

# Precession of the Equinoxes and Calibration of Astronomical Epochs

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**Abstract:** *Astronomical observations were used as a marker for time and the Calendar from ancient times. A more subtle calibration of epochs is thrown up by an observation of the position of the solstices and equinoxes, because these points shift in the sky with the years resulting in the gradual shift of celestial longitudes  $\lambda$ . Chronology based on such observations however needs to be backed up by hard evidence. We match both to take us back to 10; 000 B.C., the epi-paleolithic period, and the beginning of civilization itself.*

## 1. INTRODUCTION

It is well known that due to the tilt (of  $23\frac{1}{2}^\circ$ ) of the equator to the ecliptic, in other words the tilt of the axis of the earth's spin to its plane of revolution, there is the phenomenon of precession. This manifests itself in the Vernal and Autumnal equinoctial points sliding in the reverse along the zodiacal belt [1, 2]. The dynamical reason for this was explained by Newton in the seventeenth century, while the period of revolution of the equinoxes is roughly 25,800 years. In star charts, this manifests itself as the continuous change of longitude  $\lambda$ .

These effects can provide a marker for epochs in the following way: In ancient times the equinoctial or solstice points were observed along the solar and lunar zodiac. The lunar zodiac lies along the solar zodiacal belt, but is made up of twenty seven parts identified by the same number of lunar asterisms which have been used in ancient India and subsequently in China and also much

later in the Arab world. (This corresponds to the  $27\frac{1}{3}$  days sidereal period of the Moon. Each asterism or Nakshatra spans roughly  $13^\circ$ ). On the other hand it is relatively easy to pinpoint the equinoctial and solsticial points, as these

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are characterized by, respectively equal days and nights and longest or shortest days. Thus historical observations of these phenomena can yield valuable clues to the dates of observation. Final proof, however would have to come from archaeo-astronomical evidence. With this in mind we consider various astronomical references in ancient Indian literature and then link them to actual archaeological evidence that has been unearthed in recent times.

## **2. CALENDARIC ASTRONOMY AND ASTRONOMIC DATING**

According to generally accepted ideas, civilization and science began in Egypt and Sumeria in the third or fourth millennium B.C. and spread in various directions [3]. In the context of the Indian subcontinent (that is, South Asia), it is believed that Indo-Aryans, an Indo-European people, invaded the north-western parts of the country somewhere around 1500 B.C., overrunning in the process the then existing Indus Valley or Harappan civilization [4]. The Indo-Aryans, so the theory goes, were a semi-nomadic, hardy, rustic, and illiterate lot who could overcome the civilized and settled Harappan inhabitants, destroying their dwellings in the process, because of their superior strength and equestrian skill.

This scenario is based on an interpretation of the earliest extant Indo-European text, the Rg. Veda. The Rg. Vedic hymns are supposed to be invocations to various tribal or naturalistic deities for their aid in the Aryans' battles to conquer the original inhabitants.

Recently this view has been severely criticized, for various reasons, and today is considered questionable and dubious. The Rg. Veda and the related Vedic literature, on the contrary, contain amazingly accurate and sophisticated calendric astronomy. This fact points to not an illiterate, seminomadic tribal society, but rather a well settled agrarian and meticulously scholarly people.

This is because, a calendar is required for agriculture which in turn requires settlement. Once the astronomical content of Vedic literature is recognized, several dates begin to tumble out blatantly contradicting the prevailing picture of prehistory. It will then be shown that very recent archaeological excavations spanning a period of nearly 8500 years, from about 10000 B.C. to about 1500 B.C., can be meaningfully understood against this background.

## **3. THE CALENDARIC ASTRONOMY OF THE VEDAS**

The Rg. Veda repeatedly emphasizes *ṛitá* or cosmic order, embodied in the periodicity of astronomical phenomena; the word for seasons, *ṛitú*, derives from

ritá. Both a solar and lunar calendar were used, with an intercalation to reconcile the two. This is true even today, in India, for the purpose of festivals. Thus, the wheel of time has 12 parts and 360 spokes or days or 720 pairs of day-nights, with a remainder of about 5 days (RV 1.164). This is evidently a solar calendar. Interestingly, the Egyptians had a 360-day year followed by a 5-day gap.

From time immemorial Vedic Indians have been using a luni-solar calendar. The origin of this calendar is again to be found in the Rg. Veda. Thus Váruṇa, (literally, “the all-encompassing”) knows the 12 moons (that is, the twelve, 29.5-day months of a normal lunar year of 354 days). He also knows the moon of “later birth” (that is, the thirteenth intercalated month, added periodically to reconcile the lunar year of 354 days with the solar year of about 365 days [RV 1.25]). The Sumerians also used such a luni-solar calendar.

This gives an inkling of the problem at hand. A primitive society cannot be expected to calculate the year or the lunar month or other astronomical periodicities to any great degree of accuracy. The real problem of the calendar is the following: the Moon is, to quote the Rg Veda, the maker of the month. Thus the interval between two successive full moons, called the synodic month (or roughly, the month), is 29.5306 days (more technically, mean solar days). But the time taken by the Moon for one complete revolution about Earth, called the sidereal month, is 27.3217 days. Finally the year that we use, called the tropical year, that is, the year of the seasons, is 365.2422 mean solar days [5].

The problem now is to devise a convenient calendar that avoids the fractional days and also the fact that twelve months do not exactly t the year.

I would like to stress at this point that any society meticulous in its astronomical observation would choose the Moon quite naturally as a calibrator for observation because the movement of the Moon in the sky can be marked quite accurately against the background of the stars, something that is not true for the Sun. So in the earliest Vedic period, the path of the Moon was measured by twenty-seven stars or star groups. These are the twenty-seven nákshatras or lunar asterisms. The Moon would spend one day in each nákshatra. But since the Moon takes 27.3 days for a complete circuit, at an early point in time a twenty-eighth nákshatra was also considered. These nákshatras were the daughters of the sky who were wooed by the Moon. Some of these nákshatras are explicitly mentioned in the Rg Veda, while the Yajur Vedas and the Atharva Veda name them in detail. The Rg Veda (10.85) says, “Sóma [the Moon] in the midst of all these nákshatras hath his place ...the Moon is that which shapes the years... Sóma [the Moon] was he who wooed the maid [nákshatra]...”

The nákshatra system endured for a very long time (to this day, in fact) and is seen clearly in the astronomical text *Jyotisha Vedānga*, (circa 1350 B.C.). The Chinese used the twenty-eight nákshatra zodiac called the shiu, an improvement on the twenty-three nákshatra scheme of about 850 B.C. of the Yuehling. Some decades ago there was an unnecessary debate on the origin of the nákshatra system [6].

As can be clearly shown, its roots go back to the Vedas. An important piece of evidence is the Weber manuscript, an antique document discovered around 1890 at Kugiar near Yarkand in Sinkiang Province. It describes the twenty-eight nákshatras of the Atharva Veda as expounded by an Indian scholar Pushkarasárdi, in the archaic Gupta script [7]. Recently it was widely reported that an old star map on wooden blocks was salvaged from a pagoda [8]. It measures 25 centimeters by 21.2 centimeters and has been dated at A.D. 1005, making it China's oldest star map. It antedates by about onehundred years a previous star chart that was discovered in 1971 in a tomb at Xuan Hua, in northern China. The new find depicts the twenty-eight nákshatras in a Sanskrit incantation. (A recently discovered tomb painting from about 25 B.C., in Xian, appears to depict the twenty-eight nákshatras (hiu), while the earliest mention of their names might be traced back to about 433 B.C.) The lunar nákshatra system could also be the symbolism behind the Arabic crescent moon and star.

The Sun, however, cannot be ignored because the year is a barometer of the seasons that regulate agriculture and all of life. Hence for an agrarian community, the need to reconcile the lunar months with the solar year.

A further remark is that in Vedic literature, the devas, or gods (literally, "bright ones"), denote daytime, or the bright lunar fortnight, or the northern course of the Sun, that is, from the winter solstice to summer solstice. The asuras (or demons), literally those prohibited from the celestial draft (of brightness), denote the night, or the dark fortnight, or the southern half of the Sun's annual course. The Śatápatha Brāhmaṇa (2.1.4.9) declares that the gods are indeed the day [9].

Further, the so called Vedic rituals, as pointed out by the author, were really observations (a view endorsed by the Late astronomer, Prof. K.D. Abhyankar, as well.) A hint to this is given by a Rik (or loosely part of a hymn), which declares that these Riks are written in the high heavens, wherein are situated the bright ones. It goes on to say, who will understand them who know not this, but we who know it are assembled here. We will see dramatic evidence for this.

Finally, not only are Vedic astronomical computations incredibly accurate, but they also show a way with numbers that borders on the mystic and magical.

A very simple example is the concept of Gandharvas in the Ṛg Veda and Vedic literature in general, a concept that has been to date grossly misunderstood. The Gandharvas are associated with the Moon or Soma. Indeed, they observe all forms (or phases) of the Moon. According to the Aitareya Brāhmaṇa (5.27), Soma (the Moon) lived among the Gandharvas, who returned the Moon in exchange for a woman (that is, a nākshatra).

Their number is given variously as 27 and 6,333. All this is perfectly and exactly meaningful if we realize that the Gandharvas represent synodic months. First, 27 synodic months (from full moon to full moon) approximately equal two years, whereas 6,333 synodic months equal 512 years very accurately. This last relation in fact gives the value of the synodic month as 29.5285 days and the year as 365.2422 days, revealing an incredible degree of accuracy.

Further, 6,333 synodic months equal 6,854 sidereal months. This means that if a year began with the full moon in a particular nākshatra or lunar asterism, after 512 years, the year will again begin with the full moon in the same lunar asterism.

There is a further twist; 512 is equal to  $8^3$  and the well-known Gāyatrī meter of the Ṛg Veda is an 8/3 meter. The Ṛg Veda declares that the Gāyatrī meter has different functions. For example in an 8-year period, there are 3 intercalary months.

Another characteristic of the meter is in the above relation of there being  $8^3$ , or 512, years in 6,333 synodic months. It can now be seen why, in the Ṛg Veda, the Gandharva is called Viśvávasu or the universal Vāsu, the term Vāsu being associated with the number eight. It is specifically stated that the Vāsus are associated with the Gāyatrī meter.

Let us consider for another example the step-by-step build-up of days, months, and years to the cycle or Mahāyugá in Vedic literature of 4,320,000 years. This Mahāyugá or Megacycle is half a cycle and encompasses the eclipse saros and the precessional cycle as well. As I pointed out, there are 86,400 seconds in a day and, furthermore, 4,320,000 equals  $1^1 \times 2^2 \times 3^3 \times 4^4 \times 5^5$ . All this is to elucidate my remark about the mystic way with numbers that the Vedic composers had, in addition to their amazing degree of accuracy in astronomical observations and insight into astronomy itself. (It can be seen that the Babylonian eclipse saros and the Greek Metonic cycle are not only included in the above scheme, but far surpassed. In fact, the Māṇḍūkya

Upanishad species the 19/7 relationship of the Metonic cycle.) [11]. It is in this context that we can understand the statement in the Jaiminīya Brāhmaṇa, “Prajāpati [the lord of the devas or the bright halves, explained above] defeated Mṛtyu [the lord of the asuras, the dark halves, explained above] by numerical equivalence.”

It is quite evident that the composers of Vedic literature were a highly intelligent, knowledgeable, and sophisticated lot with a long tradition of astronomy that itself implies observation and settlement. Apart from their incredible calendric accuracy, including knowledge of precession, such other advanced and modern concepts as the heliocentric theory are already expected of the seminomadic, illiterate invaders that contemporary theory supposes. On this score alone, modern theories of Aryan invasion based on the usual interpretation of the R̥g Veda and Vedic literature become totally untenable. It is not surprising therefore that in recent times emerging evidence has steadily eroded this theory [12].

Once the astronomical and calendric character of Vedic literature is recognized, any number of astronomical dates tumble out. All of them show a continuous astronomical tradition beginning before 10,000 B.C. Many of these dates are couched in the typical allegorical style of Vedic and other ancient Indian literature. But there are a number of explicit dates also. A few are given below.

The Taittiriya Brāhmaṇa (3.1.2) refers to Ajáékapada, the nákshatra Purva Bhápada, rising exactly due east, a phenomenon that occurred around 10,000 B.C. when this asterism was at the autumnal equinox.

Another explicit reference is from the Taittiriya Sam. hita (6.5.3), which explicitly puts the asterism Kṛttikā, or the Pleides, at the winter solstice, an event that took place around 8500 B.C. While this was noticed by Dikshit in the past century, it was dismissed as being an impossibly old date [13]. The Aitareya Brahman. a, which is one of the earliest of the Brāhmaṇas or expository texts in the Vedas, explicitly refers to the asterism Púnarvasu (Castor and Pollux), presided over by the deity Àditi, also being exactly due east. This happened around 6000 B.C., and was noticed by Tilak, but for different reasons [14].

The Satāpatha Brāhmaṇa, one of the latest Brāhmaṇas, refers to the asterism Kṛttikā (the Pleides) rising due east, which immediately yields the date of about 2300 B.C. Thus an amazing continuity of astronomy from about 10,000 B.C. to about 2500 B.C. can be seen in Vedic literature.

All this is in blatant contradiction to contemporary theories that the Ṛg Veda was composed around 1500 B.C. by the invading Indo-Aryans (who displaced the settled and civilized inhabitants of the Harappan civilization). One could ask what is the evidence for either the above date of the Ṛg Veda or the invasion theory? Surprising as it might seem, there is in fact practically no evidence, archaeological or textual to support this claim [15]. As will be seen, there is far more positive archaeological, textual, and other evidence pointing to a very old date for the Vedic civilization.

#### **4. RECENT GEOPHYSICAL AND OTHER HARD EVIDENCE**

At the time the history of antiquity was formulated, and until quite recently, it was believed that about 10,000 years ago Earth was under the grip of the last great Ice Age, which enforced a nomadic lifestyle on people. Civilization in the modern sense of the word began only after this Ice Age started thawing, which in turn made agriculture and a settled lifestyle possible. This led to the great river-valley civilizations in Egypt and Sumeria.

Recent geophysical studies of the stabilization of sea levels indicate, however, that even around 10,000 B.C. several parts of Earth had already warmed up to the extent of making agriculture perfectly feasible [16]. In fact, in recent years it has been realized that the epipaleolithic civilization of about 10,000 B.C. and earlier in and around Anatolia (Turkey) already showed traces of agriculture (the growing of grain), domestication of animals (such as goats and sheep), and permanent settlements in round houses with arrangements for storage of food. This itself was preceded by settlements with seasonal camps, dating from about 14,000 B.C. [17].

The most dramatic archaeological finding of recent times has been the relatively unknown excavations at Nevali Cori in Anatolia [18]. This site dates back to around 7500 B.C. Current excavations there reveal even older underlying structures, showing an even older – at least several centuries older – civilization. While there are other settlements not too far away that go back to around 10,000 B.C., or earlier, the Nevali Cori civilization is unique in that it represents an already developed civilization with Megalithic elements and meticulous architecture and planning. The inhabitants were also a very artistic lot and several beautiful limestone sculptures have been found. In fact, this archaeological site contradicts straightaway the theory that civilization began in Egypt and Sumeria around 3000 B.C.

The very remarkable feature of Nevali Cori is that in civilizational terms it is an isolated oasis within the framework of present-day knowledge. It does

not relate to any civilization or culture of its period. There is a gap of some ve thousand years before we come to a similar civilization. With one exception. Its echoes can be found again in the fairly recent excavations at Mehrgarh in the Baluchistan area of the Indian subcontinent [19]. The Mehrgarh civilization dates back to between 7000 B.C. and 6000 B.C. and parallels Nevali Cori in terms of economy, agriculture, domestication of animals, and the planning and layout of large settlements (Professor Hauptmann, the excavator of Nevali Cori, subscribes to this view).

As noted Professor Hauptman and colleagues had unearthed at Nevali Cori near Sangli Urfa structures dating back to about 8000 B.C. However the earliest astronomical date given based on the rising exactly at the east point (vernal equinox) of the asterism Ajàékapad (Uttar Bhadrápada) was, as pointed out 10,000 B.C. A few years after Hauptman's work, Klaus Schmidt and coworkers discovered other very similar megalithic structures at Gobekli Tepe barely a few kilometers from there which, as predicted go back to, indeed 10,000 B.C. The pillars and motifs at Gobekli Tepe are clearly in the same mould as those at Nevali Cori—the latter in fact show a continuation. Once again these subsequently discovered pillars and motifs have astronomical symbolism which can be interpreted in terms of the Ṛg Vedic symbols and concepts. Firstly, in an enclosure ("D") there are twelve obelisks or pillars, one for each month! These pillars each show the gure of a fox or wolf. The fox or Vrika in the Ṛg Veda is the Moon, this being another meaning of the same word. The Ṛg Veda mentions that the fox (or she wolf) "having seen me once, slouches away through the houses." The same line also means, the Moon, the maker of the months, moves through the houses. This is clearly Luni-Solar astronomy. Each of the twelve foxes can be clearly seen to represent a month! Similarly there is the symbol of the thin crescent Moon being eclipsed by the Sun with a symbol resembling "H" above. This again is a reference to a total solar eclipse in the constellation of Gemini the twins. There are other familiar astronomical symbols like the Scorpion.

Another striking motif on the Gobekli Tepe pillars is that of a bird carrying the Sun representing Vishnu, the Sun riding atop the bird Garuda. There is also a phallic motif with a man. This represents the incestuous relationship which Prajapati (Orion) had with his daughter, and has also been elaborated upon in the Aitreya Brahmana. Because of this sin, Prajapati was shot with an arrow, represented by the three waist stars of Orion. His head also was cut o and replaced with the head of an animal, represented by the star Betelguese or Arudra. All this has been elaborated in the Vedic literature. Perhaps the denitive fact associated with Gobekli Tepe is the following.



There are the hymns in the Rig Veda of Sunashepa. He was to be sacrificed, and tied down with three pegs (the three stars of the Orion belt). One kept him on Earth, one was in the heavens and one was in the middle. Thus was Sunashepa tied down the hymns being inexplicable. The remarkable fact is that at the latitude of Gobekli Tepe, around 10,000 B.C., not only was the winter solstice near the Orion – Taurus system, but also one of the three stars was below the horizon, one near the horizon and the third above the horizon. This is a dramatic confirmation of date and place with pure astronomical positions. Incidentally Taurus the bull (Vrishabha) itself is a motif in the pillars there. Incidentally this theme of the three belt stars of Orion recur in different forms in ancient Indian literature, as pointed out in detail, elsewhere – as the legend of the King Trishanku trying to enter the heavens, as the hero of Mahabharata, Yudhistara entering heaven with the dog, Sirius and so forth.

The buildings at Mehrgarh were constructed of mud bricks. Several rooms were used for habitation and storage of food. Stone tools were used for harvesting cereal grasses. Ornaments were also being made. Social differentiation was also evident. By 5000 B.C., mud-brick storage houses were built and public architecture began to appear, as did handicrafts, including handmade pottery. Copper metallurgy was also present. Soon barley and wheat were also being extensively used. It is believed that between 5000 and 4000 B.C. the Mehrgarh civilization expanded. Many mud-brick storage buildings were built and now pottery was made using potter's wheels. There was a continuation in the making of ornaments and metallurgical activities. A few contemporary sites in Baluchistan and the Northwest Frontier province also appeared in this period. An article of pottery here from the period 4000 B.C. to 3500 B.C. shows the svastika symbol in a circle.

From about 3500 B.C. the Mehrgarh civilizational influence began to spread, particularly in pottery technology and styles, linking not only Central Asia (southern Turkmenistan), including the southern parts of Afghanistan and eastern Iran, but also the Harappan civilization. Stamp seals began to appear. In fact, the various interactions in the region are believed to have set the stage for the emergence of the Harappan civilization that, until quite recently, was supposed to have had a sudden and independent origin in full bloom!

The Harappan civilization is much too well known to be elaborated upon here [16]. It existed from about 2500 B.C. to about 1800 B.C. based on carbon dates (or from 3100 B.C. to 1900 B.C. with MASCA correction). Nearly one thousand Harappan sites have been unearthed spanning a vast area of 1.5 million square kilometers, from the borders of Iran, to Turkmenistan (Altyn

Depe), and from northern Afghanistan (Shortughai in the Bactrian Plain), through Punjab and Gujarat right up to Delhi and the Godavari Valley. It is now believed that this civilization developed from the early Indus Valley groups, especially Kotdiji, which itself was influenced by Mehrgarh. This vast civilization displays a remarkable uniformity mirroring the settlement patterns of the towns of Mohenjodaro and Harappa.

It is now clear that the worship of the mother goddess was prevalent in this civilization [20]. Brick altars for the worship of the mother goddess were built in many houses, and in Kalibangan a row of seven mother goddess altars was found, while one of the Harappan seals depicts the worship of the mother goddess with seven attendants. A few seals showing a horned deity in a yogic posture amidst animals have been interpreted, probably correctly, as depicting the god Śiva in his aspect of Paśupati, lord of animals.

There does not appear to have been a major capital or center for this vast civilization, quite unlike other ancient civilizations. This suggests what has been described as a complex chiefdom, or a series of chiefdoms strung together, rather than a united state.

The very developed public architecture of the Harappan civilization is well known, as are the thousands of seals. The decipherment of the script of these seals has been a problem. It was believed to have been a form of an early Dravidian language, but it now appears that the language of the seals was what the Indian archaeologist Rao calls an old Indo-Aryan, more plainly, a form of Sanskrit [21].

The Harappans had much contact with several places in Iran, Tajikistan, Bahrain, and elsewhere, as is evidenced by the Harappan pottery, weights, and seals found in those places.

It was believed that the Harappan civilization suddenly fell or disappeared. It now appears that many Harappan sites were affected by floods and by rivers changing their courses, and this led to the abandonment of settlements, in spite of the many low, protective walls built against such an eventuality. Though Harappan civilization declined, it continued in a decadent form in Gujarat and other parts of India. This phase is being labeled as the late Harappan period. Such late sites are found as far south as the present-day Maharashtra and as far east as Delhi. They extend up to the late second millennium B.C., and at these sites the painted grayware pottery of the early Iron Age is also found, indicating a direct cultural link between the Bronze and Iron Ages in the Indian subcontinent. This belies an earlier theorized Dark Age. The once-popular theory that the inhabitants of the Harappan civilization fled due to invasion is now called into question.

Around 2000 B.C. the cemeteries and tombs of the Mehrgarh region show some new features that are also found in the late Harappan civilization. These new traits are similar to those of Tepe Hissar III near Iran and Namazga V of southern Turkmenistan, and also to regions in Afghanistan like Dashly III. It has now come to light that around 2000 B.C. a vast region extending from the Gurgan Plains near the Caspian Sea (for example, Tepe Hissar) through southern Turkmenistan (Namazga, Altyn Depe), the Murghab Delta (ancient Margiana, Togolok, and so on), and ancient Bactria, including north Afghanistan (Dashly) right up to Mehrgarh in Baluchistan show uniform cultural traits. Parpola calls this the Bronze Age of “Greater Iran” or Namazga V culture [22]. It is characterized by distinctive monumental architecture, cult objects, iconographic motifs, bronze swords, and so on. Links with the Harappan civilization are also evident.

Further, the large quantity of weapons and evidence of chariots indicate the presence of a military elite { an Aryan military elite, as is generally agreed. At Dashly III a re temple has come to light (circa 2000 B.C.) that has three concentric circular walls, and there is evidence of another such temple as well. At Togolok 21 another re temple has been unearthed (circa 1800 B.C.). Apart from the re altars, at the Togolok temple the ancient Vedic Soma ritual was also practiced; the oblations were put in a row of vessels placed on special brick platforms. Further, at this site thirty miniature stone columns were discovered, as have been found at many other sites of Greater Iran. These are supposed to provide the link between the phallic cults of West Asia and the Hindu linga cult also in evidence in the Harappan civilization.

Apart from all these recent and comparatively recent developments, the existence of Aryan tribes in and around Anatolia – the Mittani, the Hittites, the Kassites, and so on, who lived around the middle of the second millennium B.C. – has been known for a long time. Thus the Vedic deities, Indra, Mitra, Váruna, and Násatya are invoked in the Boghuz Koi (near Istanbul) oath inscriptions between the Mittani king Sati Vaja and the Hittite king Supliluliuma [23]. In addition, the prevalence of other Vedic deities like the Mārutas, Sūrya, and also the horse-racing terms in Kikkuli’s manuscript all show a distinct Vedic and Sanskritic (Indo-Aryan) influence. There have been a number of theories about these civilizations of antiquity (but not of the newly discovered Nevali Cori civilization).

With regard to the Nevali Cori civilization, as I have pointed out, in addition to a remarkable coincidence of dates, from several points of view there is very good reason to identify the Nevali Cori civilization with the Vedic [24].

With regard to the Harappan civilization, there has been a theory popular among European scholars for several decades, namely, the Harappans were originally some sort of Dravidians and that around 1500 B.C., invading Indo-Aryans, who were also the composers of the Ṛg Veda, overran the Dravidian Harappan civilization and the Harappans were driven to the southern parts of India. For some of the reasons discussed in detail earlier (Cf.ref.[8] for example), this theory has been called into question severely.

## 5. ASTRONOMY AND RELATED CONSIDERATIONS

With this general scenario we can now discern a number of links, which form a suggestive mosaic:

1. The svastika symbol in Mehrgarh pottery, which appears some what later on some Indus seals, is an auspicious symbol in Indian epic literature. In addition, the Mehrgarh civilization dates back to the seventh millennium B.C. and has aspects of similarity with the Nevali Cori civilization.
2. There seems to be a connection between the re altars in Turkmenistan (Togolok) and Afghanistan (Dashly) and the Harappan civilization, particularly Kalibangan, where there are seven re altars, and also with the Harappan seal showing worship at a re altar with seven accompanying deities. The concept of the seven res is purely astronomical and originates in the Ṛg Veda. It is connected with the myth of the stars of the Pleiades or Kṛittikā and the seven stars of the Great Bear or Sapta Ṛishi (the Seven Sages), and its exemplified in the Mahābhārata. To understand this myth one has to notice that of the seven visible stars in the Great Bear, only one has a companion. There are six easily visible stars in the Pleiades. According to the myth, the re god (that is, the Sun) was enamoured of the seven wives of the seven sages. Another maiden (Svāhā) was enamoured of the fire god. So Svāhā successfully took the form of the wives of the sages, that is, the Great Bear, and cohabited with the Sun. Except that the wife of one of the seven sages was so chaste that Svahajust could not take her form. The six wives were promptly banished. In any case the resulting semen was put at one place – this is the Pleiades, which according to the dates proposed above was at the winter solstice in early Vedic times. To conclude the myth, the result of the cohabitation was the Hindu deity Kārttikeya, who was split asunder, the second portion being the lunar asterism Viṣākha, that is, one who has been split. (As pointed out elsewhere, the lunar asterism Viṣākha is 180 degrees away and would have been at the summer solstice in the Vedic epoch.) Kārttikeya, born of the Pleiades, rides a

peacock, probably a symbol for the several stars that constitute this lunar asterism. He is nurtured by the seven mothers. To make the identification of the Indus seal script complete, Rao's decipherment shows that the re altar on the seals was called *gahpahppat*, which clearly denotes *gārhapatya*, the Vedic fire altar to be kept at home. What would be the significance of the Sun in the form of a re god, the Pleiades, and the seven sages and seven mothers for the Harappan civilization fire altar? That at the time of the Harappan civilization the Pleiades was at the vernal equinox, as in fact is explicitly mentioned by the latest of the Brāhmaṇas, the Śatápatha Brāhmaṇa.

It is quite remarkable that the peacock and stars are prominent motifs on the pottery found in the late Harappan cemetery *H* which pottery already shows new stylistic influences [28]. Among the objects found there was an urn or pot with seven seedlike objects in it that can be directly compared with the above myth. So while the styles may have changed, the concepts seem to show a continuity.

The seven sages and seven mothers and seven seeds have an exact parallel in the Zoroastrian Haptaoring (in Sanskrit *saptaliṅga* or the seven phallic objects), and the seven sages of Sumerian lore. There is an equal parallel with the seven deities of the Hittites. In fact, the parallel is made closer if we observe that in the Hittite custom a goat approaches the deities. In the Pleiades myth from the Mahābhārata related above, a goat is also present. The link with the Hittites is of course quite natural. Apart from the many other known parallels, recently Parpola has pointed out another curious similarity between a chariot drawn by a horse and a mule in Hittite custom and the identical ancient Hindu *vipatha* chariot. Also, a few Hittite invocations are practically in Sanskrit. For example, the Hittite "Istanue Ishami," compares exactly with the Sanskrit, "Sthnu Is'ami." [29].

Similarly, from very early on a deity seated in yogic pose amid animals depicted on Harappan seals has been identified with the Hindu Śiva. This again throws up a contradiction if it is supposed that the Harappans were Dravidians or non-Aryans, because Śiva in Hindu tradition is a brāhmin, very much an "Aryan" concept. (Curiously enough, the place where the Harappan civilization was discovered in the past century by the British was called Brahminabad or Brahmin City. Could this be more than mere symbolism?) A final remark in this context is that the Harappans used a year of six seasons, as in the R̥g Veda, and further used a sixty-year (Jovian) cycle, which has been an ancient Hindu tradition.

3. The goddess associated with a tiger in a Kalibangan cylinder seal compares closely with a cylinder seal from Shahdad (Iran), also depicting a goddess. This compares with seals showing a goddess on a tiger (or lion) from Bactria [22]. All this is easily understandable in terms of Durga of Hindu mythology. This also shows links with Sumeria, because until comparatively recently, cylinder seals were exclusively associated with that region.
4. The eagle-headed deity from Baluchistan of the second millennium B.C. compares with the motifs of similar deities ghting serpents found in Greater Iran, with the variation of a human head and a bird body (both considered to be the same), again ghting serpents [22].
5. The Harappan seal found at Altyn Depe shows a link between central Asia and Harappan civilization [30]. In fact, Prof. V. Masson on this basis suggested that the south central Asian people were, like the Harappans, Dravidian.
6. The pottery and terracotta gurines from southern Turkmenistan closely resemble similar objects from the Harappan civilization [30].
7. The Vedic deities and Indo-Aryan names of Anatolia of the second millennium B.C. evidently show a close linkage.
8. The inhabitants of Greater Iran were Aryans while the language and culture of the Harappan civilization is also of the same origin. Furthermore, the racial types of southern India are no dierent from the Caucasian and Mediterranean types.
9. The burial material in southern Tajikistan of the second millennium is close to those in Indo-Aryan burials [30].
10. All this can be tied up with the distinct Vedic inuence at Nevali Cori in the form of a limestone sculpture of a head of a Vedic priest, going back to the eighth millennium B.C.

The picture that emerges from the above mosaic of evidence and dates is that in the eighth millennium B.C. or earlier a Vedic culture with R̥g Vedic Sanskrit as its language was already apparent in Anatolia, and that it gradually diffused toward both east and west. For a few thousand years – may be about five thousand years—the language, religion, and culture gradually evolved and changed. This picture is in harmony with very recent ndings based on blood groups and languages—in fact, from Europe through the Mediterranean regions to India we have the ethnic caucasoid group [31].

A model having some resemblances to the above was proposed rather recently by Renfrew [32]. But Renfrew’s model conicts with that of French

scholar Dumézil [33] who had argued that the several similarities in the myths of diverse and very widespread Indo-European cultures could not be merely accidental or due to routine diusion and contact, as is implied by Renfrew. Indeed this would be far-fetched. Dumézil, on the lines of Max Müller, went on to trace a common ancestry for the Indo-European people among the Kurgan Russians, circa 3000 B.C. Renfrew and Dumézil completed their work before some of the excavations and other evidence touched on in this discussion. The scheme proposed here, in a sense, reconciles these two views to some extent.

In the earlier models, however, the language of the Anatolian region in the eighth millennium was a hypothetical proto-Indo-European and not Ṛg Vedic Sanskrit. Apart from the doubts cast on glotto-chronology, it is possible that the rate of change of languages was slower the farther back in time we go. Such a very slow and relatively peaceful diusion is in fact mirrored by the gradual development of the Mehrgarh civilization. It is also vindicated by the Harappan model of a vast civilization comprising a large number of coexisting chiefdoms.

This brings us to around the second millennium B.C. where again we see a vast number of connections. This is also the period of the latest Brāhmaṇas and the Upanishads and the earlier epic period of Hindu literature. Indeed the literature portrays a picture not so much of a centralized empire, but that of a number of loosely interlinked smaller kingdoms, in relative harmony, on the lines of the Harappan settlements. In fact, the names of a number of Hindu epic dynasty families, for example, the Kúrus, can be traced to Greater Iran. Similarly tribe or community names from Hindu epics like the Vṛikas can be traced right up to the Gurgan Plain [22]. The far-extending lion-or tiger-borne mother goddess motifs, the eagle and serpent motifs, and the svastika motifs all support this view and can be understood against this background. Further, the “Old Indo-Aryan” language of the Harappans, in the context of the above scenario, suggests that the language, rather than being a precursor of Vedic Sanskrit, was a corruption of the latter due to passage of time and distance; the Indus Valley may not have been the epicenter of the then prevalent Vedic civilization, which was probably centered in adjacent Greater Iran.

There is in fact astronomical evidence for the above assertions. Two ancient Hindu astronomical texts, the Jyotisha Vedāṅga and the Pitāmaha Siddhānta (attributed to the hero scholar Bhīshma of the Mahābhārata), both dating to around the middle of the second millennium, are set in a latitude of about 35 degrees north, as can be deduced from the given relative length of the longest day of the year. This falls right inside Greater Iran. A few scholars have taken

the unfounded and untenable view that this merely represents a trace of Babylonian astronomy. Others would be reluctant, again without much of a basis, to transplant the epic Hindu setting to Greater Iran. But the fact is that in the Mahabharata) itself, places such as Gandhara, Kamboja (Afghanistan), and Sindh, and peoples such as the Yavanas, Valhikas, and so on, are featured. According to the longitude given by Varahamihira, circa 500 B.C. Yavana (probably Ionia) would correspond to Alexandria while Valhika has been identified with Balkhash [34].

Large-scale and possible violent migrations or invasions seem to be a feature more evident from the second millennium B.C. According to Soviet archaeologists, it appears that only from the middle of the second millennium B.C. did active migrations of the steppe tribes of central Asia take place, and these tribes penetrated the erstwhile farming and settled cultures [30]. This situation is also mirrored in west Asia around the same time.

## 6. CONCLUDING OBSERVATIONS

The very ancient date of around 10,000 B.C. proposed for the R̥g Veda or Vedic culture now appears plausible in view of the epi-Paleolithic agricultural or proto-agricultural civilizations dating back to a similar or even earlier period. If, as European scholars have supposed, the R̥g Vedic descriptions of invasions of the circular forts of the dasas or aborigines are to be taken at all literally, couldn't these forts be identified with the circular dwellings of the Neolithic people in and around the Anatolian region?

In fact, the word Aryan of the R. g Veda is derived from the Sanskrit root meaning "to plow." What all this is about is lucidly expounded in several Purāṇas (for example, the Vishn. u Puran. a) in their characteristic allegorical style. In a nutshell: From the thigh of King Vena, all the evil came out in the form of a black dwarf (that is, an aboriginal pygmy). From the king's right hand, came out a beautiful shining prince, Pṛithú, who, because of a famine, pursued Earth intending to slay it, as it would not yield its fruits. Earth finally relented. "Before his time there was no cultivation, no pasture, no agriculture, no highways for merchants, all these things originated [then]... Where the ground was made level, the King induced his subjects to take up their abode....Then proceeded all kinds of corn and vegetables upon which people now subsist...." [35]. Pṛthú's son was Manu of Hindu Mythology, the progenitor of humankind. Thus the "Arya" of the R̥g Veda would represent, rather than an ethnic type, the very first agricultural people whence civilization itself began, sometime prior to about 10,000 B.C. [36].



In this connection, it is interesting to note that the term Aryan with its modern connotation is of rather recent coinage. Once the similarities between Sanskrit, Greek, Latin, German, and the Celtic languages were discovered by Sir William Jones, the term “Indo-Germanic” was coined by Bopp, the nineteenth-century German comparative philologist. This was later rechristened “Aryan”, by Max Müller, from the R̥g Vedic – supposedly racial–“Arya” [37].

But the R̥g Veda and Vedic literature show a level of astronomy and science far ahead of that seen from about 2000 B.C. onward. Historians have, by and large, adopted a linear model of progress that has not always been true. There have been periods of regression in human civilization and human knowledge. It appears that very advanced but camouflaged astronomy in the R̥g Veda slowly decayed, as its meaning was lost. In fact, even the earliest of Brahman. as like the Aitareya Brahman. a (circa 6000 B.C.) already begins to speculate on the possible meanings of the R̥g Veda.

But there is a curious linguistic feature that might just symbolize this bifurcation. The Judeo-Christian traditions are from Abraham (of the second millennium B.C.), a word that could be interpreted as being derived from a-brahman, with brahminism being identical to the R̥g Vedic tradition.

As noted long ago by the author, this date and tradition exactly matches the description given by Plato in Timaeus about the lost civilization, which he called Atlantis.

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