connected with the Vedic ritual, *yajñā*, and is but a reflection of a special significance associated with the number five in the Vedic ritual. There is evidence to suggest that the Indian astronomers were in fact aware of the so called “defects,” and took measures to “correct” them. Astronomical observations were routinely made and there existed a group of professional astronomers. Only the fact that VJ is deep rooted in the Vedic ritual of *yajñā* and is an integral part of the same Vedic lore of five-fold manifestations can account for the continued use of VJ over thousands of years, its popularity declining only after the importance of the Vedic ritual *yajñā* itself had declined.

⁴Pingree, D., “Astronomy and Astrology in India and Iran”, *Isis*, liv pp.229–246, (1963).

⁵Sastry, T. S. K., *Vedāṅga-Jyotiṣa of Lagadha*, (New Delhi, 1985); Shukla, K. S., “Main characteristics and achievements of ancient Indian astronomy in historical perspective” in: *History of Oriental Astronomy*, (ed.) Swarup, G., Bag, A. K., and Shukla, K. S., Cambridge University Press (Cambridge, 1987).

⁶Pingree, D., “The Mesopotamian Origin of Early Indian Mathematical Astronomy”, *Journal of History of Astronomy*, iv, pp.1–12, (1973).

⁷Pingree in note 6 seems to think there was an Iranian influence on Lagadha.

2 The Yuga Concept:

The *yuga* period of five years, whose constituent years are called *saᅅvatsara*, *parivatsara*, *idāvatsara*, *anuvatsara*, and *idvatsara*, has been in use since Vedic times. For example, in Rgveda (RV 7.103.7–8) *saᅅvatsara* and *parivatsara* are mentioned. The Taittirīya-Saᅅhitā (TS 5.5.7.1–3), the Vājasaneyi-Saᅅhitā (VS 27.45 and VS 30.16) and the Taittirīya-Brāhᅅmaᅅa (TB 3.4.11 and TB 3.10.4) give the names of all the five years, although, there is some variation in the names. The TS calls them *saᅅvatsara*, *parivatsara*, *idāvatsara*, *idvatsara*, and *vatsara*, while the VS and the TB call them *saᅅvatsara*, *parivatsara*, *idāvatsara*, *idvatsara*, and *vatsara* respectively.

The length of the solar year was known to be a little more than 365 days, although the year was roughly taken to consist of 12 months of 30 days each (360 days = *sāvana* year). Taittirīya-Saᅅhitā (TS 7.1.10) says that 5 days more are required over the *sāvana* year to complete the seasons and that 4 days are too short and 6 days are too long. The scheme of adding intercalary months is also of Vedic origin as is evident from Rgveda (RV 1.25.8). The two intercalary months in a *yuga* are called *aᅅhaspati* and *saᅅsarpa* (TS 1.4.14). It is clear, therefore, that the five-year *yuga* system and the scheme of two intercalary months are much older than R̅J and must have been in practice for a long time before they were codified by Lagadha.

It is also evident that the five-year *yuga* system with the associated scheme of two *adhimāsas* continued to be in use in India for a very long time. It also occurs in later texts such as Mahābhārata (*pañcame-pañcame varᅅe dvau māᅅāv upajāyate*; MBh 4-47), and Kāuᅅilya's Arthaśāstra (*pañca saᅅvatsaram yugam iti*; AŚ 2.20.69.71). Garga-Saᅅhitā, and Paitāmaha-Siddhānta all refer to the five-year *yuga* period of VJ. It has already been noted that the Jain astronomical text, Sūryaprajñapti, mentions it (*tā pañca samvaccharā*; *sūtra* 54). The Buddhist text Śārdūlakarᅅāvādāna also reflects the use of the five-year *yuga* of VJ.

3 The Five-year Yuga: Why?

The answer to this question can be found in VJ, its Vedic sources, and in the close connection between *jyotiᅅa* and *yajñā*. The purpose of VJ is described in the verses:

kālaᅅjñānaᅅ pravakᅅyāmi ... yajñārthakālasiddhaye (R̅J 2–3)

“I shall describe [systematically] the science of time for the purpose of determining the appropriate time for [different] *yajñā*.”

VJ is not a mere civil calendar, but one whose purpose is a highly religious one, that of determining the proper times for Vedic rituals. The importance of the Vedic ritual itself is described in the following verse:

vedā hi yajñārtham abhipravᅅttāᅅ ... yo jyotiᅅaᅅ veda sa veda yajñān (R̅J 36)

“The Vedas have indeed been revealed for the purpose of the performance of *yajñā*s. [But the *yajñā*s are to be performed in different segments of time as appropriate.] Therefore, only he who knows [the science of time, namely] *jyotiᅅa*, understands fully the [performance of] *yajñā*s.”

Thus VJ not only specifies the role of *jyotiṣa* in the ritual *yajña*, but describes the interdependence of *jyotiṣa* and *yajña* also. It also points to a strong connection between the five-year *yuga* concept and the ritual *yajña*.

4 Every Thing is Five-fold

The ritual of *yajña* is central to the Vedas. The basic premise of *yajña* is to establish explicit equivalence between two different objects by means of ritual action. For example, in Agnicayana, a huge altar consisting of five layers is constructed in the general shape of a falcon, for, “he who is desirous of heaven may construct a falcon-shaped altar.” By ritual action, the equivalence of the following are established: falcon = altar, sacrifice = altar, and finally, sacrificer = altar. Therefore, sacrificer = falcon and hence the sacrificer can fly to heaven. However, if the falcon is not well made the bird will not fly. Altars are constructed according to strict geometrical principles as explained in *śulbasūtras*. There exists another set of equivalence principles related to astronomical concepts. For example, in Agnicayana, Prajāpati, the Lord of Creation, is identified with time, in fact, the year (*prajāpatir eva saṃvatsaraḥ ...*, JB II.393; and: *sa eṣa prajāpatir eva saṃvatsaraḥ*, KB VI.15). Hence, it takes a year from the moment the *yajamāna* has generated *agni* in a special pot called *ukhā* (which he carries around with him), to the culmination in a twelve-day ritual at the end. The altar as well as the *yajña* is identified with Prajāpati. It is this identification of Prajāpati with time on the one hand and the ritual *yajña* on the other that holds the secret of the five-year *yuga* period. The very first verse of RJ invokes Prajāpati in the following terms:

pañcasamvatsaramayaṃ yugādhyakṣaṃ prajāpatiṃ dinartvayanamāsāṅgaṃ praṇamya
śirasā śuciḥ ... (RJ 1)

“(I,) Śuci, salute with a bowed head, Prajāpati, who is the embodiment of the five-year period and who presides over the *yuga*, and who has for his limbs, time segments like the day, the seasons, the [northerly and the southerly] courses of the Sun, and the month...”

This characterization of Prajāpati by a five-fold embodiment in time, is also reflected in the five-layer structure of the altar which is also identified with him. In fact, the five brick layers of the altar in Agnicayana have the same names as the years in a five-year *yuga* period. A five-fold characterization is a preferred way of discussing items with reference to the ritual *yajña* (i.e., *adhiyajña*). There are five *yajñas*: *bhūtajajña*, *manuṣyajajña*, *pitryajña*, *devyajajña*, and *brahmayajña*. The altars can also be five in number: *gārhapatya*, *āhavanīya*, *dakṣiṇāgni*, *sabhya*, and *āvasathya*. There are five requisite materials for the *yajña*, which are described in ŚB (ŚB 1.1.1–8), and it is said there that the sacrificer gathers these five materials (“pañcasam̐bhārān sam̐bharati”).

The five-fold nature goes beyond the ritual (referred to by *adhiyajña*) to the material world (referred to by *adhibhūta*) and also to the Self (referred to by *adhyātma*). This is all described in TU beginning with the following declaration:

athātaḥ sam̐hitāyā upaniṣadaṃ vyākhyāsyāmaḥ pañcasv adhikaraṇeṣu (TU 1.3.1)
“Now we shall explain the *upaniṣad* of the *sm̐hitā* under five headings”

It is said in (TU 1.7.1):

prthivy antarikᅅaᅅam dyaus diᅅo 'vāntaradiᅅaᅅaᅅ agnir vāyur ādityaᅅ candramā nakᅅatrāᅅi
āpa oᅅadhayo vanaspataya ākāᅅa ātmā ity adhibhūtaᅅam

“The earth, the sky (*antarikᅅa*), the heaven, the main quarters and the intermediate quarters (which constitute the set of five worlds); fire, air, sun, moon and the stars (the set of five-*devatāᅅ*); water, plants, trees, ether and the *ātman* (the set of five living beings); thus with regard to the material existence.”

Described above are three sets of five members each as external and gross embodiment of the Supreme. This is followed in (TU 1.7.2) by:

athādyātmam prāᅅo vyāno 'pāna udānas samānaᅅ caᅅᅅus śrotraᅅam mano vāk tvak carma
māᅅsaᅅm snāvāsthi majjā

“Now, to the self; *prāᅅa*, *vyāna*, *apāna*, *udāna*, and *samāna* (the set of five vital airs), eyes, ears, mind, speech, and touch (the set of five senses), skin, flesh, muscle, bone, and marrow (the set of five constituent elements of the body).”

This enumerates the three sets of five objects each, which are internal and subtle embodiment of the Supreme. Again, in (TU 1.7.3):

etad adhividhāya ᅅśir avocat pāᅅktaᅅam vā idaᅅ sarvaᅅam pāᅅktaᅅnaiva pāᅅktaᅅam sprᅅoti
“After having analyzed all this the sage declared: all this is verily *pāᅅkta* (five-fold); by the *pāᅅkta*, indeed, does one secure the *pāᅅkta*”

Thus the TU declares every thing as having a five-fold nature and later, goes on to describe the five *koᅅas* (sheaths) that cover the Self as the *annamaya*, *prāᅅamaya*, *manomaya*, *viᅅᅅānamaya*, and *ānandamaya koᅅāᅅ*. This is also echoed in BU (BU 1.4.17):

sa eᅅa pāᅅkto yajᅅāᅅaᅅ pāᅅktaᅅ paᅅavaᅅaᅅ pāᅅktaᅅ puruᅅaᅅaᅅ pāᅅktaᅅm idaᅅ sarvaᅅam yad
idaᅅ kiᅅca

“so this *yajᅅā* is five-fold, five-fold are the animals, five-fold is the person, five-fold is all this world, whatever there is.”

Thus *śruti* declares that there is a five-fold principle that pervades the entire universe and that the principle is manifest in the external and gross aspects as well as in the internal and subtle aspects.

5 Time Units in VJ

While the main attention so far has been focused on the five-year *yuga* period, there are other intervals of time, such as *cāndramāsa*, *tithi*, *kalā*, *muhūrta*, and *kāᅅᅅthā* that are referred to in R.J. The relationships among these time units can also be found in R.J.

124	<i>kāṣṭhās</i>	=	1	<i>kalā</i>
20 and 1/10	<i>kalās</i>	=	1	<i>muhūrta</i>
30	<i>muhūrtas</i>	=	1	<i>ahorātra</i> (day and night)
2	<i>parvans</i>	=	1	<i>cāndramāsa</i>
2	months	=	1	<i>ṛtu</i>
2	<i>ayanas</i>	=	1	year.

It is interesting to note that the smallest unit of time, *kāṣṭhā*, is given in terms of the duration of five *akṣaras*:

kāṣṭhāḥ pañcākṣaraḥ smṛtāḥ (RJ 18)

The same five-fold principle is operating both at the subtle (*kāṣṭhā*) and at the gross (*yuga*) level of measurement of time and time itself may be regarded as “pāṅkta”. This idea is strengthened in view of the *pañkti*-meter consisting of five *pādas* of eight syllables each. The *śruti* declares, “five-footed is the *pañkti*-meter and *yajña* is a ‘pāṅkta.’ ” It may be noted in passing that according to Śatapatha-Brāhmaṇa (ŚB 10.4.2.23), the number of *pañktis* in Ṛgveda⁸ is equal to 10800; this is equal to the number of *muhūrtas* in a year and also to the number of bricks in the altar. The five-year *yuga* is simply another manifestation of “pāṅktam idaṃ sarvaṃ” and it is this strong dictum of the *śruti* that perpetuated the use of the five-year *yuga* period for such a long time.

6 “Accuracy” of VJ

It must have been known even in those early days that 62 synodic months take almost a day more than the 1830 days given in VJ, because at the end of one *yuga*, must have been observed to occur on the day next to the 1830th. Observation at the end of the next *yuga* would have clearly shown this (because of the cumulative error), the moon would have been well up in the sky at sunrise showing the day to be *caturdaśī* or even *trayodaśī*, so that *amāvāsyā* would occur one or two days later. The priests would never have failed to notice this, because, it was their duty to observe the last disappearance of the old moon and the first appearance of the new moon. This is connected with the “upavasatha” and referred to in the following verse:

caturdaśīm upavasathas tathābhavet yathodito dinam upaiti candramāḥ māghasuklāhniko yunkte śraviṣṭhāyāṃ ca vārṣikīm (RJ 34)

“That *caturdaśī tithi* on which the moon rises [almost] as the sun rises is the *upavasatha*. [Any characteristic of] the first day of the bright fortnight of the month of Māgha links [the *nakṣatra* of] the last day of the previous year [Śravaṇa] with *śraviṣṭha* [i.e., it is common to both].”

The *upavasatha* day is the day of *piṇḍapitryajña*, and the day previous to that is *ādhāna* or *dīkṣā* day and the next day is the *iṣṭi* day. Moon rising almost at sunrise indicates that the

⁸This is based on the syllable count of 432000, given in the ŚB; but, the actual number of syllables in the canonical text is far less. A full discussion of this point, however, is beyond the scope of the present paper.

time is near new moon. By contrast, if the moon rises well before the sun rises, it is technically called *uddr̥ṣṭa*, and all excepting Vājasaneyīś and Baudhāyanas have to perform an expiatory rite, or *prāyaścitta*, to nullify the evil that will accrue and perform *punarādhāna*, if the *ādhāna* had already been done the previous day. This shows that the priests had to be very careful to avoid such a thing happening and they must have had rules formed from observations over a long time to fix the calendar. The fact that the Vedic priests did indeed make observations is evident from the statement in the verse R̥J 24 regarding ascertaining calculations by observations (*ity upāya samuddeśaḥ ...*). The fact that there were astronomers who made observations is attested to by the reference to *nakṣatradarśa*, an observer of stars, in VS (VS 30.10) and to *nakṣatrawidyā*, the discipline of astronomy, in Chāndogya-Upaniṣad (CU 7.1.2; CU 7.7.1).

It has been suggested that a day could have been tacitly added to the *yuga* after its end (just as we add a day in the leap year) and not counted in the calculation. This would certainly avoid the most patent discrepancy. However, as 62 synodic months = 1830.8965 days, another type of error will accumulate and an intercalary month would have to be dropped after 6 yugas and another intercalary month after 7 yugas, and this has to be repeated. It may be noted that it is not necessary to know this rule to drop the intercalation. Mere observation of the moon in the *śraviṣṭha* region of the sky would have shown the need for an intercalation⁹.

7 Conclusions

We have clearly demonstrated that the five-year *yuga* cycle of VJ is much older than VJ and was not selected by Lagadha. It continued to be in use for a very long time after VJ, its popularity is due to the Vedic dictum of being *pāṅkta*. Vedic priests did make observations and must have formulated rules for overcoming, as far as possible, whatever calendrical shortcomings a five-year cycle might imply. This would have been necessary to avoid penalties in obeying the requirements of *upavasatha*. The Vedic dictum of *pāṅkta* would thus explain the enigma of the five-year *yuga* which has puzzled the scholars of VJ for over a century. When viewed in the light of “pāṅkta” dictum, the criticism of Pingree would not appear to be valid.

List of Abbreviations

AJ Atharva-Jyotiṣa

AS Arthaśāstra of Kauṭilya

BU Brhadāraṇyaka-Upaniṣad

JB Jaiminīya-Brāhmaṇa

KB Kauṣītaki-Brāhmaṇa

MB Mahābhārata

⁹Sastry, T. S. K. 1985; in fact, Muslims do so even today by observing the crescent moon.

RJ Ṛg̃jyotiṣa

RV Ṛgveda

TB Taittirīya-Brāhmaṇa

TS Taittirīya-Saṃhitā

TU Taittirīya-Upaniṣad

VJ Vedāṅga-Jyotiṣa, here also used for RJ

VS Vājasaneyi-Saṃhitā

YJ Yājuṣajyotiṣa

ŚB Śatapatha-Brāhmaṇa