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ENIGMA OF THE FIVE-YEAR YUGA OF VEDĀṄGA JYOTIṢA

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The five-year yuga and the associated scheme of two *adhimāsas* have been criticized as being "very crude". The continued use of such a system over thousands of years when even the simplest of observations would have revealed the "defects" of such a system has puzzled many a scholar. Some have gone so far as to suggest that Indian astronomers had no tradition of observational astronomy. The mystery disappears when it is recognized that *Vedāṅga jyotiṣa* is intimately connected with the Vedic ritual *yajña*. The five-year yuga is nothing but a reflection of the principle of five-fold nature of every thing in the universe as per the Vedic dictum *"pāṅktaṃ vā idagaṃ sarvaṃ"*. Contrary to the popular belief, there is sufficient evidence to suggest that the Vedic astronomers not only had a tradition of observations, but were also aware of the shortcomings of the five-year yuga period. They must have instituted practices based on observations to "correct" the "defects" of the five-year yuga, even if it was just for avoiding the penalities (*prāyaścitta*) for not performing at proper time certain rituals such as those connected with *upavasatha* and *agnyādhāna*.

Key words : Ancient astronomy of India, Five-year yuga, *Vedāṅga jyotiṣa*, Vedic astronomy

INTRODUCTION

It is well known that *Vedāṅga Jyotiṣa* (VJ) is the general name by which one refers collectively to the earliest codified texts of astronomy of ancient India, the *Ṛgjyotiṣa* (RJ), the *Yājuṣa jyotiṣa* (YJ), and the *Atharva jyotiṣa* (AJ). The RJ consists of 36 verses and the YJ of 44 verses and the authorship of these two is ascribed to Lagadha, whose disciple Śuci composed and preserved the knowledge codified by his celebrated teacher. The AJ consists of 162 verses divided into 14 chapters, but the author is unknown. In this paper we will concentrate only on the RJ, and use the general term VJ also to denote only RJ, because, it is the oldest and is of immediate relevance to our purpose. 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,[1] but which came in to vogue in astronomy in the Siddhanta period. The five-year yuga of VJ consists of 62 *chāndramāsas* (synodic months), 1830 days and 1860 *tithis* (1/30 th part

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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 pakṣa* 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. Long after the time of Lagadha, the system of VJ was still being followed in India although the winter solstice was placed in *śrāvaṇa* at the time of Jain astronomy.

VJ has often been criticized[2] for using this yuga period of five years as being "..... very ..... crude". The accuracy of VJ is a much discussed affair and it has been argued[3,4] 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 about 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 levelled their criticism of VJ, and of Indian astronomy as a whole, on this basis. An extreme example of this type of criticism is found[5] 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 vitriolic criticism of ancient Indian astronomy in general, and VJ in particular, is, in our opinion, 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[6] 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 inspite of the fact that VJ itself declares that it is for the purpose of the Vedic ritual *yajña*! One should try to understand VJ in its own contemporary context, i.e. what the actions of the Vedic people were, 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 Lagadha[7]. It is but a reflection of an intrinsic Vedic concept of five-fold nature of every thing, and is intimately connected with the Vedic ritual, *yajña*. 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 *yajña* and is an integral part of the same Vedic lore of five-fold manifestations can account for the

continued use of VJ over thousand of years, its popularity declining only after the importance of the Vedic ritual *yajña* itself had declined. The five-fold nature of some aspects of the universe is important in the Jain tradition also. This accounts for the use of the five-year yuga in Jain astronomy, even though the concept of time is different.

ṚGJYOTIṢA

The *Ṛgjyotiṣa* preserves the Hindu traditional knowledge of astronomy essential for Vedic sacrifices in a codified form akin to the style of the *sutras*, easy for memorization but sometimes difficult for understanding. 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. Both the RJ and the YJ recensions are well known with some variations in readings and have about 30 verses in common. Several scholarly studies of the two recensions have been published,[8] as also detailed comparative tables of the corresponding verses of the two recensions.[9] In this paper we will refer mainly to the text of VJ published by Sastry[3]

YUGA CONCEPT

The yuga period of five years, whose constituent years are called *saṃvatsara, parivatsara, idāvatsara, anuvatsara,* and *idvatsara*, has been in use since the Vedic times. For example, in *Ṛgveda* (RV 7.103.7-8) *saṃvatsara* and *parivatsara* are mentioned. The *Taittirīya Saṃhitā* (TS 5.5.7.1-3), the *Vājasaneyi Saṃhitā* (VS 27.45 and VS 30.16) and the *Taittirīya Brāhmaṇa* (TB 3.4.11 and TB 3.104) give the names of all the five years, although, there is some variation in the names. The *Taittirīya Saṃhitā* calls them *saṃvatsara, parivatsara, idvatsara, iduvatsara*, and *vatsara*, while the *Vājasaneyi Saṃhitā* and the *Taittirīya Brāhmaṇa* call them *saṃvatsara, 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 (*sāvana* year). *Taittirīya Saṃhitā* (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.[10] The scheme of adding two intercalary months called *aṃhaspati* and *saṃsarpa* in a yuga is also of Vedic origin[10] as is evident from *Ṛgveda* (RV 1.25.8). It is clear, therefore, that the five-year yuga and the scheme of two intercalary months in a five-year period are much older than RJ 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 and the associated scheme of two *adhimāsas* continued to be in use in India for a very long time. It occurs in *Mahābhārata* (*pancame pancame varṣe dvau māsāvupajāyataḥ* MBh 4-47), as does Kauṭilya's *Arthaśāstra* (*pañca saṃvatsaraṃ yugamiti* AS 2.20.69.71). *Garga Saṃhitā* and

Paitāmaha Siddhānta all refer to the five-year yuga period of VJ. It has already been noted that the Jain text *Sūryaprajñāpti* mentions it (*tā pañca samvaccharā*; *sutra* 54). The Buddhist text *Sārdūlakarṇāvadāna* also reflects the use of the five- year yuga of VJ.

Five-year yuga : Why?

The answer to this question can be found in VJ, its Vedic sources, and in the close connection between *jyotiṣa* and *yajña*. The purpoe of VJ is described in verse:

kālajñānaṃ pravkṣyāmi ..... yajñārthakālasiddhaye (RJ 2-3)

"I shall describe systematically the science of time for the purpose of determining the appropriate time for different *yajñas*"

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 yajñārthamabhipravṛttāḥ .....
..... yo jyotiṣaṃ veda sa veda yajñān (RJ 36).

"The Vedas have indeed been revealed for the purpose of the performance of *yajñas*. But the *yajñas* are to be performed in different segments of time as appropriate. Therefore, only he who knows the science of time, namely *jyotiṣa*, understands fully the performance of *yajñas*.

Thus VJ not only specifies the role of *jyotiṣa* in the ritual *yajña*, but describes the interdependence of *jyotiṣa* and *yajña* also. This is also true of the five-year yuga concept which is also derived from the ritual *yajña*."

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*. Another set of principles of equivalence is related to astronomical concepts. For example, in *agnicayana, prajāpati*, the Lord of Creation,

is identified with time, in fact, the year (*saṃvatsaro vai prajāpatiḥ* PU 1.9; *prajāpatireva saṁvatsaraḥ* JB II. 393; and *sa eṣa prajāpatireva 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:

pancasaṃvatsaramayaṃ devaṃ
yugādhyakṣaṃ prajāpatiṃ
dinartvayanamāsāṅgaṃ
praṇamyaśirasāśuciḥ (RJ - 1)

"(I), *Suci*, 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.

The ritual *yajña* (*adhiyajña*, to be more general) is characterized by an intrinsic five-fold nature. There are five *yajñas: bhūtayajña, manuṣyayajña, pitryajña, devayajña*, and *brahmayajña*. The altars are also five in number: *gārhapatya, āhavanīya, dakṣiṇāgni, sabhya,* and *āvasthya*. There are five requisite materials for the *yajña*, which are described in *Śatapatha Brāhmaṇa* (SB 1.1.1-8), and it is said there that the sacrificer gathers these five materials (*pancasambhārān sambharati*).

The five-fold nature goes beyond the ritual (*adhiyajña*) to the material existence (*adhibhūta*) and to the primal self (*adhyātma*) also. This is all described in *Taittirīya Upaniṣad* beginning with the following declaration:

athataḥ saṃhitāyā upaniṣadaṃ
vyākhyāsyāmaḥ paṇcasvadhikaraṇeṣu (TU 1.3.1)

"Now we shall explain the upaniṣad of the saṃhitā under five headings"

It is also said

pṛthivyāntarikṣaṃ dyaurdiśovāntaradiśaḥ
agnirvāyurādotuaścamdramā nakṣatrāṇiāpaoṣadhayo
vanaspataya ākāśa ātmā ityadhibhūtam (TU 1.7.1)

"The earth, the sky (*antarikṣam*), 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-devatas); water, plants, trees, ether and the atma (the set of five living being); thus with regard to the material existence".

This describes three sets of five members each, as external and gross embodiment of the Supreme. This is followed by:

athādhyātmam prāṇovyānopāna
udānaḥ samānaḥ cakṣus śrotram
mano vāktvak carma māṃsaṃ
snāvāsthimajjā (TU 1.7.1)

"Now, to the self; *prāṇa, 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, one finds:

etadadhividhāyaṛṣiravocat
pāṇktaṃvā idagaṃ sarvam
pāṅktenaiva pāṅktaṃ spṛṇoti (TU 1.7.3)

"After having analyzed all this the sage declared: all this is verily *pāṅkta* (five-fold); by the *pāṅkta*, indeed, does one secure the *pāṅkta*".

Thus the *Taittirīya Upaniṣad* declares every thing as having a five-fold nature and later, goes on to describe the five *koṣas* (sheaths) that cover the Self as the *annamaya, prāṇamaya, manomaya, vijñānamaya*, and *ānandamaya koṣas*. A similar statement occurs in *Bṛhadāraṇyaka Upaniṣad:*

sa eṣa pāṅkto yajñaḥ
pāṇktaḥ paśavaḥ pāṇktaḥ
puruṣaḥ pāṇktamidaṃ sarvaṃ
yadidaṁ kimca (BU 1.4.17)

"so this *yajña* 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.

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 *chāndramāsa, tithi, kalā, muhūrta*, and *kāṣṭhā* are referred to in RJ. The relationships among these time units can also be found in RJ.

124 *kāṣṭhās* = 1 *kalā*
20.1 *kalās* = 1 *muhūrta*
30 *muhūrtas* = 1 *aho - rātra* (day and night)
2 *parvans* - 1 *chāndramāsa*
2 months = 1 *Ṛtu*
2 *ayanās* = 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 pancākṣarāḥsmṛtāḥ (RJ - 18)

The same five-fold principle is operating at the subtle (*kāṣṭhā*) and at the gross (yuga) level of measurement of time and time itself may be regarded as *pāṇkta*. This idea is strengthened in view of the *paṇkti*-meter consisting of five *pādas* of eight syllables each. *Śruti* declares, "five-footed is the *paṇkti*-meter and *yajña* is a *pāṇkta*". It may be noted in passing that the number of *paṇktis* in *Ṛg Veda* is equal to the number of *muhūrtās* in a year and also to the number of bricks in the altar. The five-year yuga is simply another manifestation of *"pāṇktaṃ vā idagaṃ sarvaṃ"*. It is this strong dictum of *śruti* that everything is five-fold that perpetuated the use of the five-year yuga over such a long time.

"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, *amāvāsyā* 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:

caturdaśīmupavasathastathābhavet
yathodito dinamupaiti candramāḥ
māghaśuklāhniko yuṇkte
śraviṣthāyām 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 (*śrāvaṇa*) with *śraviṣtha* (i.e., it is common to both)".

Upavasatha day is the day of *pindapitṛyajña* and the day previous to that is *ādhāna* or *dīkṣā* day and the next day is *iṣṭi* day. Moon rising at almost sunrise indicates that the time is near newmoon. By contrast, if the moon rises well before the sun rises, it is technically called *uddṛṣṭa*, and all excepting *vājasaneyins* and *Baudhāyanas* have to perform an expiatory rite, *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 RJ-24 regarding ascertaining calculations by observations (*ityupāya samuddeśaḥ .....*)

The fact that there were astronomers who made observations is attested by the reference to *nakṣatradarśa*, an observer of stars, in VS (VS 30.10) and to *nakṣatravidyā*, the discipline of astronomy, in CU (CU 7.1.2; CU 7.7.1). It has been suggested by Sastry[11] that a day could have been tacitly added to the yuga after its end (just as we add a day in a leap year) and not counted in the calculation. This would avoid the most patent discrepancy. However, another type of discrepancy would accumulate as 62 synodic months = 1830.8965 days. An intercalary month would have to be dropped after 6 yugas, and a second intercalary month dropped after the next seven yugas and this cycle would have to be repeated. It may be noted, however, that it is not really necessary to know the rule as to when to drop the intercalary month. Mere observation of the moon in the *śraviṣṭha* region of the sky would have shown the need or lack of it for an intercalation.[11]

Jain Astronomy

The concept of time in Jainism is quite different from the Vedic concept and yet, the five-year yuga was being used in Jain astronomy also. The reason appears to be that the number five is also very important for the Jains. According to Jains, time is one of the five non-living category: *pudgala* (matter), *dharma* (movement), *adharma* (rest), *ākāṣa* (space), and *kāla* (TVDS 5.1). These five are permanent in nature and together with living beings, are fixed as the sole constituents of the universe and are devoid of touch, taste, sense and color (TVDS 5.4). The function of time is to explain (a) the existence in the present, (b) change, (c) movement, (d) long and (e) short duration (TVDS 5.22). The Jains admit five kinds of knowledge: *mati, śruti, avadhi, manhparyāya*, and *kevala* (TVDS 1.9) and practice five virtues: *ahiṃsā*, truth, non-stealing, chastity and non-attachment. They also undertake five vows (TVDS 2.15), and there are five meditations associated with each of the five vows (TVDS 7.3-8). There are five senses (TVDS 2.15) and five causes of bondage (TVDS 8.1). The effect of all these fives is similar to that of the vedic dictum "*pāṅketamidaṁ sarvaṁ*" , and helps explain the continued use of the fivēyear Yuga in Jain Astronomy.

Conclusions

We have clearly demonstrated that the five-year yuga cycle of VJ is much older than VJ and was not selected by Lagadha and continued to be in use for a very long time after VJ. Its popularity is due to the Vedic dictum of being *pāṇkta*. Vedic priests did make observations and had formulated rules for overcoming whatever shortcomings a five-year cycle might imply.

List of Abbreviations

AJ	*Atharvajyotiṣa*	RV	*Ṛgveda*
AS	*Arthaśāstra of Kautilya*	TB	*Taittirīya brāhmaṇa*
BU	*Bṛhadāraṇyaka upaniṣad*	TS	*Taittirīya saṃhitā*
JB	*Jaimini brāhmaṇa*	TU	*Taittirīya upaniṣad*
KB	*Kauṣitakī brāhmaṇa*	TVDS	*Tattvārthādhigama sūtra*
MBh	*Mahābhārata*	VJ	*Vedāṇga jyotiṣa*, here also used for RJ
PU	*Praśnaupaniṣad*	VS	*Vājasaneyī saṃhitā*
RJ	*Ṛgjyotiṣa*	YJ	*Yājuṣa jyotiṣa*

References and Notes

1. In current parlance, one *mahāyuga* consisting of *kṛta, treta, dvāpara* and *kali yugas* lasts for 4,320,000 years.
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11. Sastry, T.S.K. ref [3]; In fact, Muslims do so even today by observing the crescent moon.