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Beginnings of Indian Astronomy with Reference to a Parallel Development in China

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ABSTRACT

Hypotheses of a Mesopotamian origin for the Vedic and Chinese star calendars are unfounded. The Yangshao culture burials discovered at Puyang in 1987 suggest that the beginnings of Chinese astronomy go back to the late fourth millennium BCE. The instructive similarities between the Chinese and Indian luni-solar calendrical astronomy and cosmology therefore with great likelihood result from convergent parallel development and not from diffusion.

1. INTRODUCTION

In what follows, I propose that the first Indian stellar calendar, perhaps restricted to the quadrant stars, was created by Early Harappans around 3000 BCE, and that the heliacal rise of Aldebaran at vernal equinox marked the new year. The grid-pattern town of Rahman Dheri was oriented to the cardinal directions, defined by observing the place of the sunrise at the horizon throughout the year, and by geometrical means, as evidenced by the motif of intersecting circles. Early Harappan seals and painted pottery suggest that the sun and the centre of the four directions symbolized royal power.

A short summary of this paper, entitled "Beginnings of Indian and Chinese Calendrical Astronomy," was presented at the 223rd Annual Meeting of the American Oriental Society in Portland, Oregon, 17 March 2013. I dedicate this study to my 'elder brother' Thuppettan (Tuppēṭṭan) in Panjal, Kerala, the eminent Malayalam playwright and graphic artist Śrī Muṭṭattukkāṭṭil Māmaṇṇu Subramanian Nampūtiri, who on his 84th birthday 3 March 2013 "saw 1000 full moons" and received a hundredfold unction (*śatābhiṣeka*). Born 16 February 1929 under the Viśākha nakṣatra which defines the birthday, he is the eldest son of the late Jaiminīya Sāmaveda authority, my guru Brahmaśrī M. M. Iṭṭi Ravi Nampūtiri.

Mature Harappans probably had astronomical observatories like their Chinese contemporaries. They made stable stone pedestals likely intended for the gnomon and possibly used water to make the ground level. Around 2400 BCE, Indus astronomers lunarized the earlier heliacal calendar, concluding the stellar position of the sun from the full moon's conjunction with the opposing asterism. Stellar oppositions were established with the help of circumpolar stars, which assumed ideological importance: Ursa Major became the Seven Sages, and the steadfast pole star (alpha Draconis) symbol for the king. Harappan star-gazers also adjusted their calendar to the precession by making the Pleiades the new year star. Native Dravidian names of stars, asterisms and planets preserved in Old Tamil texts can be read in the logo-syllabic Indus script, where the most common Dravidian word for 'star,' *mīn*, is expressed with the picture of its homonym *mīn* 'fish.'

Among the Dravidian star names ending in *mīṉ* that are attested in Old Tamil is *vaṭa-mīṉ* 'north star'; this compound has a counterpart in the Indus script, where a pictogram resembling the "three-branched fig tree" motif of Harappan painted pottery occurs several times immediately before the plain 'fish' sign. A homonym of *vaṭa* 'north' is *vaṭam* 'banyan fig,' the mighty tree with rope-like air-roots from which it has got its name (cf. *vaṭam* 'rope'). This Dravidian homonymy explains two conceptions of Purāṇic cosmology, the banyan as the tree of the northern direction and the idea that stars and planets are tied to the pole star with invisible "ropes of wind". As early as in *Ṛgveda* 1,24, reference is made to stars being "fixed above" and to a banyan tree held up in the sky by King Varuṇa. The same hymn mentions Śunaḥśepa, a sacrificial human victim who was replacing in this role the firstborn son of a king according to a legend narrated in the royal consecration of the Veda. Śunaḥśepa 'Dog's tail' is originally an ancient Graeco-Aryan name of a circumpolar asterism, apparently corresponding to the tail of a large heavenly crocodile (*śiśumāra* literally 'baby-killer') mentioned as containing the pole star in *Taittirīya Āraṇyaka* 2,19 and in Purāṇa texts. The latter conception can be associated with a Harappan crocodile cult that survives up to the present day in Gujarat and that in Bengal has been connected with the sacrifice of first-born babies. By a curious coincidence the ancient Chinese too were imagining an immense heavenly alligator in the sky, apparently since Neolithic times.

2. REFUTING THE DERIVATION OF VEDIC ASTRONOMY 1000 BCE FROM MESOPOTAMIA

The relationship between the Indian,[1] Chinese,[2] and Mesopotamian[3] calendars has been much debated.[4] Recently, John C. Didier has asserted that Indians adapted the twelve Babylonian zodiacal signs into the 27 or 28 *nakṣatra*s after about 1100 BCE, whereafter the calendar went to China sometime between 900 and 400 BCE to become the 28 *hsiu*.[5] Didier's scheme accommodates the dates of the earliest attestations of the three *fully developed* systems involved, but is unacceptable for a number of reasons detailed in this paper. Indeed, given the shortcomings of Didier's work,[6] it would hardly merit serious consideration if Didier could not take as his basis.[7] David Pingree's "hypothesis"[8] that essential elements of Vedic astronomy including the nakṣatra calendar owe their origin to influence of astronomical knowledge received from Babylonia around 1000 BCE.[9]

David Pingree (1933–2005) was one of the foremost experts of both Mesopotamian and Indian astronomy, a top scientist who could read both cuneiform and Sanskrit texts. He has demonstrated that Indian mathematical astronomy, first codified in Lagadha's Ṛk-recension of the *Jyotiṣa-vedāṅga* (perhaps as early as 400 BCE), is based on transmission of Mesopotamian astronomical and astrological tradition to northwestern India when it was part of the Achaemenid empire (*c*. 515–326 BCE).[10] But when it comes to the early Vedic texts, "written [*sic*][11] over a period of several hundred years, beginning shortly before 1000 BCE (the hymns in *maṇḍala* I of the *Ṛgveda*) and extending for some time after that date",[12] the evidence is far from convincing, let alone "virtually unassailable".[13] Actually, Pingree himself originally was of the same opinion:

1 A convenient summary of the basic data of Indian astronomy is Filliozat 1953. On the Vedic data concerning the *nakṣatra*s, Weber 1862 remains fundamental, on post-Vedic Indian astronomy Pingree 1978.

2 The basic work on Chinese astronomy has been Needham 1959, now fundamentally updated by Pankenier 2013 (kindly made available to me in page proofs by the author shortly before this paper went to press; Pankenier's earlier papers which are referred to in the present paper have been included in this book in revised form).

3 A convenient summary of Mesopotamian astronomy is Rogers 1998; a recent handbook is Hunger & Pingree 1999.

4 See Needham 1959: 184, 252–259.

5 Didier 2009 I: 98 & 106–107.

6 See Pankenier 2013: 106–7 & 133–4 and http://www.lehigh.edu/~dwp0/Refute_Didier-Mair.html.

7 Didier 2009: I, 105 with n. 59.

8 Pingree 2007: 43.

9 See Pingree 1989; 1990: 274; 2007: 43; Pingree & Morrissey 1989; Hunger & Pingree 1999: 72–73.

10 Pingree 1973; 1978; and elsewhere.

11 Vedic texts were composed and handed down orally, and Vedic Indians did not read or write: after the Indus script had vanished by about 1700 BCE, writing first came to India with the Achaemenids (cf., e.g., Karttunen 1989: 29–30; Salomon 1998: 10–14).

12 Pingree 1989: 445.

13 Didier 2009: I, 105 n. 59. For criticism of Pingree, see also Falk 2000.

> The earliest Indian texts which are known – the Vedas, the Brâhmaṇas, and the Upaniṣads – are seldom concerned with any but the most obvious of astronomical phenomena; … One may point to the statement that the year consists of 360 days as a possible trace of Babylonian influence in the Ṛgveda, but there is little else which lends itself to a similar interpretation. It has often been proposed, of course, that the list of the twenty-eight nakṣatras … is borrowed from Mesopotamia. But no cuneiform tablet yet deciphered presents a parallel; the hypothesis cannot be accepted in the total absence of corroborative evidence.[14]

Still in 1978, while giving a short systematic account of Vedic astronomy, Pingree was of the opinion that the earliest "intrusion of new [astronomical] theories from the West" was that of the fifth century BCE.[15]

Later, however, Pingree assumed an earlier wave of transmissions influencing the early Vedic tradition:

> The transmissions … seem to have occurred essentially at the very end of the second or in the first half of the last millennium BCE. In a period somewhat earlier than this we know of intercourse between Vedic Indians and Mesopotamia from the famous Mitanni material. Such contact could have continued into the last millennium either overland, through Iran, or by sea; both routes had been used in Harappan times and were later followed in the Achaemenid period.[16]

However, there is no evidence of any contact between Vedic Indians and Mesopotamia during this time, and the earliest more likely evidence pointing to sea trade between Mesopotamia and the lower Indus country (which lay outside the Vedic sphere) is from the seventh century BCE.[17] The most generally accepted hypothesis concerning the Mitanni Aryans is that they separated from Proto-Indo-Aryan speakers in Central Asia and that they did not come from India;[18] they almost certainly came, via northern Iran, to Syria from the "Oxus Civilization" or the "Bactria and Margiana Archaeological Complex (BMAC)," which had archaeologically attested contacts with Syria during the first half of the second millennium BCE and very likely a Proto-Indo-Aryan speaking superstratum.[19]

The idea of a year of 360 days or 720 days and nights, attested in the *Ṛgveda* (1,164,11) and the *Atharvaveda* (AVŚ 4,35,4), results rather naturally from 12 solar

14 Pingree 1963: 229–230.
15 Pingree 1978: 533.
16 Pingree 2007: 43.
17 See Karttunen 1989: 22–31.
18 See Burrow 1973; Karttunen 1989: 23.
19 See Parpola 2012 and 2012 [2013] with further references.

months of approximately 30 days, and needs not to have come from Mesopotamia, at least not around 1000 BCE as suggested by Pingree[20] – it might have come to India from Mesopotamia in Harappan times, but could as well have been invented independently.

The same applies to two other similarities with MUL.APIN that Pingree finds significant:[21] the idea of adding an intercalary 13th month (see RV 1,25,8; TS 1,4,14; KB 19,2) (once during a five-year cycle: $5 \times 360 + 30 = 1830$ days, which divided by five gives an average of 366 days for a solar year, about 3/4 of a day longer than the actual solar year), and of the observation of the solstices and equinoxes from the change of sun's rising point along the eastern horizon: the sun "stands still" before going north for six months and before going south for six months (KB 19,3).[22]

The earliest systematic star catalogue preserved from Mesopotamia is contained in the so-called "Three Stars Each" tablets, the oldest surviving examples of which date from around 1200 BCE. They list in all 36 stars, three for each of the twelve months of the year, one from each of the "three paths/ways," presented as circular and concentric in so-called 'astrolabes,' the (innermost) "path of (the water god) Ea," the (middle) "the path of (the sky god) Anu" and the (outmost) "path of (the wind god) Enlil". These paths are supposed to represent, respectively, the southern sky, the equator and the northern sky, but the divisions are astronomically incorrect, and the lists contain also planets; "these lists include the earliest records of several farming-calendar constellations, and they clearly state that their heliacal risings were used in a calendrical system".[23]

The next important astronomical cuneiform text is the one that Pingree thinks has influenced early Vedic astronomy, called from its first words MUL.APIN ('plough star') and according to its astronomical data compiled around 1000 BCE.[24] Because it is important to have an idea of this text as a whole in order to judge Pingree's hypothesis, I quote its condensed characterization by John Rogers, in whose paper one can find the star lists (with translations of the names) and star maps:[25]

> The star-lists are direct descendants of the Three Stars Each lists, including the same stars, the same purposes, and some of the same descriptions. But they had been reworked on the basis of accurate obser-

20 Pingree 1989: 441–442.

21 *Idem*, 442–444.

22 The "northern" and "southern" course of the sun can in principle be interpreted in two ways: from one solstice to the other (sunrise moving from one extremity on the horizon to the other), or from one equinox to another (sun rising on the north side or the south side of due east).

23 Rogers 1998: 16–17; see Hunger & Pingree 1999: 50–57.

24 Hunger & Pingree 1989; see Hunger & Pingree 1999: 57–83.

25 Rogers 1998: 17–22.

vations around 1000 BC, and are much more extensive and systematic and accurate astronomically. They record more constellations, including most circumpolar ones for the first time; the new ones include more of the zodiacal figures, and several portraits of deities, but also more depicting farming activities and animals. … The lists on the first tablet are:

I. Catalogue of 'stars' in the 3 Ways: 71 constellations, stars, and planets (Table 3). This catalogue includes all the 'stars' in the earlier lists (Table 2) (except Bir) and all the 'stars' in the following lists of MUL.APIN (except for a few single stars). …
II. Dates of heliacal risings. …
III. Pairs of constellations which rise and set simultaneously.
IV. Time-intervals between dates of heliacal risings. …
V. Pairs of constellations which are simultaneously at the zenith and at the horizon. …
VI. The path of the Moon and the planets. 'The gods who stand in the path of the Moon, through whose regions the Moon in the course of a month passes and whom he touches: The Pleiades, the Bull of Heaven … [altogether 18 names].' … this list contains most of the zodiacal constellations … they are not strictly organized into the 12 signs, and some others intrude. Note that the Pleiades and Taurus were named first; they marked the spring equinox before 2200 BCE.

The main lists on the second tablet are:

VII. Solar calendar, with dates when the Sun is at the cardinal points.
VIII. The planets and the durations of their solar conjunctions.
IX. Stellar risings and planetary positions for predicting weather and dictating leap years (intercalary months).
X. Telling time by length of the gnomon shadow.
XI. Length of night watches through the year, by water clock, and rising and setting of the Moon.
XII. Omens connected with appearance of stars, planets, ?comets (MUL-U.RI.RI) and winds (though not with the zodiac).

A missing third tablet … was probably just an optional appendix or link to other texts, containing omens.

The fact that the oldest *nakṣatra* lists start with the Pleiades, like the sixth list of MUL.APIN, is no evidence for the latter's influence on the former, as Pingree suggests;[26] rather, it shows that both lists go back to a tradition originating in the third millennium, as noted by Rogers (see note 25 above), especially since the Vedic texts specifically connect the Pleiades with due east (ŚBM 2,1,2,3–4: "the Kṛttikās never swerve from the east"; the context of this passage is discussed in detail below).

That both MUL.APIN and the Brāhmaṇa texts connect the lunar mansions with deities can equally well reflect Mesopotamian influence of Harappan times, for already the Sumerians associated their deities with heavenly bodies, and the Indian deities connected with the nakṣatras differ from those mentioned in the MUL.APIN, as Pingree duly notes.[27]

The MUL.APIN lists 18 stars in the path of the moon, so around 1000 BCE the Babylonian zodiac of 12 constellations determining the twelve solar months had not yet consolidated. This does not square with the fact that on the basis of their names, the nakṣatras originally numbered 24, obviously corresponding to the 24 half-months of the year. Vedic texts lay stress on the parallellism of three time cycles each split into luminous and dark halves: (1) the nychthemeron consisting of the day and and the night, (2) the month consisting of the 'white half' (*śukla-pakṣa*) of crescent moon and the 'black half' (*kṛṣṇa-pakṣa*) of decreasing moon, and (3) the year consisting of the auspicious 'northern course' (*uttarāyaṇa*) of the sun, and the ominous 'southern course' (*dakṣiṇāyana*) of the sun.

Three *nakṣatra*s of this originally solar calendar were each split into two to provide the moon with a lodge for each of the 27 nights of the sidereal lunar month (27d 7h 43m). That the split asterisms correspond to single constellations in the MUL.APIN list does not prove that the *nakṣatra*s were divided into two after the asterisms were first borrowed as such from Babylonia. Pingree quotes this as the closest link between the two lists,[28] but himself notes that "against the significance of this is the fact that three other Mesopotamian constellations … are each paralleled by two separate nakṣatras."

Pingree also notes an important difference: in the case of eight *nakṣatra*s, the Indian astronomers "selected stars that by no means could be said to lie in the path of the Moon. This indicates that they did not require that the Moon actually touch the constellation, as MUL.APIN had".[29] What actually mattered to the Indian astronomers was, as pointed out by Jean Filliozat, that the *nakṣatra*s formed pairs of stars that were 180° opposite to each other (Fig. 1);[30] to achieve this, they selected even relatively small stars in preference to more luminous ones.

Pingree stresses that while there are just a couple of stray references to stars later included in the *nakṣatra* calendar in the latest books of the *Ṛgveda*, composed around 1000 BCE, the full system appears only in subsequent texts some time

26 Pingree 1989: 440–441, 444–445.
27 *Idem*, 440.
28 Ibid.
29 *Idem*, 440–441.
30 Filliozat 1962.

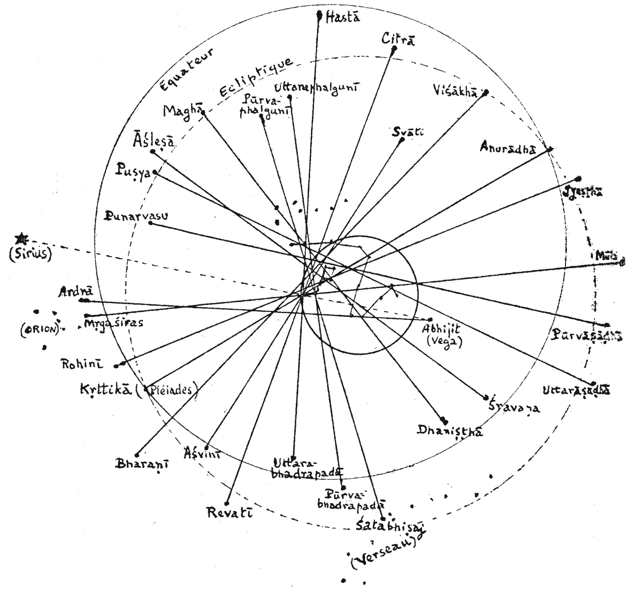

Figure 1: Nakṣatras as opposing pairs of asterisms. After Filliozat 1962: 350.

afterwards. He clearly implies that these attestations reflect the evolution of the *nakṣatra* calendar. Pingree ignores the fact that the Ṛgvedic Aryans were not the first Indo-Aryan speakers in the Indus Valley. While the oldest parts of the *Ṛgveda* (which do not refer to the *nakṣatra*s) mostly reflect the religion and culture that the Ṛgvedic Aryans had before and during their arrival, the latest books already anticipate the deep influence exerted upon them by the earlier arrived Indo-Aryan immigrants. These in their turn also had not arrived into a vacuum void of people, but to the Indus Valley shortly before inhabited by Harappans estimated to have numbered one million.[31]

Since the publication of a seminal paper by Jan Heesterman in 1962 it has been widely recognized that the 'classical' Vedic ritual codified in the Brāhmaṇas and Śrautasūtras was preceded by a more violent and sexually more explicit 'pre-classical' ritual. Fossils of this 'pre-classical' ritual have survived in Vedic texts in the form of rites associated with military sodalities whose members were called *vrātya*, in rites connected with royalty (*rājasūya, vājapeya, aśvamedha*), and in ceremonies of the *mahāvrata* day. The *mahāvrata* concludes year-long rites and celebrates one of the turning points of the year.[32]

31 The estimate is from Kenneth K. R. Kennedy 1995 (personal communication). That the Aryans did not bring the *nakṣatra* calendar with them when they came to South Asia is strongly suggested by the fact that the Iranians of Pre-Islamic times did not have a comparable star calendar; see Panaino 2013.

32 Most scholars have connected the *mahā-*

It is very significant that the ritual context in which the Yajurvedic Saṃhitās and Brāhmaṇas list the *nakṣatra*s is the building of an elaborate fire altar (*agniciti*) with a large number of baked bricks. Such a fire altar is a necessary part of a year-long rite, and the completed fire altar is praised on the final *mahāvrata* day (cf., e.g., PB 5,4). There are many variants of Vedic fire altars, one common type having five layers and 10.800 bricks. The fire altar is an image of the creator god Prajāpati (identified with the sacrificer) and his body, i.e., the cosmos and the year (which has $360 \times 30 = 10.800$ 'moments,' one day-and-night having 30 'moments' and there are 30 days in a month). The *nakṣatra*s and the full and new moon are connected with specific 'pebbles' (*śarkarā*) laid down as 'bricks' in two rows around the centre of the uppermost layer.[33] The building of fire altars is described in detail in Vedic Śulvasūtras, which codify a fairly advanced geometrical tradition.[34] There is no reference to this tradition or to the brick-built fire altars in the *Ṛgveda*, and it is out of the question that, in the relatively short time that separates the *Ṛgveda* and the Yajurvedic Saṃhitās, the nomadic Aryans of the *Ṛgveda* should have created such a tradition. Rather, it makes sense to derive this tradition from the Harappans, who during much of the third millennium lived in large cities elaborately built of millions of bricks.[35]

The planets figure prominently in the MUL.APIN. If this text really influenced early Vedic astronomy, why are the planets apparently not at all mentioned in the *Ṛgveda*, and it is extremely difficult to find references to them even in later Vedic texts? After all, the planets differ from all other heavenly bodies through their independent movement, and at times belong to the brightest phenomena

vrata with the winter or summer solstice (see Rolland 1973: 58–60), and indeed in several Vedic texts the *mahāvrata* and the middle day of the year, *viṣuvat* clearly denote the solstices. However, a number of facts suggest that originally the *mahāvrata* celebrated the autumnal equinox (see Parpola 1994a: 205). For one thing, the Pleiades constitute the first asterism of the oldest *nakṣatra* lists, marking thus the beginning of the year, and several of the individual star names of this asterism relate to rain (see Weber 1862: II, 301, 368; Scherer 1953: 117). Secondly, one characteristic action of the *mahāvrata* day is the sounding of different musical instruments (Rolland 1973: 73–76), so that "all (manner of) voices (i.e., music) resound" (*sarvā vāco vadanti* TS 7,5,9,3; PB 5,5,20). According to TB 1,8,4,2 this takes place in the rainy season (*prāvṛṣi sarvā vāco vadanti*), which lasts from about the middle of July to the middle of September. The TB passage speaks of rites connected with the regular plundering tours of Kuru and Pañcāla tribes (see Rau 1957: 15), and these have been connected with the plundering expeditions of the *vrātyas* (Heesterman 1962); the *mahāvrata* can be further linked with the great *navarātri* festival of Durgā, the goddess of war and victory, celebrated at the end of the rainy season around the autumnal equinox, which has traditionally been one of the main times to start a warring expedition (see Parpola 2002). Secondly, while the *mahāvrata* concludes the year-long sacrifice, the mid-point of the year is the *viṣuvat* day (see, e.g., Hillebrandt 1897: 157), and *viṣuvat* or *viṣu* denotes the 'vernal equinox' in many Indian languages (see Turner 1966: 693 no. 11982) and is celebrated today as such in many parts of India (see Brighenti 2012).

33 See Staal 1983: I, 494–495, Fig. 40 & table 13.

34 See Kulkarni 1983; 1987; Sen & Bag 1983; Michaels 1978.

35 See Kulkarni 1983: 1–8.

of the night sky. They cannot have failed to attract the attention of early astronomers. From the oracle bones and the chronicle called Bamboo Annals we know that as early as 1576 BCE, Chinese astronomers were closely observing planetary movements, and that later in the second millennium BCE dynastic transitions were justified with reference to unusually dense clusters of all the five planets visible to the naked eye.[36] I suspect that the Vedic aversion to mention planets is probably due to the important position they and astrology in general had in the religion that prevailed in the Indus Valley before the arrival of the Ṛgvedic Aryans.

Yet some proper names reveal that the planets were not unknown. Perhaps the clearest case is, significantly, connected with the 'pre-classical' rites of the vrātyas. According to *Pañcaviṃśa-Brāhmaṇa* 24,18,1, the *daiva vrātya*s (who were adherents of 'the God,' i.e., Rudra), had Budha as their leader (*sthapati*); the *śloka* verses quoted in PB 24,18,5–7 mention Saumāyana as the patronym of this Budha.[37] *Budha* means 'wise' and it is the later Sanskrit name of the planet Mercury, while Soma denotes not only the sacred drink of Vedic Aryans but also the 'moon.' One of the best-known astral myths in classical India (told in many Purāṇa texts and referred to in the *Mahābhārata*) concerns the birth of Planet Mercury. Soma ('the moon') robs Tārā ('the Star'), the lawful wife of Bṛhaspati, i.e., planet Jupiter, and engenders this splendid son to whom he gives the name Budha. The myth and its textual history have been studied in detail by Wilibald Kirfel.[38] The epics and Purāṇas are, of course, post-Vedic, but they go back to non-Ṛgvedic traditions manifested in tMagadha. Many of Buddhism's early persons have astral proper names. Astral he 'proto-epic' *gāthā* and *śloka* verses quoted in Brāhmaṇa texts and associated with the vrātyas and the non-Brahmanical country of Magadha.[39]

Tārā is an important goddess in Buddhism, which arose in Magadha. Many of Buddhism's early persons have astral proper names. Astral names are very rare in older Vedic texts, although the Gṛhyasūtras prescribe giving a baby a secret name derived from the birth star. Besides, Law texts recommend that an Āryan should not marry a girl whose name is derived from a constellation, just as one should avoid a girl bearing the name of a low caste or slave (see Manu 3,8–9). All this suggests that while the Vedic Aryans had a certain aversion against astral

36 See Pankenier 1995a; 1995b: 504–508.

37 See Horsch 1966: 130–131; 405–406, 409.

38 See Kirfel 1952. Kirfel speculates that the myth may have come from Mesopotamia and that Tārā might be the bright star Spica in Virgo, the *nakṣatra* Citrā. In Mesopotamia, Virgo was a manifestation of the Mother goddess, was in Near Eastern astronomy and astrology connected with Jupiter as well as Mercury, and periodically came into contact with the moon (see Kirfel 1952: 82–84). In my opinion the myth originally relates to the changeover from heliacal to luni-solar calendar at an early phase of Indian astronomy, when Tārā would have been the new year star Rohiṇī (see below and Parpola 1994a: 263).

39 See Horsch 1966: 401–448.

lore beyond the use of an astral calendar, it was important among pre- and non-Vedic Indo-Aryans, who probably had inherited it in India from the descendants of the Indus Civilization.[40]

3. THE PARALLEL DEVELOPMENT OF ASTRONOMY IN CHINA

Ancient astronomers determined the seasons by observing the position of the sun on its heavenly path (the ecliptic). In Egypt,[41] and in the Near East until about 1100 BCE, this was done by observing the heliacal risings of stars near the ecliptic just before sunrise.[42] The great difficulty with this method of observation, in which the attention concentrates on the horizon and the ecliptic, is that the time of observation is very brief and the star difficult to see on account of the brilliance of the sun and atmospheric disturbances on the horizon.[43]

The Chinese and Indian astronomers avoided this difficulty by adopting a different method of observation, based on the fact that when the moon is full, it is exactly opposite the sun; this could be deduced from the rise of the full moon on the eastern horizon at the moment when the sun sets on the western horizon.[44] In China,[45] as well as in India,[46] the lunar asterisms were chosen so that they form pairs which stand more or less exactly opposite to each other (Fig. 1).[47] From the conjunction of the full moon with a specific asterism one knew that the sun was in conjunction with the opposite marking star.

Joseph Needham, in the third volume of his celebrated *Science and Civilisation in China*, noted that,

> the common origin of the three chief systems [of lunar calendar] (Chinese, Indian and Arab) can hardly be doubted,[c] but the problem of which was the oldest remains. That of the *manāzil* ['mansions,'

40 See Parpola 1990.

41 See Parker 1978.

42 "Heliacal rising" denotes the moment when a constellation first becomes visible rising in the dawn. In the "Three Stars Each" tablets compiled in the Middle Babylonian period it is clearly stated that the heliacal risings were used in a calendrical system (see Rogers 1998: 16), and also in the MUL.APIN the heliacal risings are among the most important topics dealt with (see above). The earliest astronomical text from Mesopotamia, the Venus Tablet of Ammiṣaduqa, which constitutes Tablet 63 of the omen collection Enūma Anu Enlil and dates from the Old Babylonian period and most probably around 1700 BCE, records observations of the first appearance and disappearance of the planet Venus in the East or in the West during twenty-one years (see van der Waerden 1978: 672; Hunger & Pingree 1999: 32–39).

43 See Needham 1959: 229–230.

44 *Idem*, 232 fn. a.

45 *Idem*, 229–230, 253.

46 *Pace* Needham 1959: 253, see Filliozat 1962: 350 and see Fig. 1.

47 According to David Pankenier (personal communication 2013), this old view is now considered "very doubtful, especially since the Chinese lodges vary so greatly in size". Jean Filliozat (1962) noted that the creators of the *nakṣatra* calendar selected even small stars in order to obtain opposition, which in my opinion speaks in favor of the old hypothesis.

> i.e., the Arab calendar, which is clearly derived from the Indian one] is not a competitor....[48]

In his footnote *c*, Needham however made the following reservation:

> Unless of course one should take the view that every civilisation using a primarily lunar calendar inevitably needed a system of lunar mansions, so that independent invention occurred. This may be tenable astronomically but hardly historically or ethnographically.[49]

It should be noted, however, that the Chinese and Indian calendars are luni-solar; a purely lunar calendar (based on the observation of the moon's phases) is out of step with the seasons, as is exemplified by the circulation of the Muslim month of Ramadan around the solar year. Interestingly, a purely lunar calendar was used in Assyria until 1067 BCE, when the Babylonian luni-solar calendar was adopted during the reign of King Aššur-bēl-kala.[50]

Recent archaeological discoveries made in China and their interpretation by specialists of Chinese astronomy,[51] as well as the research of the Vedic and Harappan cultures reported below, do strongly suggest that the Chinese and Indian lunar calendars developed independently of each other. The Chinese calendar starts with the star *Chio* 'Horn,' i.e., the bright star Spica (alpha Virginis, the *nakṣatra Citrā* of the Indian calendar): according to Duke Huan (707 BCE), when the Dragon's Horn first rose in the evening above the eastern horizon with the first full moon of the spring, it was the time to conduct the great rain sacrifice, celebrated to induce the Dragon Spirit at this new year festival, and there is abundant evidence for the worship of the Dragon (i.e., the Chinese alligator) in the Early Bronze Age and indeed Neolithic times in China.[52] By contrast, the Indian calendar begins with the *nakṣatra Kṛttikāḥ* i.e., the Pleiades (ēta etc Tauri), which are important figures in early Indian mythology (see below). Yet the fact that the two calendrical systems in spite of their probably different origin became so similar makes it likely that they evolved in the same way. This paper is mainly about the beginnings of Indian astronomy, but

48 Needham 1959: 253.

49 *Idem*, footnote *c*.

50 Jeffers 2013.

51 I am most grateful to David Pankenier for his expert help with regard to the Chinese astronomy and its development. He not only has sent me many publications, but also made helpful comments including the following (20 Oct. 2012): "The assumption that central elements of Chinese astronomy must have diffused into China from the West is based on the long-standing misconception that (i) the beginnings of sophisticated astronomical observation in China are comparatively late, and (ii) such imported traditions would readily have supplanted existing Chinese traditions even in the absence of conquest or religious conversion. Recent archaeological discoveries have shown that Bezold's and Needham's assumptions about the beginnings of Chinese astronomy are plainly wrong" (see Pankenier in press).

52 See Pankenier 2013: 38–80.

acquaintance with the evolution of the Chinese parallel helps understanding and evaluating my proposals concerning the Indian evidence.

The fully developed Chinese stellar calendar comprizes 28 asterisms, called *hsiu* (also transcribed *sieou* and in modern Pinyin *xiu*) 'mansion,' thus providing approximately one constellation for each day of the moon's monthly cycle:

> while the moon takes 29.53 days to complete its phasic cycle from full to full or new to new (the lunation or synodic month), it takes only 27.33 days to return to the same place among the stars (the sidereal month). These periods are always out of step but 28 was a very convenient average.[53]

The different lunar periods were reconciled with each other and the solar year by regulating the month length and with intercalations.

The complete *hsiu* system[54] is found in Chinese texts dated to the last three centuries BCE.[55] Out of the 28 *hsiu*, 23 are attested in a text that may date from 850 BCE, and 8 in a text dated 900–700 BCE.[56] But as pointed out by David Pankenier,

> even successful demonstration that some names of asterisms, which later came to be incorporated among the 28 lodges (originally lunar, not solar), actually occur in much earlier texts, cannot establish the existence of the entire SYSTEM of 28 lodges at that early date.[57]

More important is the evidence for an early use of quadrantal *hsiu*, whose dimensions approximate the length of the seasons.

The 28 *hsiu* are divided into four heavenly 'palaces' of seven asterisms each:

- the palace of the "Blue Dragon" (*tshang lung*) in the east,
- the palace of the "Vermilion Bird" (*chu niao*) in the south,
- the palace of the "White Tiger" (*pai hu*) in the west, and
- the palace of the "Black Tortoise" (*hsüan wu*) in the north.

Oracle bones belonging to the time of the Shang dynasty king Wu-Ting (1339–1281 BCE) mention

(1) the "Bird star" (*niao hsing*), identified with the "Red Bird" = the 25th *hsiu, hsing* (alpha Hydrae, central to the southern palace of "Vermilion Bird" = *chu niao*),
(2) the "Fire star" (*huo hsing*), identified with Antares (alpha Scorpii) = the 4th & 5th *hsiu* (*fang & xin*) central to the eastern palace

53 Needham 1959: 239.
54 *Idem*, 234–237, table 24; 243, Fig. 91; and the map in Fig. 94.
55 *Idem*, 248.
56 *Idem*, 254.
57 Personal communication 2012.

(3) an important unidentified star probably pronounced *shang*
(4) the "Great star" (*ta hsing*).

As Needham says,

> Chu Kho-Chen plausibly infers from these names that the scheme of dividing the heavens along the equatorial circle into four main palaces … was growing up already at this time.[58]

ARCHAEOLOGICAL DISCOVERIES

One great archaeological discovery throwing new light on the history of Chinese astronomy was made in 1978 in excavations at Leidugun, the cemetery place for the Zeng kingdom in the Sui-xian (Sui-zhou) county, Hubei province. Here "Marquis Yi" (or "Duke Yi") was buried around 433 BCE in tomb no. 1 of Leidugun with more than 7000 grave goods. These included a lacquered wooden clothing box. On the cover of the box the names of the 28 constellations[59] are written in seal script around the large seal script character *dou* 'Ursa Major' that occupies the centre of the cover. The oval circle of the 28 *hsiu* is flanked on the left side by a large image of tiger and on the right side by a large image of dragon (Chinese alligator; see Fig. 2). These two animals have been identified with the "White Tiger" of the western palace and the "Blue Dragon" of the eastern palace.[60]

Given this parallel, an even more dramatic discovery was made at Puyang, Xishuipo county, Henan province, in the 1987 excavations of a Yangshao culture burial site. In the elite tomb M45 dated to around 3000 BCE, the corpse was oriented along the north-south axis, feet to the north, head to the south. The corpse was flanked by two large mosaic images made with mussel shells, that on the western side depicting a tiger, that on the eastern side depicting a dragon or alligator. A third image on the northern side of the corpse consisted of a mosaic triangle and two human tibias, interpreted to depict Ursa Major (Fig. 3).[61].

The 25th, 5th, 11th and 18th *hsiu* each one central to its palace (equatorial quadrant), are all quite clearly mentioned in a passage of the "Historical Classic" (Shu Ching) dated between 800 and 400 BCE. Here they are connected with shadow lengths of the gnomon, the sun stick:

58 Needham 1959: 242.

59 Pankenier (pers. comm. 2013) notes that in his new book (2013) he has shown that "two of the lodges, 'East Aligner' and 'West Aligner' inscribed on the lid, previously comprised left and right sides of a single asterism *Ding*, corresponding to the Square of Pegasus. Therefore, prior to 433 BCE, there would only have been 27 lodges."

60 See Huang Jiangzhong & al. 1982.

61 See Pankenier 2004a: 307 n. 16; 2011a: 45–46; 2011b: 305–306; 2013: 337. See also Pankenier (personal communication 2013): "I discovered that the head of the acolyte's skeleton aligned roughly east-west in fact points to the azimuth of winter solstice sunrise at Puyang. See sidebar discussion on p. 337 of Pankenier 2013."

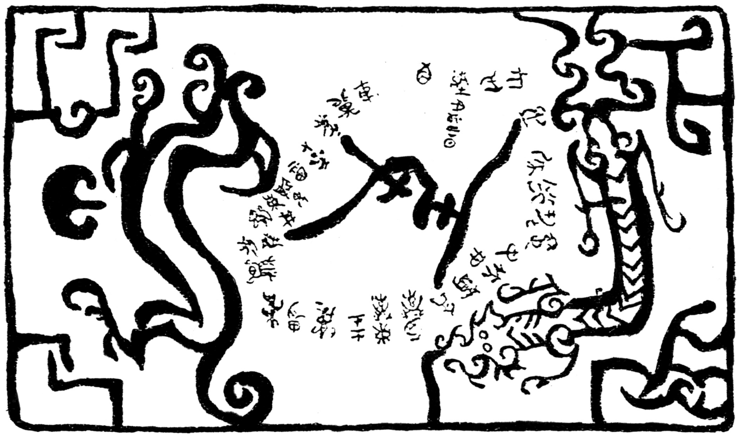

Figure 2: Astronomical figure with 28 hsiu on the cover of laquered wooden box from the tomb of "Marquis Yi" (*c.* 433 BCE) at Leigudun, Hubei, China. After Huang Jiangzhong et al. 1982, fig. 1.

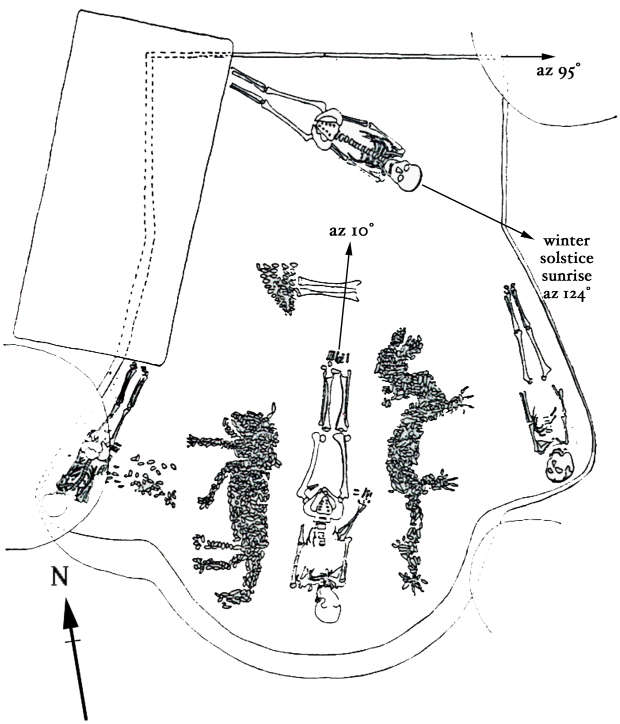

Figure 3: Yangshao culture elite grave ("cosmo-priest's tomb") with shell mosaics (from 1987 excavations). Puyang, Henan, China, *c.* 3000 BCE. The north arrow shows magnetic north (redirect slightly eastward to correct for –3.5° declination). After Pankenier 2013: 338, fig. 11.10, reproduced by permission of the author and Cambridge University Press.

> The day of medium length and the (culmination of the) star *Niao* [alpha Hydrae] (serve to) adjust the middle of the spring. … The day of greatest length and the (culmination of the) star *Huo* [alpha Scorpii] (serve to) fix the middle of the summer. … The night of medium length and the (culmination of the) star *Hsü* [*Xu* beta Aquarii] (serve to adjust the middle of the autumn. … The night of the greatest length and the (culmination of the) star *Mao* [Pleiades] (serve to) fix the middle of the winter. … The year has 366 days. The four seasons are regulated by means of intercalary months (*jun yüeh*).[62]

Needham comments:

> At first sight [these four *hsiu*] seem to be associated here with the wrong seasons. … in the early part of the -2nd millennium Hsing (Niao) and Hsü were solstitial *hsiu*, while Fang & Hsin (Huo) and Mao were equinoctial ones. But this applies of course to the moment of solar conjunction, when the stars would be invisible. One of the basic observations of the old Chinese astronomers was that the quarters of the diurnal rotation correspond every three months with the quadrants of the annual revolution. Thus the *hsiu* which culminates at 6 p.m. at the winter solstice (in this case Mao) could be identified as that in which the sun would stand at noon of the following spring equinox, and so on successively all through the yearly round. This procedure was entirely in character for ancient Chinese astronomy, which solved its sidero-solar problems by deducing the positions of invisible bodies from those of visible ones, all being firmly held in a polar equatorial coordinate network.
>
> The apparent exactness of this passage has long offered to scholars an irresistible invitation to determine its date by the precession of equinoxes. Thus J. B. Biot [1862: 363ff.] was able to show that the four *hsiu* mentioned would have occupied the equinoctial and solstitial points (0°, 90°, 180° and 270°) about the year -2400. Indeed, there is not much escape from this conclusion.[63]

Needham was not yet aware of the dramatic archaeological discoveries mentioned above and therefore concluded:

> In view of all that we now know about ancient Chinese history, it seems very unlikely that the data in our text could refer to a time

62 Needham 1959: 245, quoting the translation of Leopold de Saussure; see also Pankenier 1995a: 148.

63 Needham 1959: 245–246.

Figure 4: Heavenly Emperor in his carriage consisting of Ursa Major. Relief from Wu-liang-tze in northern China, 147 CE. After Jeremias 1913: 128, Abb. 107, based on Chavannes 1909: pl. LXIX no. 133.

> earlier than about -1500 at the most generous estimate … But the possibility remains open that the text is indeed the remnant of a very ancient observational tradition, not Chinese at all, but Babylonian.[64]

The constellations forming opposing pairs of the lunar calendar are never both visible at the same time, but the position of the stars below the horizon could be defined by means of the pole star and the circumpolar stars, especially Ursa Major, which never rise or set. The Mesopotamian origin of the Chinese and Indian calendars, suspected by Needham, is hardly likely, because the opposition of the sun and the full moon was utilized only at a late phase of Mesopotamian astronomy, and not as the basis of the regular calendar: circumpolar *ziqpu* stars are recorded for the first time in the MUL.APIN about 1000 BCE, and they were used for the determination of time intervals of lunar eclipses and related phenomena.[65]

The Chinese astronomers observed the circumpolar stars and systematically recorded their upper and lower transits of the meridian (the great circle of the celestial sphere passing through the pole star and the observer's zenith).[66] The rotation of Ursa Major functioned as a celestial clock marking the hours of the night as well as the seasons. "Pheasant-Cap Master" (between 400 BCE & 200 CE) states:

> When the handle of the Dipper points to the east (at dawn), it is spring to all the world. When … south (i.e., up), it is summer … when … west, it is autumn … when north (i.e., down), it is winter. As the handle of the Dipper rotates above, so affairs are set below….[67]

In "Grand Scribe's Records" (late second century BCE), again, we read:

64 *Idem*, 240.

> The Dipper is the Lord-on-High *di*'s carriage [Fig. 4]. It revolves about the centre, visiting and regulating each of the four seasons. It divides yin and yang, establishes the four seasons….[68]

The circumpolar stars indeed play a dominant role in Chinese astronomy and cosmology. In addition to the four palaces defined by the equinoctial and solstitial points, the Chinese distinguished a fifth, central "Palace of Purple Tenuity," which was the celestial archetype cosmically empowering the Chinese Emperor. Around 500 BCE Confucius equates the King with the Pole Star:

> The Master said: To conduct the government by virtue may be compared to the Northern Asterism: it occupies its place, while all other stars revolve around it.[69]

Inscriptional evidence for this heavenly prototype being used for political legitimation comes from the end of the second millennium BCE, when the Shang dynasty was overthrown by the Zhou:

> In seeking Heaven's blessing on the new dynasty the Zhou King Wu conducted the most sacred of inaugural state sacrifices at a location called the 'Hall of Heaven' (*tianshi*), a reference to Mt. Sung, the 'Central Peak' (*zhongyue*) or *axis mundi* which rises impressively from the yellow earth plain just southeast of Luoyang. This location was associated with the pole of the heavens where the celestial deity dwelt and about which all the heavenly minions (*tianguan*) revolved. When the notion of a 'central kingdom' (*zhong guo*) is first made explicit in early Western Zhou inscriptions, we recognize this as a continuation of the Shang concept that the heart of their domain was the centre of the universe, as well as the physical centre of the world. Thus, in the earliest Zhou inscriptional record of state worship of Heaven reference is made to surveying the four cardinal directions from the vantage point of the *axis mundi*, indicating that one of the first official acts of the Zhou king was to establish ceremonially the legitimacy of Zhou authority over the four quarters.[70]

Following Mircea Eliade[71] and Paul Wheatley,[72] David Pankenier convincingly argues that the concept of astral-terrestrial correspondence between the

65 See Rogers 1998: 17–22; Hunger & Pingree 1999: 55, 68–70, 84–94, 155, 197–198.

66 See Needham 1959: 230.

67 *Heguan zi* 5,21,1–4, see Pankenier 2004a: 290.

68 *Shi ji* 27, 1291, translated Pankenier 2004a: 291.

69 *Lunyu* 2,1, tr. Pankenier 2004a: 288.

70 Pankenier 1995a: 139–140.

71 Eliade, *Patterns in Comparative Religion* 1958, chapter X, *Sacred places: Temple, palace, "centre of the world."*

72 Wheatley, *The Pivot of Four Quarters* 1971.

archaic kingship and the north pole or "Northern Culmen" (*beiji*) – the dwelling place of the High God (*di*) – in China goes back to the Bronze Age and even to the Neolithic. Ever since the earliest dynastic state Xia (from 2000 BCE), palatial structures and royal tombs remain uniformly quadrilateral and cardinally oriented.[73]

The usual presumption is that solar calendar was created because agriculturalists needed it. However, Pankenier notes,

> this easy assumption has often been questioned. Farmers generally find the signs of nature to be a safer indication of the season than a civil calendar. The latter is probably an invention that followed upon urbanization, not least as a tool of social control.[74]

From this conclusion I now turn to the evidence for the beginnings of astronomy in the India.

4. THE EARLIEST ASTRONOMY IN INDIA

Urbanization in the Indus Valley began in earnest with the Early Harappan Kot Diji culture dated to about 3200–2600 BCE. One of its first towns is Rahman Dheri in the former Northwest Frontier Province of Pakistan, now renamed as Khyber Pakhtoonkhwa. The streets and buildings of Rahman Dheri are already oriented according to the cardinal directions, the grid pattern being clearly visible in the air photograph of the town.[75] A town with the grid pattern does not result from a gradual growth but implies a strong regulating authority, like the use of standardized brick size (with 1:2:3 ratio in the Early Harappan period, and the most effective 1:2:4 ratio in the Mature Harappan period); it also implies a more or less simultaneous construction of the whole town, settling a large number of people who are allotted house plots, and enables the use of wheeled traffic in the town (ox-carts appearing with the

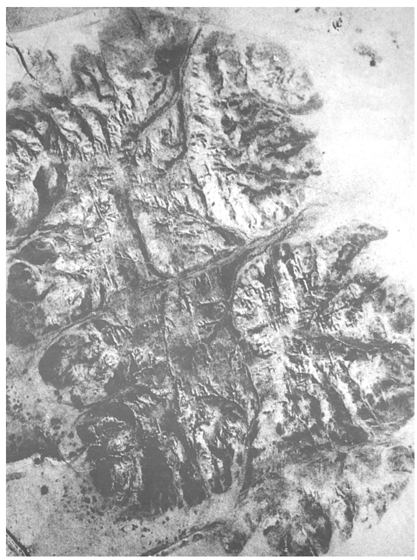

Figure 5: Rahman Dheri from the air. After Durrani 1988: 210 pl. 6. Reproduced courtesy of IAAUP.

73 Pankenier 1995a: 140 n. 33; 2004a: 287–293.

74 Personal communication 2012.

75 See Durrani 1988: 210, pl. 6 = Fig. 5.

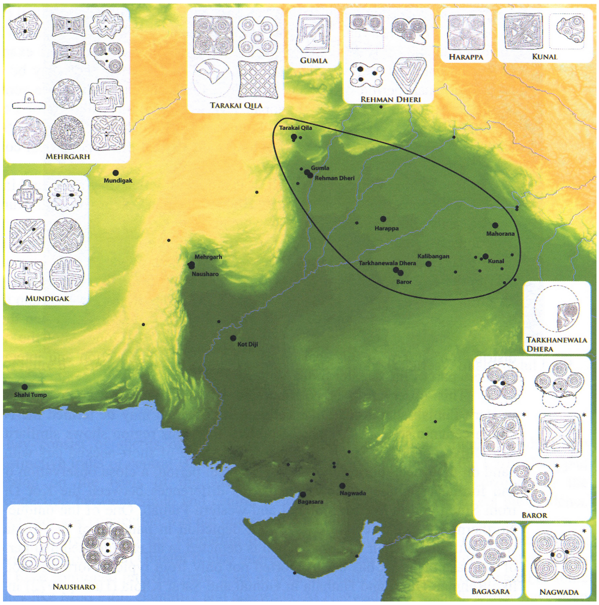

Figure 6: Distribution of geometrical seals in Greater Indus Valley during the Early and (*) Mature Harappan periods (*c.* 3000–2000 BCE). After Uesugi 2011: 372, fig. 7. Reproduced courtesy of Akinori Uesugi.

Kot Diji culture); pre-planned level streets are also a precondition for such sophisticated water engineering as the elaborate drainage system of the Mature Harappan city of Mohenjo-daro.[76]

Akinori Uesugi has shown that the spread of the Kot Diji culture all over the Indus Valley is connected with the spread of a new type of stamp seal, which continues to exist in the following Harappan period (Fig. 6).[77] The basic figure in these Kot Diji seals consists of "concentric circles," usually four of them placed into the four corners of a square or cross-shaped seal. A common variant has in addition a fifth figure of concentric circles in the centre of the seal (Fig. 7). This seal type appears to be first attested at Mehrgarh in the piedmont area at the mouth of the Bolan Pass, which connects the highlands of Baluchistan with the plains of the Indus Valley.

This new type of seal – an important instrument of administration – that Uesugi has recognized to accompany the spread of the Kot Diji culture in my opinion reflects the importance that the four cardinal directions and the centre have started to play in the cosmology and political ideology of the Early Harappans. At Rahman Dheri, we have a seal where concentric circles are surrounded by

76 See Ratnagar 1991: 89–95.

77 Uesugi 2011.

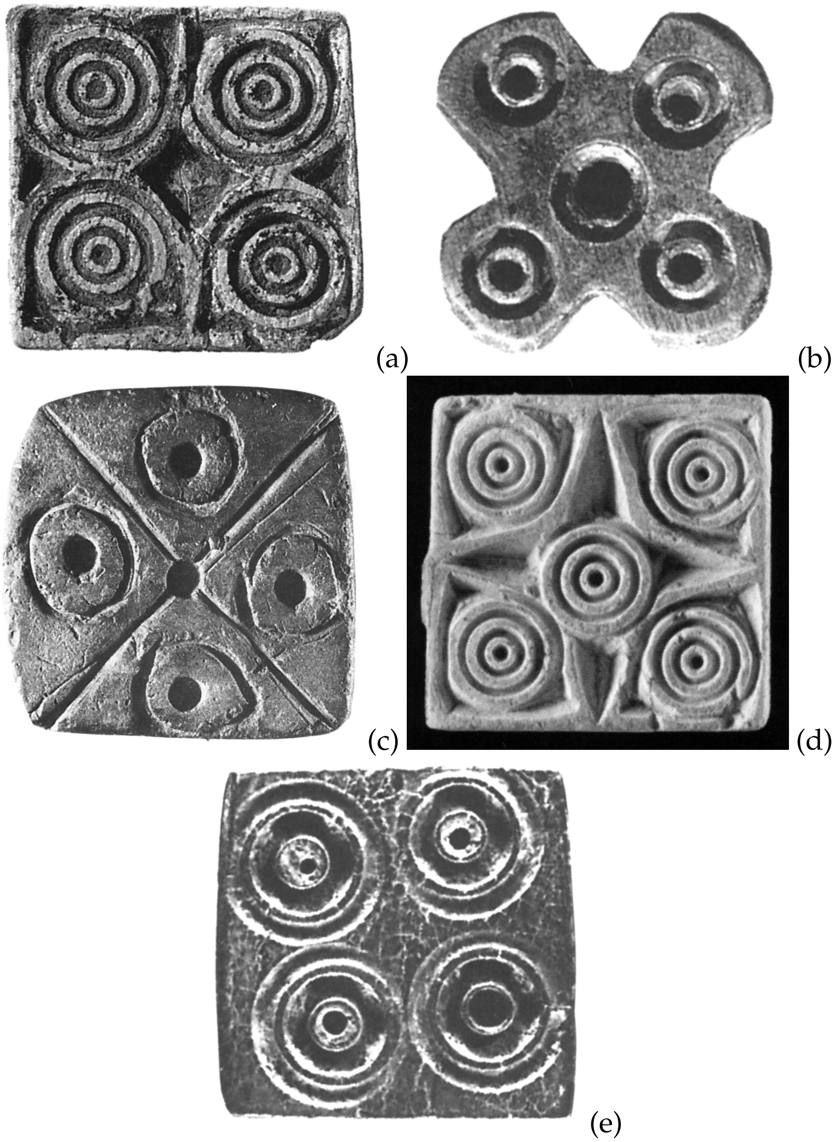

Figure 7: Kot Diji type seals with concentric circles from (a, b) Taraqai Qila (Trq-2 & 3, after CISI 2: 414), (c, d) Harappa (H-638 after CISI 2: 304, H-1535 after CISI 3.1: 211), and (e) Mohenjo-daro (M-1259, after CISI 2: 158). Reproduced courtesy of IAAUP (a, b), DAMGP (c, e), © HARP (d).

"rays" (Fig. 8), on the basis of which the concentric circles have astral or (rather) solar symbolism. Painted bowls from Mehrgarh VI-VII (about 3200–2600 BCE), in particular one where the field is divided into four squares occupied by sun-like circular images surrounded by "rays" (Fig. 9), even more clearly suggest a cosmology based on the yearly course of the sun, divided into four quadrants by the equinoctial and solstitial points, which also define the four cardinal directions. Such a cosmology is undoubtedly shared by many other seals with geometric motifs, particularly those depicting the cross and svastika, but while such seals are found also in contemporary Iranian seals and can be just copies of western models, those with four or five sets of concentric circles are likely to be a creation of the Early Harappan culture[78] and with great probability reflect its dominant ideology.

The earliest Indian texts in which we can seek possible reminiscences of Harappan ideology are the oldest Vedic texts, the *Ṛgveda* and the *Atharvaveda*, dating from the late second millennium BCE. These two hymn collections commonly mention four and sometimes five directions of space (Sanskrit *diś-*, *pradiś-* or *āśā-*). The four directions are rarely specified, but they undoubtedly are the four main directions, as in RV 7,72,5. When five points of the compass are mentioned, the centre is the fifth direction (see *madhyataḥ* in RV 10,42,1). In the slightly later Yajurvedic Saṃhitās (e.g., MS 2,8,9; 3,12,8; TS 5,5,8; 7,1,15; VS 10,10–14) and Brāhmaṇas (e.g., ŚB 9,4,3,10), the fifth point is the zenith, normally called *bṛhatī dik* 'the high region,' consistently associated with Bṛhaspati (the Vedic predecessor of the Hindu god Brahmā who in classical Sanskrit texts occupies the centre). Besides the four and five directions, the *Atharvaveda* several times (AVŚ 4,11,1; 4,20,2; 10,7,35; 13,3,1) speaks of six directions, which include the 'fixed

78 A necklace (Sb 9373 in the Louvre) comprizing many pieces made of heated and glazed steatite and bearing the motif of concentric circles was excavated at Susa IVB (2340–2100 BCE); it has been considered to be an exotic import at Susa. Its central piece is identical with the cross-shaped Kot Diji type seals having four sets of concentric circles; this suggests that it comes from the Indus Valley. This identification of a Kot Diji type seal in Susa is interesting for the problem of origin of the Gulf Type seals which have Indus script and Harappan iconography (bison with manger) and boss with a single groove on the reverse, but differ from the square Harappan seals of the Indus Valley through their round shape. I have previously suggested that the creators of the Gulf Type seal adopted the distinctive round shape from Iranian seals in Susa *c.* 2100 BCE (Parpola 1994b: 315); Laursen (2010: 129) has some further evidence endorsing this hypothesis. The Iranian seals in question have their back side divided by two crossing lines into four fields each of which has a 'star' in the middle, and this motif can be seen to have a Kot Diji parallel (see Fig. 9 here). Interestingly, the uninscribed round Dilmun seals with mostly Mesopotamia-inspired motifs, which replace Gulf Type seals *c.* 2000 BCE add two dots-in-circle on both sides of three grooves that now intersect the reverse side in the middle. Thus, while the Dilmun seals seem to lose most Harappan features of their predecessors, they appear to introduce the originally Kot Diji-related motif of four sets of concentric circles absent in the Gulf Type seals.

Figure 8: Seal from Rahman Dheri with the motif of "rays around concentric circles". After Durrani & al. 1994–95: 207. Reproduced courtesy of IAAUP.

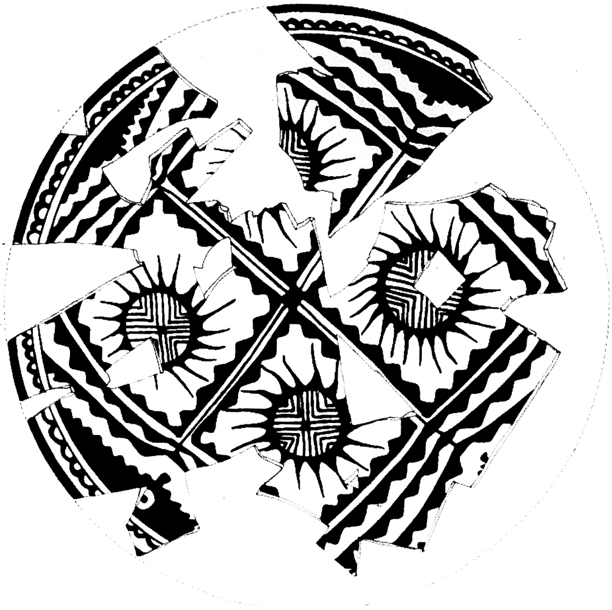

Figure 9: "Sun" in "four quadrants," painted on Faiz Mohammad style grey ware from Mehrgarh, period VI (*c.* 3000–2900 BCE), Kacchi plain, Pakistan. After C. Jarrige et al. 1995: 160. Reproduced courtesy of J.-F. Jarrige and G. Quivron

region' (*dhruvā dik*) or centre, and the 'upwards direction' (*ūrdhvā dik*) or the zenith.[79]

One ritual connected with the directions of space is crucially important for understanding their ideological significance. This is the 'mounting of the regions' (*digvyāsthāpanam*), which is an essential part of the Vedic royal consecration (*rājasūya*). In this rite –also called *Varuṇa-sava* as it is connected with God Varuṇa, the 'divine king' – the king at his consecration dons the *tārpya* garment ornamented with applicated figures of *dhiṣṇyas*, i.e., ritual fireplaces equated with the stars (this will be discussed in more detail below). This royal robe of Varuṇa almost certainly goes back to the trefoil-ornamented 'sky garment' of the Harappan 'priest-king' (Fig. 10) modelled on Mesopotamian prototypes.[80] Then the king makes a step in each of the five directions, therewith ascending the zenith: "from the quarters he goes to the heaven" (MS 4,4,4: 54,3); for "the heaven is the quarters of space (*diśo vai svargo lokaḥ*)" (MS 4,4,4: 54,1–2). The *Śatapatha-Brāhmaṇa* (5,4,1,8) explains: "It is the seasons, the year, that he [the *adhvaryu* priest] thereby makes him [the king] ascend; and having ascended the seasons, the year, he is high, high above everything here."

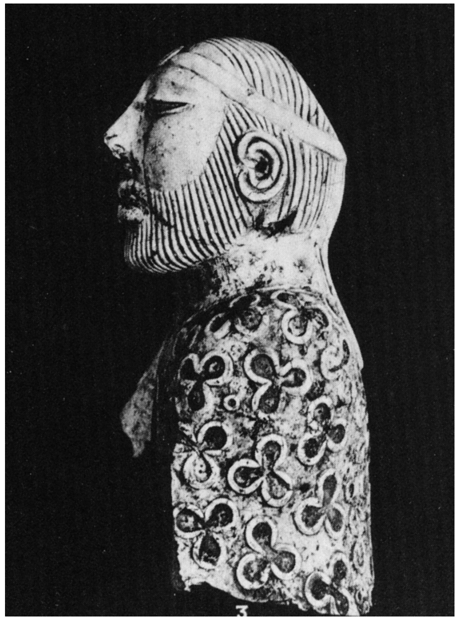

Figure 10: Statuette of "Priest-King" from Mohenjo-daro, wearing "Sky Garment" decorated with 'trefoils,' 'figures-of-eight' and 'circles.' After Marshall ed. 1931: III, pl. 98: 3.

> At the same time he wins the quarters of space or the seasons, thus mastering the whole of the universe in respect to space as well as time … the whole is articulated on the number five; the universe is divided into four parts with, as its centre, the fifth, highest quarter (zenith), which encompasses the whole … Thus by performing the fifth step the sacrificer appropriates the whole universe.[81]

79 See Wessels-Mevissen 2001: 4–5.

80 See Parpola 1985; 2012b: 13. The Near Eastern models of the Indus 'Priest-King's' cloak comprize both the garments of gods and kings with star-decorations (see Oppenheim 1949), and trefoil-decorated statues of the 'Bull of Heaven,' the latter having a fragmentary counterpart in Mohenjo-daro (see Parpola 1985).

81 Heesterman 1957: 104. See also, *idem*, 103–105; Wessels-Mevissen 2001: 4 with n. 3.

In the parallel consecration ceremony of the royal vājapeya ritual, also called Bṛhaspati-sava, the ascent to zenith is made even more concrete: after the horse race, the victorious king dons the *tārpya* garment and (followed by his wife) with the help of a ladder ascends the sacrificial post, and when reaching its top declares: "We have reached the sun/heaven, we have become immortal," seating himself thereafter on the throne placed at the foot of the pillar.[82]

In the *Mahābhārata*, the zenith is stated to be the king of the directions (14,43,10 *diśām udīcī … rājā*). In the epic Yudhiṣṭhira, the eldest of the five Pāṇḍava brothers, aspires to perform the *rājasūya*, fully conscious that only a king of the whole world is entitled to it (2,11,55 *sa vijitya mahīṃ sarvām … ājahāra rājasūyaṃ mahākratum*; 2,12,36 *yaś ca sarveśvaro rājā rājasūyaṃ sa vindati*). In the 23rd section of the epic called *Digvijaya* 'conquest of the directions,' Yudhiṣṭhira's four younger brothers conquer the four cardinal directions, and the 24th section called *Rājasūya* describes Yudhiṣṭhira's royal consecration. The victorious king has the sun as his model (see also the popular royal name of classical times, *Vikramāditya*): it rises in the east creating light and expelling darkness and goes through all the regions (see MS 4,14,14; ŚBM 10,3,5,3), east in the morning, south at noon, west in the evening and north (supposedly) in the night. The sun is accordingly called 'four-cornered' (*catuḥ-srakti-*): the directions are his corners (ŚBM 14,3,1,17). The sun defines these four directions through his daily as well as his yearly course through the equinoxes and solstices (see JB 2,26): the sun is the year (JB 2,28). It is the sun that the gods anointed on the royal throne, and he who knows this sits on the royal throne having become the sun (see JB 2,25–26).[83]

Connecting the ruler with the sun and the centre of the four directions defined by the sun's daily and yearly course, important in Vedic and epic royal ideology, thus seems to have originated in the Early Harappan culture. That it prevailed also in the Indus Civilization is suggested by the so-called "Proto-Śiva" seal from Mohenjo-daro (Fig. 11). Here an anthropomorphic person wearing the horns of the water buffalo is seated on

Figure 11: The seal M-304 from Mohenjo-daro with "Proto-Śiva." After CISI 1: 382. Reproduced courtesy of ASI.

82 See TS 1,7,9; TB 1,3,7; BaudhŚS 11,11; Steiner 2004: 91–97.

83 On the great royal unction on the throne and the victories of the kings who have performed it, see also AB 8,12–23.

a throne, which is a major symbol of royal authority in Vedic culture.[84] Sir John Marshall, who labelled the figure "Proto-Śiva," suggested that he is three-faced like many later Indian images of Śiva.[85] This suggestion has been both accepted by some,[86] and doubted by others. I prefer the alternative explanation expressed by several scholars, including Marshall himself,[87] that the "Proto-Śiva" may equally well have four faces, the one on the back left invisible, like Śiva in the shape of *caturmukha-liṅga* symbolizing the axis mundi,[88] or the Hindu God Brahmā, whom Indian architectural texts connect with the centre.[89]

The four faces of "Proto-Śiva" looking into the four directions are in all likelihood related to the four male animals depicted on either side of the "Proto-Śiva," arranged so as to form a rectangle: elephant above tiger on the left, and rhinoceros above water buffalo on the right. Marshall had already suggested their connection with the four directions.[90] In later Indian tradition, the four quarters of the world are often conceived and depicted as being upheld by four directional elephants (*dig-gaja*, *diṅ-nāga*).[91] But the abacus around the Lion capital of Aśoka's

84 See ŚB 12,8,3,4; TB 1,3,9,2.

85 Marshall 1931: 52–55. On the later images, see Coomaraswamy 1927: 100 with n. 1.

86 E.g., by W. Kirfel in his book *Die dreiköpfige Gottheit*, 1948.

87 See Gonda 1965: 29.

88 Commenting on the image of the *caturmukha-liṅga* of the eighth-century Caturmukha Mahādeva temple at Kuthāra (Nachna) in the Vindhya mountains, Stella Kramrisch (1954: 207 on Fig. 108) notes: "The four faces of Śiva comprise his total manifestation, in the four directions. The fifth face of Śiva is not shown. It is known to face upward where the pillar of the Liṅga raises to its dome shape. [The 'Fifth face,' Īśāna, is ontologically the first face of 'the coming into manifestation' of the trancendental Śiva.]"

89 According to the Bhāgavata-Purāṇa (3,8,16), Brahmā seated on the lotus that came out of Viṣṇu's navel, started looking in all the directions and created himself four faces, one for each direction. In other Purāṇic accounts Brahmā formerly had five heads, but Śiva or his fierce form Bhairava cut off the fifth head, specified as the head of a tiger, horse or donkey. see Dange 1986: I, 198–199.

90 Marshall 1931: 53 n. 1. Berta Volchok (1970) and Alf Hiltebeitel (1978: 776–9) agreed with the connection of the four beasts of the "Proto-Śiva" seal with the four cardinal directions, noting that the elephant is the vehicle of Indra as the guardian of the east and the water buffalo the vehicle of Yama as the guardian of the south. The water buffalo could stand for the autumnal equinox, around which Indians have traditionally sacrificed buffaloes to the Goddess. The tiger may have been connected with the vernal equinox, as apparently originally in China. In the "Proto-Śiva" seal the tiger is depicted as opposing the buffalo, which is its natural enemy in the nature; in the Proto-Elamite iconography, the lion(ess) is the opponent of the wild bull, and these two animals figure also in the principal motif of the Akkadian royal seals, the 'contest,' which has been borrowed into the Harappan iconography from the Near East (see Parpola 2011b: 287–323). In a Harappan-style cylinder seal supposed to come from Mesopotamia, a *standing* hero mastering tigers is depicted next to a *seated* man with buffalo horns who is surrounded by water-buffaloes, fishes and snakes, as if these two deities represented the *rising* and *setting* sun, or the crown prince and the ruling king in later Indian ideology (see *idem*, 322). In Indian poetry, dark rainclouds are compared to the elephant (see Kālidāsa, *Meghadūta* 2), which may stand for the summer solstice. This leaves the rhinoceros for the winter solstice.

91 See Kālidāsa, *Raghuvaṃśa* 1,77/78 & *Meghadūta* 14; see also the Sanchi stupa 2 pil-

pillar at Sarnath (*c.* 250 BCE) has four different animals: lion, elephant, bull and horse. There are several interpretations for them, but "most common is the idea that they represent the guardians of the quarters, *dikpāla*".[92] V. S. Agrawala links lion with east, elephant with south, bull with west and horse with north,[93] and matches these four animals with the four animals on the "Proto-Śiva" seal.[94]

Four animals are associated with the four heavenly palaces in China: Blue Dragon with east, Red Bird with south, White Tiger with west and Black Tortoise with north. But the palaces of spring and autumn were so named on the basis of lunar, not solar, conjunctions of the marking stars,[95] so the opposites count for solar conjuntions: the White Tiger would stand for the east and the sun at the vernal equinox, and so forth. From the fact that the constellations Taurus, Leo and Scorpius are mentioned in Babylonian astronomical texts with Sumerian names (MUL.GU.AN.NA 'bull of the sky,' MUL.UR.GU.LA 'lion or lioness,' MUL.GIR.TAB 'scorpion,' the prefixed MUL 'star' being a semantic classifier of astral names), it has been concluded that these constellations existed already in the third millennium, most likely already around 3000 BCE when these constellations plus Aquarius marked the solstitial and equinoctial points.[96] It does not seem far-fetched to assume that the four animals depicted on the "Proto-Śiva" seal do in fact represent the sun at the equinoctial and solstitial points as well as the associated seasons and directions of space.

The Early Harappan town of Rahman Dheri was oriented according to the cardinal directions already around 3000 BCE. One of the principal ways to find out due east is to observe the points where the sun rises in the horizon throughout the year, and to mark the point of the vernal equinox. Holger Wanzke has studied the axes of the buildings and streets in Mohenjo-daro and found out that they diverge one to two degrees clockwise from the cardinal points; according to him, this orientation would match perfectly the setting of the star Aldebaran in the west against the horizon of the Kirthar mountains.[97]

In the 1999–2001 excavations of the Late Neolithic town at Xiangfe, Taosi, Shanxi Province of China, archaeologists discovered what has with great probability been identified as a solar observation platform, dated to *c.* 2100 BCE. It was originally "a curved rammed-earth wall, facing east-southeast, perched atop

lar topped by four elephants facing the four directions and the solar wheel above them, illustrated e.g., in Dehejia 1996: 68.

92 Falk 2006: 145.

93 Agrawala 1964: 2. The same four animals are depicted on 1st–2nd century Buddhist stūpa sites in Sri Lanka, and generally connected with the directions as follows: elephant E, bull S, horse W and lion N (see Smith 1911: 237; Wessels-Mevissen 2001: 19 n. 121; Falk 2006: 145). Agrawala (1964: 29–40 & 60–63) has collected a lot of material allowing various identifications.

94 Agrawala 1964: 60 no. 2.

95 See Needham 1959: 240, quoted above on p. 36.

96 See van der Waerden 1978: 673; Rogers 1998: 10.

97 Wanzke 1987.

three concentric rammed-earth terraces. The curved wall was perforated by narrow slits forming an array of twelve pillars".[98] The Indian astronomers Mayank Vahia and Srikumar Menon have examined a peculiar circular stone structure near the acropolis of the Harappan city of Dholavira in Kutch, Gujarat, and suggested that it may have been an astronomical observatory. It would be more or less contemporaneous with its Chinese parallel in Taosi.[99]

Another way to find out the directions of space is by means of the gnomon or sun-stick, the oldest astronomical instrument. It consists of a straight peg erected at right angles to a level base, perpendicular to the horizon. By recording the length and the direction of the peg's shadow every day of the year one can define the hours of the day, and from measurements made at noon one can find out the solstices and equinoxes. The *Kātyāyana-Śulvasūtra* gives the rules for finding the cardinal directions as follows:[100]

> Having fixed a peg on level ground and having drawn a circle around it by means of a rope that has the same length as the peg (and is attached to it), he fixes two pegs at the two points where the shadow of the tip of the peg falls on the line (of the circle); that (line joining these two new pegs) (is) the east(-west line). After adding to the rope its length and making two loops (at its either end), he fixes the loops at the two pegs marking the east-west line. Stretching the rope (draw a circle around each of the pegs) and fix a peg south and north in the middle (area where these two large circles meet). That (line joining these new pegs) is the north(-south) line.[101]

Ernest Mackay has recorded ten pedestals from Mohenjo-daro, "invariably carefully made".[102] He states that "the exact purpose of these stands is problematical, but … some of them may, in fact, be bases of *liṅgas*",[103] i.e., images of Śiva's phallus, which in Hinduism has a round stand representing the *yoni* ('vulva' or

98 Pankenier 2011a: 21–24 with Fig. 1.1; in more detail Pankenier & al. 2008. Pankenier (personal communication, 2013) notes that in chapter one on Taosi of his forthcoming book (2013), he also mentions a similarly purposed observation platform from the Liangzhu culture (roughly same date) 800 km south of Taosi, near present-day Hangzhou. He adds: "Ruggles & Ghezzi published in *Science* (315, 2007, p. 1239) the site of Chankillo in Peru which is strikingly similar in conception to Taosi, but about 2000 years later. This shows the folly of too easily assuming diffusion."

99 Vahia & Menon 2011.

100 *Kātyāyana-Śulbasūtra* 1 (2): *same śaṅkuṃ nikhāya śaṅkusammitayā rajjvā maṇḍalaṃ parilikhya yatra lekhayoḥ śaṅkvagracchāyā nipatati tatra śaṅkū nihanti sa prācī. (3) tadantaraṃ rajjvābhyasya pāśau kṛtvā śaṅkvoḥ pāśau pratimucya dakṣiṇāyamya madhye śaṅkum evam uttarataḥ sodīcī.*

101 Pankenier (personal communication 2013) observes that "there is an exact Chinese parallel to this method in the pre-imperial text Artificer's Record *Kao gong ji*."

102 Mackay 1938: I, 411–413.

103 *Idem*, p. 411.

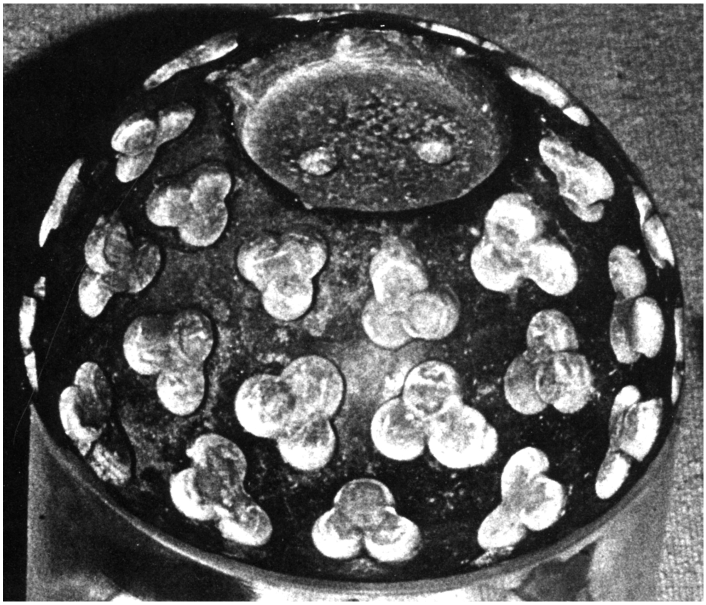

Figure 12: Finely polished stone pedestal from Mohenjo-daro, decorated with 'trefoil' figures and very probably meant for gnomon (sun-stick). After Parpola 1985: fig. 9a.

'womb') of the Goddess. Mackay observes that though no *liṅga* stones have been found fixed to these stands, their absence can be explained by assuming that they were of wood. Yet he has qualms about this explanation, because in the historical period "the *liṅga* is invariably made of stone." This, however, is not true. As I have pointed out, in Orissa, for example, pillars expressly identified as Śiva's *liṅga* are made of wood, and later myths of Śiva's flaming *liṅga* can be connected with cultic burning of wooden pillars. From the Indus Civilization we have both realistic and stylized *liṅgas* as well as depiction of human sexual intercourse, evidence of a Harappan *liṅga* cult.[104]

However, I would like to argue that the above-mentioned stands were primarily made for wooden gnomons (which might have had a phallic connotation). For a gnomon it is imperative for the ground to be as level as possible, and for the peg to be as straight, stable and orthogonal as possible. In the *Kātyāyana-Śulvasūtra* (7,4) we find a statement that nothing is more level than the (surface of still standing) water, and that the peg should be made of the particularly stable core part of old, hard-wooded acacia tree (*khadira*) which is without any "wounds".[105] My conviction that these stands from Mohenjo-Daro are gnomon bases is due to the

104 See Parpola 1994a: 218–224.

105 *Kātyāyana-Śulva-Pariśiṣṭa* 7,7–10, see Michaels 1978: 63–64.

extra care in making the bottom quite flat and in securing the stability and upright position of the shaft inserted in the round depression in its middle by two dowel-holes. One stand (Fig. 12), made of dark red stone, is also decorated at regular intervals with the trefoil motif which in Mesopotamia and in the Indus Valley almost certainly had an astral significance.[106]

Baudhāyana-Śulvasūtra describes a method of constructing an oriented square and thus of defining the cardinal and intermediate directions by using a gnomon and a cord with marked midpoint (Fig. 13).[107] This produces a pattern of "intersecting circles," which is an important motif on Mature Harappan painted pottery,[108] a motif which can be traced back to Early Harappan times; for instance, it is found on the polychrome boxes of the Nāl culture of Baluchistan.[109] It seems significant that "intersecting circles" is a favourite motif of Harappan bathroom floors[110] and "bath tubs," such as the one with 1.1 m diameter from Kot Diji (Fig. 14).[111] I suspect that this is connected with the necessity of levelling the ground for the gnomon by means of water:

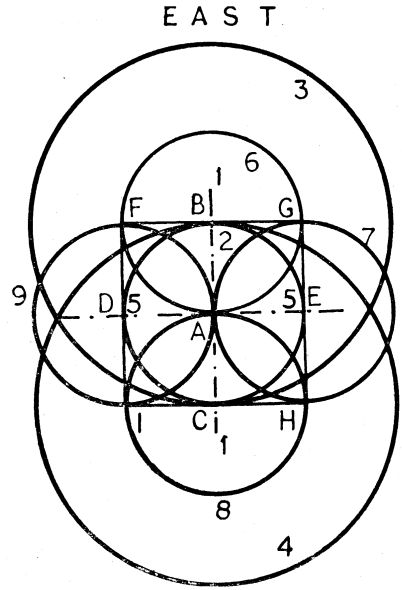

Figure 13: Construction of an oriented square using a gnomon and a cord with marked midpoint described in the *Baudhāyana-Śulvasūtra*. After Kulkarni 1987: 20, fig. 1.

> On the stony surface, made water-level, or upon hard plaster, made level, there draw an even circle, of a radius equal to any required number of the digits of the gnomon.[112]

> The expert (astronomer) should first level the ground perfectly by means of levelling instruments or water. He should then pick up a gnomon....[113]

106 See Parpola 1985.

107 *Baudhāyana-Śulvasūtra* 1,22–28; see Kulkarni 1987: 19–21.

108 See Dumarçay 1966.

109 See Hargreaves 1929.

110 A large surface has survived at Balakot in Sindh, illustrated in Chakrabarti 1999: 154; a fragmentary tile from Mohenjo-Daro in Kenoyer 1998: 109 Fig. 6.11.

111 From F. A. Khan 1964: pl. 39 no. 14.

112 *Sūryasiddhānta* 3,1, transl. Burgess 1860: 108.

113 Nīlakaṇṭha's *Manuṣyālayacandrikā* 2,1, transl. K. V. Sarma; see Subbarayappa & Sarma 1985: 92. Pankenier (personal communication 2013) notes: "This is also stipulated in Artificer's Record, plus plumb line to establish verticality."

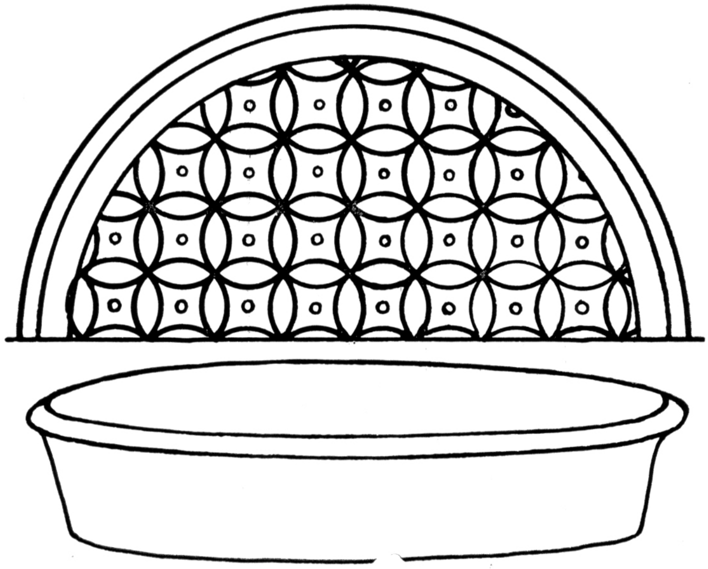

Figure 14: "Intersecting circles" on the bottom of a Harappan "bath tub" (diameter 1.1 m) from Kot Diji. After Khan 1964: pl. 39,14. Reproduced courtesy of DAMGP.

The intersecting arcs also produce lenticular figures called "fish" (*matsya, timi*) in later astronomical texts describing this method of finding out the cardinal and intermediate directions.[114] From Harappa a corresponding pottery figure has four fish in the lenticular sections.[115]

"Fish" is also a motif of Harappan painted pottery from Early Harappan times, starting with Mehrgarh VI, Nāl polychrome, and Rahman Dheri, down to Mature Harappan times.[116] Fish constituted a significant part of the Harappan diet, but there were certainly other reasons as well that made it an important symbol. Fish increase rapidly, have a phallic shape, and are the principal animals living in water that is vital for life and vegetation. For all these reasons they have remained auspicious symbols of fertility in South Asia, and are in Hinduism emblems of the water god Varuṇa and the love god Kāma.[117]

'Fish' pictograms, depicting either plain fish as such, or fish provided with various diacritical markings, are among the most frequently occurring signs of the Indus script. The pictorial meaning 'fish' is certified by several depictions of the 'fish' sign in the mouth of a fish-eating crocodile in Harappan art.[118] The Indus script undoubtedly belongs to the logo-syllabic writing systems together

114 See *Sūryasiddhānta* 3,1–6; see Burgess 1860: 108–111; Subbarayappa & Sarma 1985: 92.

115 See Kenoyer 1998: 168.

116 Parpola 1994a: 192–193, fig. 10.20 a–u.

117 *Idem*, 184–190.

118 *Idem*, 180 fig. 10.1.

with all other scripts in existence when it was created around 2600 BCE; this is clear from the number of graphemes, which is around 400, significantly higher than in syllabic or alphabetic scripts, in which it is around 100 and less than 50 respectively. In logo-syllabic scripts the signs can function either as 'word' signs, denoting the concept that the sign depicts (in this case 'fish') or as 'syllabic' signs, expressing the sound shape that the word expressing the pictorial meaning had in the language underlying the script. In the Sumerian script, for example, the sign depicting 'arrow' could mean the word *ti* 'arrow,' or its homonyms *ti* 'rib' and *ti* 'life.' The fish are often elaborately carved on Harappan seal stamps, and at least in this context the 'fish' signs probably have some meaning other than 'fish,' for the Mesopotamian seal inscriptions never speak of fish.

For historical reasons, it is likely that the Indus people spoke a Dravidian language.[119] From its distribution throughout the language family, the principal Dravidian word for 'fish' can be reconstructed for Proto-Dravidian as **mīn*;[120] post-Vedic Sanskrit has *mīna-* 'fish' as a loanword from Dravidian. It was homophone with **mīn* 'star'.[121] Long and short vowels can alternate within Dravidian roots (see **kaṇ* 'eye' and **kāṇ* 'to see'),[122] so it is likely that both words are derivatives of the Proto-Dravidian root **min* 'to flash, shine, glitter':[123]

> Who that has seen the phosphorescence flashing from every movement of the fish in tropical seas or lagoons at night, can doubt the appropriateness of denoting the fish that dart and sparkle through the waters, as well as the stars the sparkle in the midnight sky, by

119 The Dravidian languages, nowadays mainly spoken in southern and central India, constitute the second largest language family in South Asia after the Indo-Iranian languages of the Indo-European language family that have spread all over northern South Asia since the fall of the Indus Civilization in the early second millennium BCE. One Dravidian language heavily influenced by Baluchi, Brahui, is spoken in Baluchistan and southern Indus Valley even today, and the existence of a Dravidian language in the Punjab during the second millennium BCE can be deduced from the Dravidian loanwords identified in the language of the *Ṛgveda* and in increasing numbers from later Vedic texts. The third largest language group in South Asia, the Austro-Asiatic languages, are spoken by only about one percent of the population, and chiefly in the eastern parts of the subcontinent, having their linguistic relatives in South-East Asia. On these grounds the Harappan people, estimated to have numbered about one million, most likely spoke a Dravidian language. An additional reason to believe this is that archaeological evidence suggests that the Neolithic and Chalcolithic cultures of central and southern India ultimately came from the Early and Mature Harappan cultures (see Parpola 1994a: 125–175; 2012a: 8). The 26 Dravidian languages spoken today allow a partial reconstruction of their common source, Proto-Dravidian both phonemically and grammatically (see Krishnamurti 2003) and lexically (see Burrow & Emeneau 1984 = DEDR).

120 DEDR 4885; Krishnamurti 2003: 13.

121 DEDR 4876. Krishnamurti (2003: 13) reconstructs **miHn;* see next note.

122 Krishnamurti (2001: 323–344) explains this variation by assuming a Proto-Dravidian laryngeal *H, which had derivative and causative functions, but was lost in all but a few words, such as Old Tamil *paḵtu* 'ten,' where *ḵ* is a voiceless glottal continuant.

123 DEDR 4876.

one and the same word – viz., a word signifying that which glows or sparkles?[124]

The earliest surviving Dravidian literature was composed in Old Tamil during the first five or six centuries CE; it has preserved much genuinely Dravidian tradition.[125] *Paripāṭal* (16,36–38) records the conception that the stars are fish swimming in the waters of night sky; this relatively late Old Tamil text has been more subject to north Indian/Indo-Aryan influence, as can be seen also from this its comparison of the river Vaiyai with its *mīn* to the heavenly Ganges (in Sanskrit *ākāśa-gaṅgā* 'heavenly Ganges' is the name for the ecliptic, the course which the planets travel through the sky). Mature Harappan painted pottery from Amri combines 'star' and 'fish' motifs suggesting that the Indus people associated the two concepts.[126]

Early writing systems strived for economy in trying to eliminate unnecessary signs, and the double meaning of the 'fish' signs is reinforced by the absence of a star-like sign from the Indus script, though a star symbol did exist in Early Harappan times, in seal iconography (Fig. 8) as well as a motif of painted pottery,[127] continuing in this function also in Mature and Late Harappan pottery. Unlike the Indus script, on the other hand, the cuneiform script did have a star pictogram; it denoted 'sky' (Sumerian *an*), 'sky god An,' as well as 'god' (*dingir*). It occurs very often in Mesopotamian seal inscriptions, because the 'star' sign was used as a semantic indicator to label the following word as a divine name, and gods' names were used as building blocks of human personal names, which were what the seal texts chiefly recorded.

The 'star' symbol was used in Mesopotamian art as well, being placed next to a god's head to indicate the divinity of the depicted figure. This Near Eastern convention is occasionally found in Harappan art, too: a star has been carved in the loops of the horned headdress of an Indus deity squatting in 'yogic posture' on a fragmentary seal stamp from Mohenjo-daro; the accompanying inscription contains two 'fish' signs.[128] This, together with the tradition of naming people after stars, recorded in the name-giving rules of the Vedic Gṛhyasūtras,[129] gives reason to suspect that the 'fish' signs of the Indus script may stand for names of stars, used as symbols for Harappan deities, or for divine or human proper names.

This hypothesis can be tested by attempting to read signs which are either prefixed to the 'fish' signs as attributes (in accordance with the Dravidian syntax), or combined with them as diacritical additions. To take an example of the

124 Caldwell 1913: 573 f.
125 See Hart 1975.
126 See Parpola 1994a: 183 with Fig. 10.5.
127 See, e.g., the goblet from Mehrgarh VII, see Parpola 1994a: 183 with Fig. 10.6.
128 *Idem*, 184–185 with figs. 10.8–9.
129 See Parpola 1990.

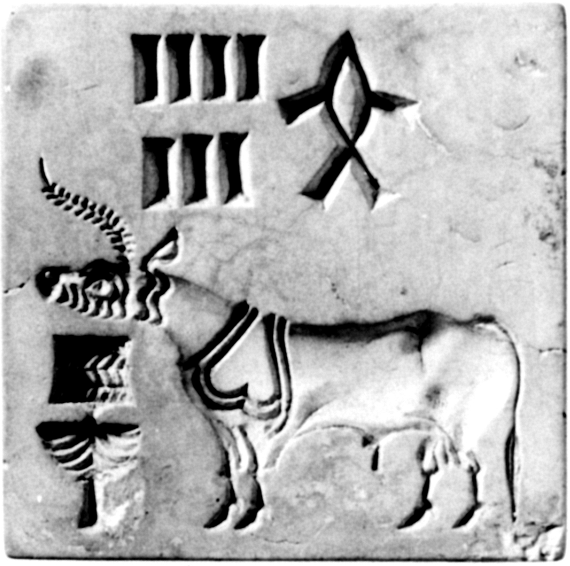

Figure 15: Seal H-9 from Harappa with the sign sequence "7" + "fish" = Old Tamil *e̱ḻu mīn* 'seven fish' & 'seven-star,' name of Ursa Major. After CISI 1: 166. Reproduced courtesy of ASI.

latter first, one of the 'fish' signs has a roof-like addition above it. A Dravidian root denoting 'thatched roof' is **vēy/*mēy*, which is acceptably close[130] to **may* 'black,' which forms the first component of the compound *mai-m-mīṉ* attested in early Old Tamil (*Puṟanāṉūṟu* 117) as the native name of the planet Saturn, literally 'black star.' According to later Buddhist and Jaina texts, the planetary god Śani, the 'slow' planet Saturn, has the turtle for his vehicle; the association is likely to be an ancient one, for the Indus sign seems to express its message not only phonetically but also pictorially: the turtle symbolizing Saturn is a watery animal, hence a kind of 'fish,' which is covered by a roof-like shield.[131]

The Indus script uses groups of vertical strokes (arranged in one or two rows) to express numerals, and three such numeral signs occur immediately before the plain 'fish' sign, forming stable compounds with it. All three compounds correspond to native Old Tamil appellations of constellations, the two principal ones being *aṟu-mīṉ* 'Pleiades,' literally '(constellation consisting of) six stars' and *eḻu-mīṉ* 'Ursa Major,' literally '(constellation consisting of) seven stars.' It is significant that the inscription of one unusually large and carefully carved seal from Harappa consists of nothing but the two signs '7' + 'fish' (Fig. 15), which yields the Proto-Dravidian reading *eḻu-mīn*. The seal may be a Harappan counterpart to

130 For the **v-/*m-* and **ey/*ay* alternations, see Zvelebil 1970: 71–72, 125–128, 157; Krishnamurti 2003: 118–119.

131 See Parpola 1994a: 197.

Mesopotamian seals, which mention the name of the individual deities to whom they were donated as votive offerings.[132]

The oldest Yajurvedic texts prescribe that a Brahmin should establish his sacred fires in the spring, which is the first/beginning of the seasons, like the fire god Agni is the foremost of the gods (always going in their front) and the Brahmin is the foremost (social class) of the human beings; a Rājanya (belonging to the second social class) should establish his fires in the summer, and a Vaiśya (belonging to the third social class) in the autumn. A Brahmin should establish his fires under the Pleiades (*kṛttikāḥ*), for the Pleiades belong to Agni, and the Brahmin (the priestly class) belongs to Agni (who is the priest of the gods). The Pleiades are seven, there are seven 'breaths' in the head, and the Pleiades are the head of the creator god Prajāpati and Agni (who eats the offerings) is his mouth (*mukham* 'mouth, face, entrance, forepart, beginning').[133] The *Śatapatha-Brāhmaṇa* (2,1,2,1–5), while similarly recommending the Pleiades as the asterism under which the sacred fires should be set up, adds that originally the Pleiades were the wives of the Seven Sages, but are now precluded from intercourse with their husbands, as the Seven Sages rise in the north, but the Pleiades in the east. Now the Pleiades have Agni as their mate, and it is with Agni that they have intercourse. In most references of the early Vedic texts, Agni is the god of the eastern direction,[134] and as such the rising sun.

In this context, the *Śatapatha-Brāhmaṇa* (2,1,2,3) states that the Pleiades "do not move away from the eastern quarter, whilst the other asterisms do move from the eastern quarter". Jean Filliozat (1962) has interpreted this to mean that while the east is defined by the sun's rising above the horizon in the east, due east or the east *par excellence* is defined by the sun's double rising at the vernal equinox: the sun rises into the northern hemisphere as well. The dictum, "the Pleiades do not forsake the eastern direction," is cited also in Baudhāyana's *Śrautasūtra* (25,5). This is the earliest Vedic text to deal with the methods of orientation (*c.* 700 BCE); it prescribes that the measuring (of the sacrificial hut with the eastward-oriented beam) is to be done on the appearance of the Pleiades in the horizon.

In the same context, the *Śatapatha-Brāhmaṇa* (2,1,2,4) also explicitly states that "the Seven Sages (*ṛṣayaḥ*) were in former times called Bears (*ṛkṣāḥ*)". The word

132 The Old Tamil text *Paripāṭal* (16,36–38) compares an earthly river with its fish (*mīn*) to the heavenly Ganges (ecliptic) with its stars (*mīn*), showing that the stars were conceived to be fish (*mīn*) swimming in the waters of night sky. The Babylonians also saw in the sky a heavenly ocean and heavenly rivers in which heavenly fish are swimming (see Jeremias 1913: 60). The Sumerians also spoke of "Seven Sages" (Sumerian *abgal*), who were supposed to be antediluvian kings and who were represented in the art as half man half fish. I have compared them to the Indian "Seven Sages" (i.e., the stars of Ursa Major); according to the *Mahābhārata* (3,185,1–54), the Seven Sages were on the ark with Manu, the first man and ancestor of the human race, all being thus saved from the flood (see Parpola 1994a: 190).

133 See MS 1,6,9; KS 8,1; TB 1,1,2,6–8.

134 See Wessels-Mevissen 2001: 5–9.

ṛkṣa- which in Sanskrit means both 'bear' and 'star,' occurs already in *Ṛgveda* 1,24,10, which asks: "Where have gone in the daytime those bears/stars which are seen in the night as fixed high up?" Especially as this verse belongs to the Śunaḥśepa hymn (to be discussed below, pp. 60 ff.), it is fairly certain that the stars of Ursa Major are meant here: in Graeco-Aryan antiquity the stars of Ursa Major were originally conceived as a mother bear (Greek ἄρκτος) followed by three bear cubs.[135] The appellation *sapta ṛṣayaḥ* 'Seven Sages' was almost exclusively current since the *Atharvaveda* (AVŚ 6,40,1). The choice of the word *ṛṣi-* 'sage, seer, holy man' (which may come from the extinct language of the Oxus civilization or BMAC[136]) was obviously influenced by the inherited Indo-Aryan term, which resembles the new name phonetically. But the semantic content of the new name undoubtedly goes back to conceptions that prevailed in pre-Vedic India.[137]

The Seven Sages (*sapta ṛṣayaḥ*) are considered to be the ancestors of the Brahmanical clans since the *Ṛgveda* (see RV 4,42,8), and are probably the same as the 'Seven Sacrificers' of yore (*sapta hotrāḥ*), with whom Manu (the first man) performed the first sacrifice to the gods.[138] According to the *Mahābhārata* (3,43), ancient saints shine with a light of their own acquired by their merits, standing ablaze on their own hearths (*dhiṣṇya*): these lights are seen as the stars from the earth below, looking tiny like oil flames because of the distance. This conception can be traced to early Vedic texts, for while dealing with the piling of the fire altar the *Taittirīya-Saṃhitā* (5,4,1,3–4) states: "He puts down the constellation bricks; these are the lights of the sky; verily he wins them, the Nakṣatras are the lights of the doers of good deeds…." The *Maitrāyaṇī Saṃhitā* (1,8,6) is most explicit in connecting the stars with ancient sacrificers.[139] In the Vedic ritual, the word *dhiṣṇ(i)ya* in the strict sense denotes the fireplaces of seven priests officiating in a Soma sacrifice; six of them are built in a row in the sitting hall, one is outside the hall on the border of the sacrificial area. A very similar row of seven fireplaces has been excavated on a ceremonial platform in the acropolis of the Harappan

135 See Scherer 1953: 131–134, 177 n. 1.

136 See Lubotsky 2001; Parpola 2002b: 92–93.

137 If *ṛṣi-* 'sage' is an Oxus word, Sanskrit *muni-* in the sense of 'sage' is likely to reflect the corresponding Harappan term. According to the Tamil tradition, particularly powerful among the Seven Sages is Vasiṣṭha (the only one among the Seven Sages who still has a wife), called in Tamil *Vāḻu-muṉi* (see Biardeau 2004: 279), 'prosperous sage' (from *vāḻ* 'to live happily, flourish, prosper, (of women:) to be married with husband living' DEDR 5372). Sanskrit *muni-* may come from the Proto-Dravidian root **mun, *munnu, *muntu* 'prior in space and time, first, former, previous, ancient, superior, eminent,' cf. Telugu *muni* 'first, former, previous, front'; Tamil *muṉaivaṉ*, *muṉṉavaṉ* 'the first being, God, Śiva, saint, Arhat, the Buddha, chief, elder brother,' *muṉṉōr* 'predecessors, ancestors, the ancients, chief ministers' (DEDR 5020); cf. also **mū*, **mutu* '(to be) first in age, rank or place, old, senior, ancient, first, best' (DEDR 4950 & 4954). The homophonous Dravidian root **muni-* 'to be angry, irritated, displeased' (DEDR 5021) expresses a characteristic often ascribed to sages in Indian literature.

138 See RV 10,63,7; Macdonell 1897: 144–147.

139 See Parpola 1985: 57–61; 1994a: 216.

city of Kalibangan.[140] Images of *dhiṣṇyas* – fireplaces and stars– are sewn to the royal *tārpya* dress, King Varuṇa's sky-garment.[141]

The *Śatapatha-Brāhmaṇa*'s account of the divorce of the Seven Sages and the Pleiades is the earliest version of the famous Hindu myth of the birth of the war-god Skanda, whose metronym *Kārttikeya* connects him with the Pleiades (*kṛttikāḥ*). According to the fuller epic and purāṇic versions, Agni or Śiva seduced the Pleiades in the absence of their husbands, the Seven Sages. In one variant, the Seven Sages cursed Śiva to lose his fiery phallus, which dropped down and started burning the world, and did not stop until it was placed upon the vagina – the *yoni* base upon which Śiva's cult image having the shape of an erect phallus is installed. Thus the origins of the *liṅga* worship is associated with this myth. In the earliest Vedic texts, the rising sun is described as the *axis mundi*, a pillar which separates heaven and earth and props the sky; the 'pillar' of the rising sun is also the turning post around which the Aśvins, the divine chariot twins of Proto-Indo-Aryans, drive in their cosmic race.[142] The wooden sun-sticks supposedly mounted on the stone pedestals of Mohenjo-daro (Fig. 12) probably also played their part in the evolution of the *liṅga* cult.

The Vedic *nakṣatra* lists[143] start with the asterism *kṛttikāḥ* because their heliacal rise at the vernal equinox started the new year. The Pleiades were closest to the equinoctial point *c.* 2240 BCE. On account of the precession, the asterism marking the vernal equinox with its heliacal rise has been slowly changing. By 80 CE, the Indian astronomers revised the *nakṣatra* list by making it start with Aśvinī, which was the constellation closest to the equinoctial point between *c.* 655 BCE and 300 CE.[144] It seems that a similar calendrical adjustment was made by Indus astronomers at the peak of the Mature Harappan period. By this time the celestial science had undoubtedly developed from its beginnings in the Early Harappan period. Already well before the discovery of the Indus Civilization, Albrecht Weber, in his thorough study of the *nakṣatra*s in Vedic literature, suggested that originally *rohiṇī*, the second *nakṣatra* in the old list, might have started the calendar.[145] *Rohiṇī* 'the red (female)' is Aldebaran, the large red star alpha Tauri next to the Pleiades; Aldebaran was closest to the equinoctial point *c.* 3054 BCE. In the *Taittirīya-Saṃhitā*'s version of the earliest *nakṣatra* list (4,4,10) there is another star with same name *Rohiṇī* 180 degrees opposite to Aldebaran. There indeed is a large red star in that position, namely alpha Scorpii, confirming the astral identification.[146] Weber thought that the two stars had identical names because originally both started a half year period at the equinoxes.

140 Parpola 1985: 122–123.
141 *Idem*, 52–55.
142 See Parpola 2005: 49–51.
143 MS 2,13,20; KS 39,13; TS 4,4,10,1–3; TB 1,5,1–5 & 3,1,4–5; AVŚ 19,7,2–5.
144 See Pingree 1978: 537.
145 Weber 1862: II, 276–277.
146 See Pingree & Morrissey 1989: 100.

More persuasive is Weber's reference to an astral myth explaining why the moon wanes. According to the Brāhmaṇa texts, the creator god Prajāpati gave his daughters, the *nakṣatra*s in marriage to the Moon. The Moon however neglected all his other astral wives and cohabited only with Rohiṇī, his favorite wife. The other wives in anger returned to their father, who severely reprimanded his son-in-law. The Moon promised to treat all his wives equally, but still continued cohabiting with just Rohiṇī; in punishment he was inflicted with the illness that makes him wane. Weber thought that this could be a reminiscence from times when Aldebaran was the only wife of the moon, but on account of the very high age this would give to the calendar, he hesitated to draw the conclusion that Aldebaran was the original new year star.[147]

Both of the post-Vedic Sanskrit epics, the *Mahābhārata* (3,219,10) and the *Rāmāyaṇa* (5,31,5), speak of the time when "*rohiṇī* was the first of the stars". In the *Atharvaveda* (AVŚ 13,1,22), Rohiṇī is actually said to be the devoted wife of Rohita, the 'Red' rising sun. The *Jaiminīya-Upaniṣad-Brāhmaṇa* (4,27) mentions Savitṛ, the 'Instigator' god = the rising sun, and his mate, the 'solar maiden' Sāvitrī, as the archetypal couple. In the marriage hymn of the *Ṛgveda* (10,85), however, Soma the moon is the bride of Sāvitrī. These references have suggested to me that it was the *heliacal* rise of the *rohiṇī* that most originally marked the beginning of the new year in India. I also think that the old myth (known already to *Ṛgveda* 10,109) in which Soma robs (and eventually returns) the wife of Bṛhaspati, originally refers to the changeover from solar to luni-solar calendar, Bṛhaspati being here the rising sun, later the golden planet Jupiter – hence Tārā, the 'Star' *par excellence*, was originally Rohiṇī.[148]

Weber also pointed out that the Yajurvedic Saṃhitās referred to the *nakṣatra*s as heavenly mistresses of the moon, called *bhekuri* (VS 18,40) or *bekuri* (MS 2,12,2; KS 18,14; TS 3,4,7,1).[149] The *Śatapatha-Brāhmaṇa* (9,4,1,9) compares the moon joining the *nakṣatra*s to a heavenly playboy (*gandharva*) who has sexual intercourse with heavenly dancing girls (*apsarases*) and gives a folk-etymological explanation of *bhekuri* as the name of the *nakṣatra*s by stating that the *nakṣatra*s 'make light' (*bhāṃ kurvanti*). I have suggested that this etymologically unexplained[150] word

147 Weber 1862: II, 275–277.

148 See Parpola 1994a: 263.

149 Weber 1862: II, 274. See also *bekurā* in PB 1,1,1).

150 Mayrhofer (1996: II,233) suggests, with a question mark, that these words may be onomatopoeic: he takes their meaning to be probably 'voice, sound' or 'sounding, singing,' because (1) *Bekurā* is said to be the name of the goddess Vāc = Sarasvatī in the mantra in PB 1,3,1 = 6,7,6 (quoted in LŚS 1,11,9 = DŚS 3,3,17) and JB 1,82, and (2) because the other words are attributes of the *apsarases*. Sarasvatī, originally a river goddess, appears as a goddess or war and victory in early Vedic texts, and in later Hinduism is the patroness of music and fine arts, being also called Vāgīśvarī etc., which reflect her identification with the goddess Vāc in Brāhmaṇa texts (*vāg vai sarasvatī*) (see Parpola 1999: 114–115). Goddess Vāc, worshipped with all kinds of music on the *mahāvrata* day in Vedic ritual (see Parpola 1999:

b(h)ekuri goes back to the original Dravidian appellation of the *nakṣatra*s as heliacally rising morning stars, preserved in the Old Tamil words for 'morning star' *vaikal mīṉ* and *vaik'uṟu-mīṉ* (the first component also in Gondi *viyā sukum* and Kui *vēgam boḍuṛi* 'morning star'), derived from the Proto-Dravidian roots **vayku* 'to stay overnight, to outlast the night, to begin to grow light, to dawn',[151] and **uṟu* 'to be joined, to be close together, touch, have sexual intercourse'.[152]

In most versions of the old *nakṣatra* list the second Rohiṇī, i.e., alpha Scorpii, is called *Jyeṣṭhā*. *Jyeṣṭhā* means 'the eldest (lady),' and the asterism is connected with the goddess of Misfortune, the elder sister of Lakṣmī. However, *Jyeṣṭhā* probably is a hypocoristic abbreviation of *jyeṣṭhaghnī* 'killer of the eldest (son),' for AVŚ 6,110,2 speaks of birth under the ominous constellation *jyaiṣṭhaghnī*.[153] This star name reminds of the sacrifice of the first-born child related in the Śunaḥśepa legend.[154] Recitation of this legend was an integral part of the royal consecration.[155] We have already seen that this rite, also called Varuṇa's sacrifice (*varuṇa-sava*), contains components that appear to be of Harappan origin: mounting the regions of space and donning the *tārpya* garment.

112, 120–123), is said to have originally been on the side of the asuras opposing the devas, and she is addressed as a lioness and a goddess of victory (see ŚBM 3,2,1,18; 3,5,1,22–23; 3,5,2,9ff.), and in many ways a predecessor of Durgā (see Parpola 1999). I have suggested (Parpola 1999: 135–137) that her Sanskrit name *Vāc* 'voice, sound, speech' (cf. Latin *vox*) is likely to be a translation of Proto-Dravidian **viḷ(i)* 'voice, sound, song, word, speech, shout of excitement or joy, war-cry,' as a verb 'to say, speak, shout, roar, summon, sing, proclaim, make known, reveal' (DEDR 5433), a homonym of **viḷ/*veḷ* 'to break (as the day), become bright, become white, become clear,' with derived nouns denoting 'light, lamp, brightness, dawn, the planet Venus, purity' (DEDR 5496a), concepts that are all associated with the goddess of victory in Mesopotamia as well as in India. Thus the lighted lamp (*viḷakku/viḷakkam* in Tamil and Malayalam) is a central cultic symbol for the goddess of victory, who as Light annihilates the dark forces of night and death. In Mesopotamia, the planet Venus, the brightest morning and evening star, is a symbol of Inanna-Ištar, the Goddess of War and Sex, and in the Hindu tradition, Friday connected with the planet Venus (called in Proto-Dravidian **veḷḷi*) is associated with women and the goddess. Rohiṇī, either the 'red' dawn or the 'red' new year star as the mate of the rising sun (Rohita), is also a symbol for the goddess of victory, for she is prayed to give booty in AVŚ 13,1,22.

151 DEDR 5554.

152 DEDR 710. See Parpola 1994a: 206–207, 268.

153 See Weber 1862: II, 310 with note 2 and 291–292.

154 AB 7,13–18; ŚŚS 15,17–27; Horsch 1966: 78–99, 284–294.

155 See Heesterman 1957: 158–166. The hotar recites the legend partly in *ṛk* stanzas, to each of which the adhvaryu priest responds with *om*, partly in *gāthā* stanzas, to which the response is *tathā* '[be it] so, yes!.' Reference has already been made to the 'pre-classical' affinity of the gāthās. *Om* 'yes,' the 'hieratic' reply corresponding to the 'profane' *tathā*, is in later Vedic texts the sacred syllable par excellence (see Malamoud 1977: 86–87); significantly, it is a word of Dravidian etymology not attested in the *Ṛgveda* (see Parpola 1981).

THE LEGEND OF ŚUNAḤŚEPA

The Śunaḥśepa legend tells about King Hariścandra ('Yellow Moon'), who had a thousand wives (cf. the stars), but who did not get a son. He was advised to resort to King Varuṇa, and the god indeed granted him a son on the condition that Hariścandra would sacrifice him to Varuṇa. The boy, named Rohita 'Red' (cf. the rising sun, called *rohita* in AVŚ 13,1–2) was demanded by Varuṇa after his birth on several occasions, but each time Hariścandra could postpone the sacrifice on various pretexts. When Rohita had become 16 (when a warrior youth comes of age), the father told the son that he would fulfil his promise to Varuṇa. Rohita, however, refused to become a victim, took his bow and arrows, and went to forest. His father was punished by Varuṇa with dropsy. Eventually Rohita bought a surrogate victim, a Brahmin boy called Śunaḥśepa, from his parents. Śunaḥśepa's father was even prepared to slaughter his son when he was bound to the sacrificial stake, but Śunaḥśepa's prayers to gods released his ties. Simultaneously Hariścandra became healed of his illness.

In Vedic texts, Varuṇa is, among other things, the god of waters – including the heavenly waters – and the master of all kinds of aquatic animals. In the later Hindu religion, Varuṇa is above all a water god and he is usually depicted as riding a crocodile. Before the British stopped this cruel practice in the early 19th century, childless Hindu parents used to feed crocodiles in the hope of getting offspring, and "in fulfilment of a vow to obtain the blessing of children, offer the first-born to the deity to whom this vow has been made" – "women in performance of a vow used to throw a first-born son to the crocodiles at the mouth of the Hooghly in the hope that such an offering would secure them additional offspring".[156] Symbolic feeding of a baby to a crocodile identified with Śiva continues in Bengali religion.[157] A tablet from Dholavira in Kutch, Gujarat, suggests that the Harappans offered human children in sacrifice to a crocodile god (Fig. 16).

A unique crocodile cult has been preserved until our times in 50 tribal villages of southern Gujarat. In order to get offspring and fulfilment of other wishes, these tribals have an image of crocodile or a pair of them made of wood by the priest, who instals the image horizontally upon a wooden pillar which goes through the back part or the middle of the body (Fig. 17). The image is then consecrated in a marriage ceremony and worshipped by daubing it with vermilion

156 William Ward 1811, see Parpola 2011: 23–24, 40.

157 Mahapatra (1972: 132–133) includes the following in his description of the third day of the Śaiva festival of gajan, celebrated in Bengal at the end of the Caitra month: "In some places a crocodile associated with Śiva is worshipped. A big crocodile is made with earth near the shrine of Śiva. Its skin is made by some seeds. The mouth of the crocodile is made red by using vermilion. A baby made of earth is placed near the mouth of the crocodile as if it is trying to eat the baby. It is called the 'Siver kumir' or 'crocodile of Śiva' and it is worshipped."

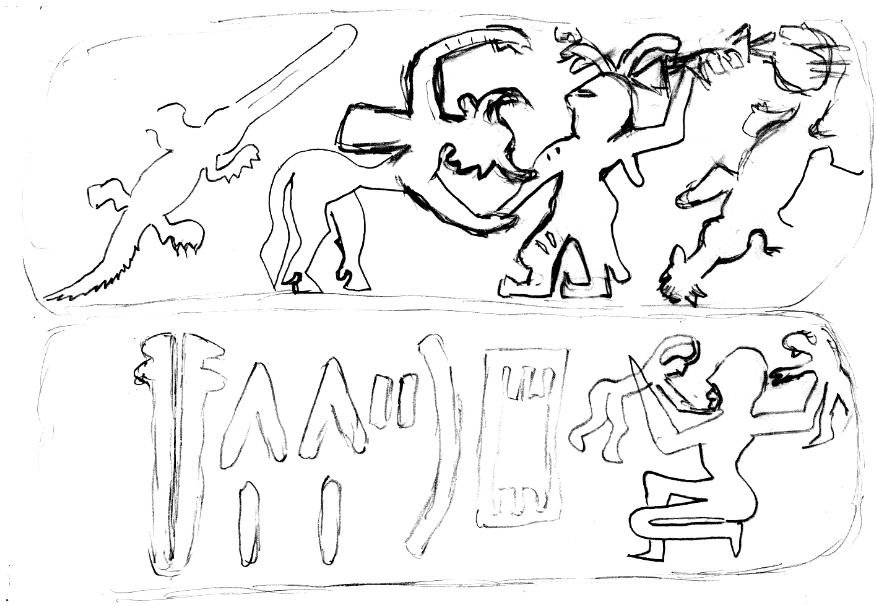

Figure 16: Unpublished two-faced tablet from Dholavira, Kutch, Gujarat, suggesting child sacrifice (lower picture) connected with crocodile cult (upper picture). After Parpola 2011: 41 fig. 48 (sketch AP).

and offering it animal victims and strong drink, which are afterwards consumed by the worshippers.[158] That this cult has survived more or less unchanged from Mature Harappan times is suggested by a broken painted pot from Amri III in Sindh, where two crocodiles are set on poles (Fig. 18).[159]

The Pole Star

The *Taittirīya-Āraṇyaka* (2,19) speaks of a heavenly mighty crocodile (*divyaḥ śākvaraḥ śiśumāras*), which has a tail (*puccha*) of four sections. Because the fore and hind legs are also mentioned among its body parts represented by stars, the word *śiśumāra* cannot here have the alternative meaning 'dolphin,' but must denote 'crocodile.' Literally the word *śiśumāra* means 'baby-killer,' which probably is not just a folk etymology.[160] The context where this heavenly crocodile is mentioned is the worship of Brahma, which a Vedic householder is supposed to perform by uttering a prayer at dusk while facing the region of the pole star (*dhruva-maṇḍala*). This prayer begins with the words *dhruvas tvam asi, dhruvasya kṣitam* 'You are firm, foundation of the firm,' and ends with *namaḥ śiśukumārāya* 'Obeisance to

158 Fischer & Shah 1971; Parpola 2011a: 25–29.

159 See Parpola 2011a: 29.

160 *Idem*, 19–20.

Figure 17: Wooden cult images consisting of a horizontal crocodile set on a vertical pole. Tribal sanctuary of Devlimadi, Sondagh Taluk, southern Gujarat. After Fischer & Shah 1971: pl. 2.

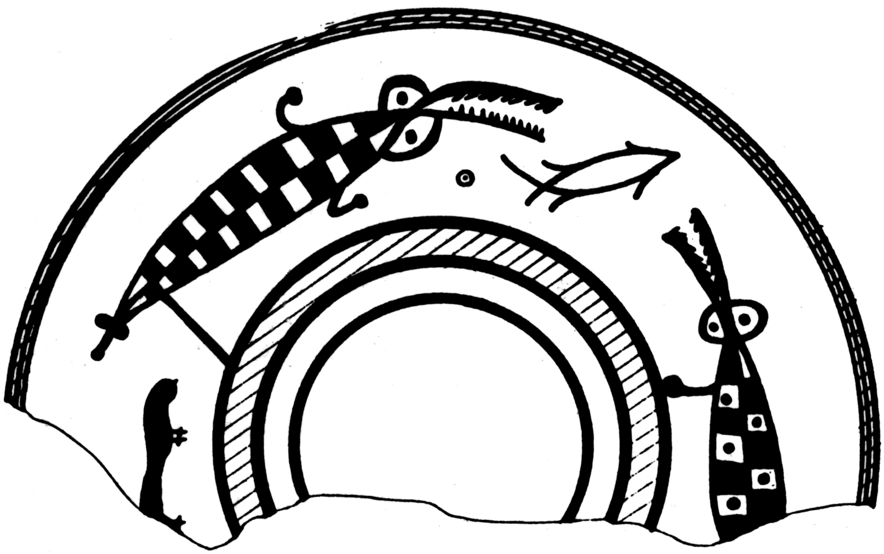

Figure 18: Horizontal crocodiles set on vertical poles, Mature Harappan painted pot from Amri, Sindh, Pakistan. After Casal 1964: II, fig. 75, no. 323. Reproduced courtesy of J.-F. Jarrige and G. Quivron.

Śisukumāra'.[161] *Dhruva* 'firm, fixed, stable, immutable, permanent, constant' is the Sanskrit name of the pole-star, towards which the worshipper should turn when pronouncing this mantra. The oldest parts of the cosmographic descriptions of the Purāṇa texts tell that the God (Viṣṇu) appears in the sky in the shape of a crocodile consisting of stars, and that the pole star is in the tail of that crocodile.[162] Thus the pole-star occupies in the sky the a position comparable to that of the pole in the back part of the body of the cultic crocodile images in Gujarati tribal villages and in Harappan painted pot from Amri. In the sky the heavenly crocodile turns around with the pole star as its pivot, just like the tribal crocodile images are supposed to be able to turn around on their poles. In favour of the Harappan origin of the concept of a heavenly crocodile speaks also the fact that on Indus tablets depicting a procession of animals the crocodile is not on the lower register with the other animals but in the upper register corresponding to the sky.[163]

In the Śunaḥśepa legend, King Hariścandra's name denotes the 'moon,' and his thousand wives apparently stand for stars. Hariścandra's son has a name that is also used of the rising sun. Albrecht Weber suggested that the name *Śunaḥśepa* as well has an astral denotation.[164] It means literally 'Dog's tail,' and corresponds exactly to Greek Κυνόσουρα and its Latin translation *Canis cauda* 'Dog's tail,' which describes the asterism of Ursa Minor[165] (actually Κυνοσουρὶς ἄρκτος 'Female bear with a dog's tail') in the Greek and Roman tradition.[166] Śunaḥśepa is thus an astral term of Indo-European origin for a circumpolar constellation, which moreover has the concept of 'tail' in it;[167] it is very likely that the early Indo-Aryan speakers substituted this term of their own for the original Harappan-Dravidian name of the Draco constellation conceived to have the shape of a crocodile with the pole star in its tail.[168]

Immediately after the starry crocodile which has the pole star in its tail, the

161 See Malamoud 1977: 113–114, 130–131, 201–206.

162 *Viṣṇu-Purāṇa* 2,9,1 (cf., also for the other parallel texts, Kirfel 1954: 67 & 260): *tārāmayaṃ bhagavataḥ śiśumārākṛti prabhoḥ / divi rūpaṃ harer yat tu tasya pucche sthito dhruvaḥ*.

163 See Parpola 2011a: 37 with Fig. 45. When *Ṛgveda* 1,116,18 mentions the bull (*vṛṣabhá-*) and the crocodile (*śiṃśumā́ra-*) as the two draught-animals of the Aśvins' chariot, the two beasts may be connected with day and night respectively, as the two Aśvins themselves are so often (see Parpola 2005).

164 Weber 1853: 237.

165 In Parpola 2011a: 39a Ursa Major as a lapsus.

166 See Scherer 1953: 176–177.

167 Śunaḥśepa had two brothers also called 'Dog's tail,' Śunaḥpuccha and Śunolāṅgūla. Sanskrit *lāṅgūla-* 'tail' and its many variants in Indo-Aryan languages is likely to be of Dravidian origin. Burrow and Emeneau (1984 DEDR 5201) have connected it with Central Dravidian words for 'tail' such as Pengo *niṅguṇ* and Kuwi *leṅguṇi*, reconstructing **l-* as the initial consonant. I suggest that the Central Dravidian etymon originally began with **n-*, and that the word is a derivative of the Proto-Dravidian root **ñāl* 'to hang, be suspended' (DEDR 2912): **ñ-* has in most Dravidian languages merged with **n-* (see Krishnamurti 2003: 139).

168 See Parpola 2011a: 38–39.

Purāṇa texts describe the crucial function of the pole star as the hub and upholder of the entire stellar system:

> As the pole star revolves, it causes the moon, sun and other planets to turn also, and the lunar asterisms follow that revolving (pole star) in the manner of a wheel (turning around the nave). The sun and the moon, the stars, the lunar asterisms along with the planets are all in fact bound to the polar star by cords consisting of an array of winds. … The planets, asterisms and stars all without exception go around their proper orbits as tied to the pole star by cords of wind. As many as there are stars, so many are there bands of wind; being all tied to the pole star they while revolving cause that (pole star) turn around. As the oil-pressers, going around, cause the wheel (of the oil-press) to turn, so the (heavenly) lights go around everywhere whirled by a wind. Like a wheel of firebrands they (the heavenly lights) move, set in motion by a wheel of wind. Because it conveys (*vahati*) the (heavenly) lights, therefore that (wind) is known as 'Forward-Carrying' (*pra-vaha*)".[169]

David Pingree has dated this Purāṇic cosmology "to the middle of the last millennium B.C. at the earliest".[170] His two criteria for this dating are the concepts of Meru (the central mountain) and Dhruva: Dhruva

> first appears in the prescriptions for the marriage ceremony given in the gṛhyasūtras, though there only as an unmoved star, not as one pole of the axis about which the other celestial bodies revolve.[171]

The Heavenly Fig Tree

Yet the conception of pole star with 'ropes' issuing from it goes back to the Indus Civilization. One early attestation connected with it is found in a Ṛgvedic hymn, which refers to Śunaḥśepa in two of its verses (RV 1,24,12–13); the tradition ascribes to Śunaḥśepa the Ṛgvedic hymns 1,24–30, which he is supposed to

169 *Viṣṇu-Purāṇa* 2,9,2–3 and 2,12,25–28 (see Kirfel 1954: 67, 76, and 259–260, also for parallel passages in other texts): *saiṣa (dhruvo) bhraman bhrāmayati candrādityādikān grahān / bhramantam anu taṃ yānti nakṣatrāṇi ca cakravat // sūryacandramasau tārā nakṣatrāṇi grahaiḥ saha / vātānīkamayair bandhair dhruve baddhāni tāni vai // … graharkṣatārādhiṣṇyāni dhruve baddhāny aśeṣataḥ / bhramanty ucitacāreṇa maitreyānilaraśmibhiḥ // yāvatyaś caiva tārās tās tāvanto vātaraśmayaḥ / sarve dhruve nibaddhās te bhramanto bhrāmayanti tam // tailāpīḍā yathā cakraṃ bhramanto bhrāmayanti vai / tathā bhramanti jyotīṃṣi vātāviddhāni sarvaśaḥ // alātacakravad yānti vātacakreritāni tu / yasmāj jyotīṃṣi vahati pravahas tena sa smṛtaḥ //* see also the following verse attributed to Bhartṛhari (ed. Kosambi 1948: 97 no. 248) *jātaḥ kūrmaḥ sa ekaḥ pṛthu bhuvanabhārāyārpitaṃ yena pṛṣṭhaṃ / ślāghyaṃ janma dhruvasya bhramati niyamitaṃ yatra tejasvicakram / …*

170 Pingree 1990, p. 274.

171 *Ibid.*; this is based on Kirfel 1920: 35.

have addressed to the gods while bound to the sacrificial stake in Hariścandra's royal consecration, as a human victim to Varuṇa. RV 1,24,7 speaks of a banyan tree (*Ficus bengalensis*) in the sky:[172] 'King Varuṇa holds up the crown of the (heavenly banyan) tree in the bottomless space; up is the basis of its (aerial roots) which hang down: may these beams of light (*ketavaḥ*) be fixed on us!'[173] The banyan tree, in Vedic Sanskrit *nyag-ródha-* 'downwards-grower,' is characterized by its rope-like air roots falling down from its branches and eventually taking root around the original stem of the tree. In heavenly contexts, the word *ketú-* usually denotes 'beam of light' (also 'meteor' or 'comet'), but here the meaning 'aerial root' of banyan is also implied.[174] In the Ṛgvedic passage at hand, the aerial roots of the banyan correspond to beams of light that bring vital energy to living beings; see ŚB 2,3,3,7–8, where the rays (*raśmí-*) of the sun are conceived as ropes (*raśmí-*) that both bring and take life:

> 7. Now yonder burning (sun) doubtless is no other than Death.... It is by the rays (or reins, thongs, *raśmi*) of that (sun) that all these creatures are attached to the vital airs (breaths or life), and therefore the rays extend down to the vital airs. 8. And the breath of whomsoever he (the sun) wishes he takes and rises, and that one dies....[175]

According to the Purāṇic cosmology, the sun nourishes the moon and other heavenly luminaries as well as gods, men, ancestors etc. with its rays (*raśmi*).[176]

The Vedic and Hindu texts repeatedly refer to a heavenly fig tree. This conception seems to be reflected on an Indus tablet (H-179), which depicts an anthropomorphic deity inside a fig tree: at bottom, the fig tree is flanked on either side by a star, which suggest a heavenly connection for the tree.[177] The Indus script in turn testifies to the Harappan origin of the conception of the pole star as a cosmic banyan tree with 'ropes' issuing from it. A recurring sequence of Indus

172 According to AVŚ 5,4,3, there is a pipal tree (*Ficus religiosa*) as a seat of gods in the third heaven herefrom (*aśvatthó devasádanas tṛtī́yasyām itó diví*). An "eternal *aśvattha* tree which has its roots above, its branches below" is mentioned in *Kaṭha-Upaniṣad* 6,1 and *Bhagavadgītā* 15,1,2, but they appear to be adaptations from *Taittirīya-Āraṇyaka* 1,11,5, which speaks just of "a tree (*vṛkṣa*) which has its roots above, its branches below," and this in turn is an adaptation of RV 1,24,7 (see Emeneau 1949). Here the heavenly tree has been identified as the banyan tree (*Ficus bengalensis = Ficus indica*) by, inter alia, Geldner 1889; 1951: I, 25; Coomaraswamy 1938; Emeneau 1949; Bosch 1960: 65ff.; Renou 1960: VIII, 72–73.

173 *Ṛgveda* 1,24,7 *abudhné rā́jā váruṇo vánasyordhvám̐ stū́paṃ dadate pūtádakṣaḥ / nīcī́nā sthur upári budhná eṣām asmé antár níhitāḥ ketávaḥ syuḥ //*

174 In Dravidian, such an association has a linguistic motivation: from the root *viḻu* 'to fall down, descend,' there are both words meaning 'aerial root of the banyan, falling roots of a fig tree' (*viḻutu, vīḻal*) (DEDR 5430–1) and (in Tamil) *viḻu-mīṉ* 'meteor.'

175 Transl. Eggeling 1882: I, 343.

176 See *Viṣṇu-Purāṇa* 2,11,22–25 (cf., also for other parallel texts, Kirfel 1954: 73, 249, 253–255).

177 See Parpola 1994a: 244.

Figure 19: The sequence of signs depicting "fig tree" + "fish" in the Indus inscription of the seal M-414 from Mohenjo-daro. After CISI 1: 100. Reproduced courtesy of ASI. Being a modern seal impression, the text is read right-to-left, as was originally intended by the maker of the original, laterally inverted stamp.

signs is "fig tree" + "fish" (Fig. 19). The pictorial meaning "fig tree" assigned to the first sign in this sequence is based on its the similarity to the "three-branched fig" motif of Early, Mature and Late Harappan painted pottery.[178] The sign sequence "fig" + "fish" has a counterpart in the Old Tamil compound *vaṭa-mīn*. Tamil *vaṭam* 'banyan tree' and its cognates in other Dravidian languages (such as Malayalam *vaṭam* 'Ficus indica,' Kannaḍa *vaṭa* 'the banyan, Ficus indica,' Tulu *vaṭa* 'the large banyan tree') have not been included in the *Dravidian etymological dictionary* (DEDR), nor even in the *Dravidian borrowings from Indo-Aryan*,[179] being perhaps considered too obvious loans from Sanskrit *vaṭa* 'banyan.' The Sanskrit word, however, is first attested rather late, from the epics onwards, and has a very good etymology in Proto-Dravidian **vaṭam* 'rope, cord'.[180]

178 See Parpola 1994: 234–236 with figs. 13.15–16.

179 Emeneau & Burrow 1962.

180 DEDR 5220. Tedesco (1947: 90) has proposed an Indo-Aryan Prakritic etymology for (lexical) Sanskrit *vaṭa-* 'rope,' deriving it from the Sanskrit root *vṛt-* 'twist,' which is semantically plausible, but hardly acceptable in view of the scanty attestation of the word in Indo-Aryan languages (see Turner 1966: 654 no. 11212).

Rope-like air-roots are one of the most characteristic features of the banyan, which is also called *vaṭa-maram* 'rope-tree' in Tamil (Fig. 20).[181] The homophony with Proto-Dravidian **vaṭa* 'north'[182] explains the Purāṇic ascription of the banyan to the northern direction as its symbolic tree.[183] The sequence "fig tree" + "fish" thus yields the compound *vaṭa-mīn* 'north star,' which in Old Tamil is the name of the tiny star Alcor in Ursa Major.[184] *Vaṭa-mīṉ* occurs many times as the symbol of conjugal fidelity (*kaṟpu* or *tiṟam*).[185] In the first canto of the Old Tamil epic *Cilappatikāram*, the groom points out the *vaṭa-mīṉ* to the bride in the wedding ceremony, and this is still the Tamil custom in South India and Sri Lanka.[186]

Figure 20: The banyan tree (Ficus bengalensis) with rope-like down-hanging air roots. Photo Asko Parpola.

According to the ŚB passage discussed earlier, the Kṛttikās were formerly wives of the Seven Sages who shine in the sky as the stars of Ursa Major: the Sages divorced their wives after they had been seduced by Agni or Śiva. Vasiṣṭha's faithful wife Arundhatī however could stay with her husband: Arundhatī is the tiny star Alcor next to Vasiṣṭha's star Mizar = zeta Ursae Majoris.[187] Alcor is shown to the bride in the Vedic mar-

181 The word *vaṭa* 'banyan' has been considered an Indo-Aryan word, a Prakritic form derived (over **vaṭṭa*) from Sanskrit *vṛtta* 'turned' (see Tedesco 1947: 91). However, the Sanskrit word is not used with the meaning 'banyan tree.' Besides, the Aryan nomads first encountered this tree in the Indian subcontinent, and adoption of the tree's earlier native appellation would have been a natural thing to do.

182 DEDR 5218.

183 In Purāṇic cosmology, four mountains arise in the four cardinal directions around the golden Mount Meru in the centre, and on the top of each mountain grows an enormous tree, different in each direction. The tree growing in the north is the banyan fig, called *vaṭa* in most sources (e.g., *Viṣṇu-Purāṇa* 2,2; *Agni-Purāṇa* 108,11–12; *Matsya-Purāṇa* 113,47; 264,15–16) *nyagrodha* in other texts (see Kirfel 1920: 93; 1954: 3*-4*; 8, etc.). While homonymy connects the banyan fig with the north in Dravidian, there is no such linguistic association in Indo-Aryan languages.

184 Tamil *vaṭa-mīṉ* is not a translation loan from Sanskrit, for the Sanskrit sources do not have a term meaning 'northern star.'

185 E.g., in *Puṟanāṉūṟu* 122,8.

186 See Parpola 1994a: 241–243.

187 The earliest attestation of this tradition seems to be the late *khila* verse in RV-Khila 3,17,5

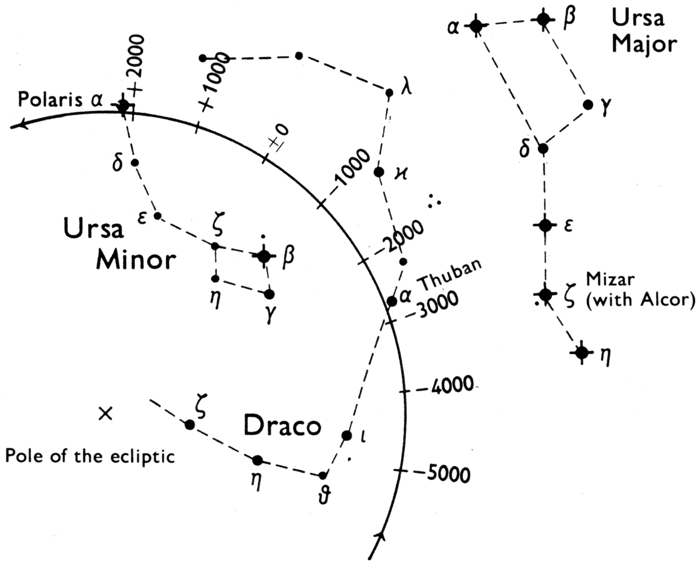

Figure 21: Circumpolar stars and the celestial pole. After Parpola 1994a: 243, based on Liebert 1969: 168.

riage ceremony as a model to be emulated. Originally *vaṭa-mīn* 'north star' probably denoted the nearby pole star. Actually, the old *khila* verse appearing as the last stanza of the marriage hymn RV 10,85 says just *dhrúvaidhi* 'be constant/ faithful',[188] and in some Gṛhyasūtras (PGS 1,8,19; ŚGS 1,17,3–4) and in Kālidāsa's *Kumārasaṃbhava* (7,85), only the Pole Star is shown; GGS 2,3,8–12 has the Pole Star and Arundhatī, while other stars as well, especially the Seven Sages, are mentioned in JGS 1,21; ĀśvGS 1,8,22; and HGS 1,22,14.[189]

In 4000–1900 BCE the pole star was Thuban (alpha Draconis), close to Ursa Major. In 2780 BCE, Thuban was only 0.6° distant from the heavenly Pole (Fig. 21). Thuban is the only star that could really be called 'fixed' (*dhruva*) centre of the rotating heavens before our own Pole Star Polaris. For instance Hermann Jacobi concluded that even though the custom of showing the pole star in the marriage ritual is recorded as late as in the Gṛhyasūtras, it must date from a much earlier

átrer yathā́nusūyā syād vasíṣṭhasyāpi arúndhatī / kauśikasya yathā sā́tī tathā́ tvam api bhā́rtari (on this *khila* see Scheftelowitz 1906: 104).

188 RV-Khila 3,17 as RV 10,85,48 *dhrúvaidhi póṣyā máyi máhyan tvādā́ bṛhaspátiḥ / máyā pátyā prajā́vatī sáñ jīva śarádaś śatám* (see Scheftelowitz, *ibid*.).

189 According to later explanations, the Pole Star is shown to the bride first because it is easier to see than the small star Alcor; it has become an example or 'maxim' (*nyāya*) of 'gradual instruction' (Śaṅkara on UMS 1,1,8 and 12).

time when there was a real pole star, i.e., from the first half of the third millennium.[190]

The *Hiraṇyakeśi-Gṛhyasūtra* prescribes that while showing the bride the pole star and/or Arundhatī, the bridegroom should address the pole star with a long mantra. On the basis of its contents, in particular the following verses, it was originally the king who spoke this mantra to the pole star, most probably in the royal consecration, "Varuṇa's sacrifice" (*varuṇasava*), although it is not extant in the *rājasūya* texts:[191]

> Then he worships the Pole Star with (the formula), 'Firm dwelling',[192] firm origin. The firm one art thou, standing on the side of firmness.
>
> Thou art the pillar of the stars; thus protect me against the adversary.
>
> …
>
> I know thee as the nave of the universe. May I become the nave of this country.
>
> I know thee as the centre of the universe. May I become the centre of this country.
>
> I know thee as the string that holds the universe. May I become the string that holds this country.
>
> I know thee as the pillar of the universe. May I become the pillar of this country.
>
> I know thee as the navel of the universe. May I become as the navel of this country….[193]

Varuṇa is the divine King, and in this mantra the pole star is a symbol of royalty. All principal varieties of fig trees (*nyagrodha, aśvattha, udumbara* and *plakṣa*) are emphatically associated with kingship in AB 7,27–34, and the mightiest of them, the banyan tree, belongs to Varuṇa.[194] It is King Varuṇa who according to RV 1,24,10 holds the heavenly banyan tree in the sky, while the Purāṇas (e.g., *Viṣṇu-Purāṇa* 2,9) explain that the stars and planets not fall down from the

190 See Jacobi 1894: 72–73; 1895: 227–229; 1896: 69–72.

191 See also the hymn RV 10,173 ascribed to Dhruva and related to the royal consecration.

192 The Pole Star as the 'firm dwelling' demands comparison with RV 8,41,9: "Fixed is Varuṇa's dwelling-place (*váruṇasya dhruvám sádaḥ*); (there) he governs the seven."

193 *Hiraṇyakeśi-Gṛhyasūtra* 1,22–23: … *dhruvam upatiṣṭhate / dhruvakṣitir dhruvayonir dhruvam asi dhruvasya sthitam / tvaṃ nakṣatrāṇāṃ methy asi sa mā pāhi pṛtanyataḥ / …/ nabhyaṃ tvā sarvasya veda, nabhyam aham asya janapadasya bhūyāsam / madhyaṃ tvā sarvasya veda, madhyam aham asya janapadasya bhūyāsam / tantiṃ tvā sarvasya veda, tantir aham asya janapadasya bhūyāsam / methīṃ tvā sarvasya veda, methy aham asya janapadasya bhūyāsam / nābhiṃ tvā sarvasya veda, nābhir aham asya janapadasya bhūyāsam /….*

194 See *Gobhila-Gṛhyasūtra* 4,7,24: *nyagrodho vāruṇo vṛkṣaḥ*.

sky, because they are bound to the pole star with invisible "ropes of wind," undoubtedly the imagined air-roots of the cosmic banyan tree.[195] These conceptions follow naturally from the original Dravidian name of the pole star: *vaṭa-mīn* "north star" = "banyan star" = "rope star."

ABBREVIATIONS

AB	*Aitareya-Brāhmaṇa*
ASI	Archaeological Survey of India
ĀśvGS	*Āśvalāyana-Gṛhya-Sūtra*
AVŚ	*Atharvaveda, Śaunaka-Saṃhitā*
BaudhŚS	*Baudhāyana-Śrauta-Sūtra*
CISI 1	Joshi & Parpola 1987.
CISI 2	Shah & Parpola 1991.
CISI 3.1	Parpola & al. 2010.
DAMGM	Department of Archaeology and Museums, Government of Pakistan
DEDR	Burrow & Emeneau 1984.
DŚS	*Drāhyāyaṇa-Śrauta-Sūtra*
GGS	*Gobhila-Gṛhya-Sūtra*
HARP	Harappa Archaeological Research Project
HGS	*Hiraṇyakeśi-Gṛhya-Sūtra*
IAAUP	Institute of Archaeology and Anthropology, University of Peshawar
JB	*Jaiminīya-Brāhmaṇa*
JGS	*Jaiminīya-Gṛhya-Sūtra*
KS	*Kaṭha-Saṃhitā* (*Kāṭhakam*)
LŚS	*Lāṭyāyana-Śrauta-Sūtra*
MS	*Maitrāyaṇī Saṃhitā*
PB	*Pañcaviṃśa-Brāhmaṇa*
PGS	*Pāraskara-Gṛhya-Sūtra*
RV	*Ṛgveda*
ŚB	*Śatapatha-Brāhmaṇa*
ŚBM	*Śatapatha-Brāhmaṇa* (*Mādhyandina* recension)
ŚGS	*Śāṅkhāyana-Gṛhya-Sūtra*
TB	*Taittirīya-Brāhmaṇa*
TS	*Taittirīya-Saṃhitā*
UMS	*Uttara Mīmāṃsā Sūtra*
VS	*Vājasaneyi-Saṃhitā*

195 The idea that the stars are bound to the Pole Star seems to be implied as early as the *Ṛgveda*, which states that 'those stars, which, being fixed high up (*níhitāsa uccā́*), were to be seen in the night, have gone somewhere in daytime' (RV 1,24,10). As this same hymn speaks of the heavenly fig tree and of its air roots as beams of light, it does not seem far-fetched to think that the poet linked this banyan tree with the Pole Star.

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