CHAPTER - 7

Vedic Literature, Astronomy and *Sadhana*

Abstract

Falling temperatures and increased aridity in the western Asia during the last glaciation pushed a somewhat varied population of men to the banks of Sindhu from Mediterranean-Baikal Region in search of warmer southerly lands with ameliorating climate. This newly migrated population interacted with the one already present there. In this land of plenty, they discovered that hunger was less bothering and running about for food curtailed. In the new environment they expanded their knowledge about language, astronomy and arithmetic besides spending long times for *sadhana* in search of eternal life. They have left behind a store of knowledge in *veds* and *vedangs* which bring out their potential in the introversion of consciousness and understanding of eternal life. The mathematical acumen among these people developed mainly on account of astronomical observations. Some of the Upper Paleolithic observatories are still surviving on the Indian soil and are illustrated.

The *vedic* literature is conveniently divided into four units i) *Samhitas* or basic books, ii) *Brahmans* that deputize and elaborate *samhitas* in connection with rituals besides containing some traditional stories iii) *Aranyaks* or texts meant for the men renouncing homes and taking to forests, and iv) *Upanishads* that are nearly synonymous with the last. Again, *ved*, in general refers to *samhitas* which are four: *Rik*, *Yajus*, *Sam* and *Atharv*. Each of these *samhitas* are followed by *brahmans*, *aranyaks* and *upanishads* of the specific *veds*. The four *samhitas* were composed initially between 26 and 11 Ka. The fourth, however, was referred as *Atharvanigaras vidya* and does not figure as a *ved* in the ancient works like Manusmriti.

The hymns of the *Rigved* were composed mainly in the territory of the now offshore Kachchh, the *Yajurved* was compiled on the then actively flowing Gaggar River and *Samved* relates to an area of the old channel of Sam, then flowing by the side of Sam near Jaisalmer. Sam was the southerly course of Saraswati river in Rajasthan. *Atharvved* was largely composed in the *Brahmarshidesh* but was practised mainly in Gujarat on the bank of Mahi River after the *Brahmarshidesh* was inundated by sea around 10 Ka. *Vedangs* include works related to education of pronunciation and recitation of *vedic* hymns, grammar, composition of meters and vocabulary. There are also books on code of conduct called *smrities*. *Vedic* arithmetic and grammar suggest a remarkable achievement of the bards in the intellectual field. Much of this grammar, referred as Panini grammar, in the book Astadhyayi, began at the bank of River Vaxini, the southerly main trunk of the Indus near Saurashtra. Erroneously this is ascribed to an individual in Afghanistan. Memorization of grammar commencing during the early *vedic* days took nearly four hours of exercise every day for the mind. It was a morning walk for the intellect to keep the consciousness system fit for introversion and concentration.

The astronomical sites of the Middle and Upper Paleolithic discovered by this author during the last eleven years fall under three categories i) Mid-day marker and solstice indicator systems, ii) Equinox indicator systems and iii) Complex observatories. These were built in Rajasthan, Kachchh and Madhya Pradesh and range in age from 40 Ka to 11 Ka. Illustration of the observatories are provided here and conclusions drawn regarding their antiquity with the help of stone implements. A site in Rajasthan proves to

be decidedly *vedic* and relatable to the famous deity *Dyavaprithivi.* The pattern of the carving is referable to Perigordian close to Gravettian age (around 24 Ka). The earliest date of *vedic* astronomy works out as 24.8 Ka on the basis of Panini Astadhyayi. The observatory also shows that the people by this time had become aware about precession of equinoxes with reference to asterisms. Theoretical consideration about the observatory, *vedic* months and their seasons in conjunction with grammar suggest that asterism *Ashadha* was named around 25 Ka and the *vedic* people had set their activity fully by 26 Ka. A far more complex observatory was made by these people in Kachchh with stone implements around 14-11 Ka.

The knowledge building activity among the *vedic* men of India was essentially memory based and involving deep introversion. The consciousness so focused proceeded on three fronts : intellectual excellence, rituals for heavenly existence and for attaining *brahm.* Chanting of *vedic mantras* and verses with closed eyes and full concentration accelerated the complex process of consciousness introversion. Added to it was the conduct of highest purity among the *vedic rishis.* It was essentially this process that led them to revelation of past births and rules of *karms* which suggest that **no action, good or bad, is destroyable without giving fruits in times to come.**

Their *sadhana* in the pursuit of *brahm* led them to discover that the main organs of consciousness not only lie in the head but there are also within the chest and abdomen. They practised to strengthen them in *yog* and *tantra. Atharvved* excelled in this pursuit leading to *brahm* through *yog* and *tantra.*

Introduction

The lush green Sindhu country at the tropic of Cancer witnessed a huge conglomeration of human population descending on this land from the Meditteranean-Caspian-Baikal terrain around 26 Ka in wake of decreased rain and harsher, rapidly cooling climate of Wurm-II Glaciation in the northern hemisphere. These were the very Khasi-Munda people who had once migrated from Indian soil during Wurm II/III Interglacial and then reached back to rediscover their old home of dense vegetation, copious fruits and rich grain potential. While the streams themselves were full of fish, abundant domestication-prone animals and birds inhabited the riverine land. Even some thing more came in their way of experience. Unlike the colder countries left behind, there were no pangs of hunger or pressure for gluttonous eating in India. Instead people could undergo prolonged fasts for several weeks and months. This naturally cut down the requirement of running whole day for hunting food. The local inhabitants also contributed to their wisdom because their knowledge base and education were superior.

The migrants found something still fascinating in the population already existing in the Sindhu Land. These were the Khasis and their cousins like Santhal and Mundas abounding in the then Kachchh-Sindh tract (Fig.7.1). They spoke, in a refined language and their knowledge of calculations about asterisms, days and months was better. It was some thing like the British reaching India a few centuries ago and discovering Sanskrit and *vedic* arithmetic.

On such a substratum the newly migrated population of Sindhu country started to add to the knowledge base in three directions: language refinement, expanding the knowledge of astronomy and formulations of rules for arithmetic. Composition of hymns for prayer of river gods, *Purukha, Dyavaprithivi* and others also became a part of their life.

Sindhu Land also had a powerful consciousness flux to nurture their inner-self. Introversion of thoughts and channelling of emotional energy was thus innately picked up to take them on the path of *sadhana* for *brahm* and eternal life. In their acute and active minds it was accelerated many times as a consequence of memorization related to grammar, arithmetic and prayers. Potential of introversion of consciousness came their way naturally for developing the science of consciousness—*vidya.* Consciousness acceleration also led them to 'see' that life does not end with body and the journey on the path of repeated births has to continue for long till the eternal life is reached.

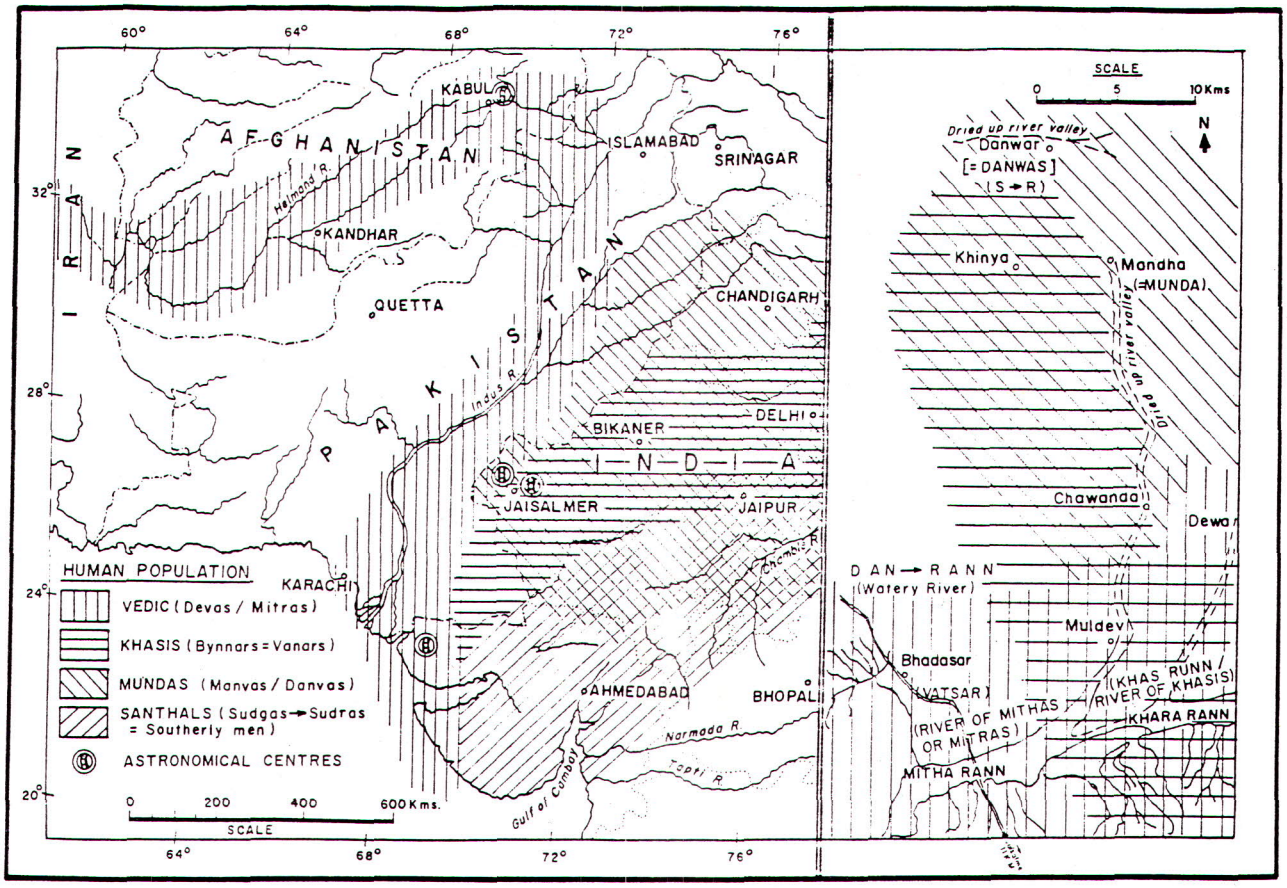


Fig. 7.1 : Inhabitants of Western India-Eastern Iran at the dawn of *vedic* period. *Santhal people seem to have been widespread in the areas of eastern Kachchh, Madhya Pradesh and belong to a southerly population hence addressed by the Devas as Sudras. Khasis were the people occupying the Kachchh and Rajasthan. They addressed themselves as Bynnars while Devas called them as Vanars. Munda people related to river Munda, seem to be the inhabitants on the bank of river Munda(=Chamunda=Chenab) Their village Mandha on the tributary of Saraswati suggests that Rajasthan was their home for a long time after migration from North Eastern India.*

The effort of the *vedic* population during the 26 Ka and 11 Ka, was focused mainly upon attainment of a level of consciousness where I-ness or self is free from the domain of physical body as *brahm* and man attains freedom from the death. A bifurcation of human knowledge set in here. There was an intellectual knowledge related to information gathering and its utilization. This included grammar, arithmetic as also prayers and rituals of *veds*. Also, there was a knowledge of the self or *atma* evident through *yog*, *samadhi* and *tantra* as discussed in the *Atharvved*. The former tied the man with mortality while the latter took him to eternal life. None wanted to die as a mortal; all intelligent eyes were set on the principles of immortality and eternal life.

The intellectual achievements of *vedic* people led them to appreciate the training or *sadhana* of immortality. Noticeably the *sadhana* for *moksh* had hardly any direct relationship with the man's intellectual acumen because it related to sensitising the invisible consciousness centres in the body to perceive *brahm*. *Avidya* or intellectual pursuits, nevertheless, were essential as an initial training for introversion of mind and enabling it to move towards the higher *sadhana*. That is why a very specific statement "Know *avidya* and *vidya* together" [ISH:11].

Inspite of the principles of eternal life, well known to *vedic* men they realised that all the people do not take *sadhana* for eternal life even though it was the ideal goal for mankind. Mental attitude of men, inspite of all the theoretical knowledge about immortality, could not delink the mind from physical enjoyments and worldly gains. This observation led them to classify men into two groups by their attitude towards life—acquisitive and renunciative. There were low-consciousness-men falling for worldly gains—the *laghuchetasas*. In contrast, there were highly conscious men, the *mahatmas*, who alone fell for *sadhana*. That they represent two main stages in the evolution of man, *vedic* people realized long ago.

In the modern communities, the Andamanese and western populations are *laghuchetasas* and *vedic* people and ascetics are *mahatmas*. The evolved or *mahatmas* were advised to follow their orderly course of *avidya* and *vidya* without unnecessarily provoking the less evolved fellow men [GIT : 3.26]. This advice was given because the control of the self lies in the taming of *prakriti* (ego) and intellectual learning or preaching offered little help in this matter.

Briefly discussed in the chapter are the *vedic* literature available at hand, the attainments of *vedic* arithmetic and grammar. The arithmetic had emerged as a consequence of computations required in astronomy. Hence, an introductory field survey of Paleolithic astronomical observatories in India is provided to substantiate the conviction of the author that a high level of astronomical development existed during the *vedic* period. The impact of this learning on the achievements of the *vedic* people in the field of *sadhana* also figures briefly in the later part of this chapter.

Vedic Literature

Etymologically, *ved* is tied to a verb-root *vid* or to know. This derivation, however is fairly late when the *Atharvved* fell in the fold of the *ved*s. Prior to this period, i.e., in Manusmriti or Chhandogya Upanishad, *ved* did not include *Atharvangiras vidya*, designated later as *Atharvved*. *Vid jyane* or *vid* for knowledge accordingly is not the basis for the noun *ved* because traditionally *veds* include *avidya* and not *vidya* [SHW:5.1]. Possibly in the archaic usage, this word existed as a bisyllabic noun indicating *va-id* or worship of River or river-gods like *Indra* or *Varun*. These river gods were personified male gods in the *vedic* period like Pharaoh. In Chhandogya Upanishad, Indra is the same as *Indh* and, the latter is unmistakably the same as River Indus. The same is also evident in the statements like *'Indro vridhashravah'* (=*Indra* the big river ; *Shantipath*, MUN.) and *'Indra dashuh'* or *Indra* the non-drying river [RIK: 3.25.3]. Accordingly, in their initial use, *veds* were a collection of verses in the prayer of river-gods like *Sindhu*, *Varun*, or *Indra*. Prominent among the riverine lands were *Rik*, *Yajus* and *Sam* and so were also the *veds*. In addition to river-gods, other gods like *Agni* (Fire) and *Dyavaprithivi* or *Purukha* (Creator) are also prayed in *veds*.

Veds are often called *shruti* or memorised and phonetically reproduced texts as also *Nigam* or the Definite Path (for higher life). In the written standard texts *vedic* verses are accordingly printed with notation for pronunciation.

The literature related to *veds* is conventionally divided into four units (i) *Samhita*s or basic books, (ii) *Brahman-granths* or *Brahmans* that deputize and elaborate the *Samhitas* in connection with rituals besides containing some traditional stories, (iii) *Aranyaks* or texts for the men renouncing homes and taking to forest and (iv) *upanishads*. The last also etymologically means close to the forest [*up*: close and *nishad* : land devoid of men=forest]. In a book like Vrihad-Aranyakopanishad, *aranyak* and *upanishad* both are combined as syllables of a single word. Again, *ved*, in general, connotes only the *samhitas* which are four: *Rik*, *Yajus*, *Sam* and *Atharv*. Each of these *samhitas* is followed by *brahmans*, *aranyaks* and *upanishads* which have also been placed as components of these *veds* in the existing compilations. As discussed in the preceding pages, the first three *samhitas* are recognised as pretty old, dating back to 26 Ka to 11 Ka. The fourth containing slightly modified verses of *Rigved* besides its own and having a large component of *tantric mantras* was not included among traditional 'three *veds*' (*ved-trayee*). However, as Awasthi (1953) opines, it is also of the same age as *Rigved* although the western scholars emphasise its younger age. Conceivably, this *ved*

developed largely during the upper *vedic* period on the basic substratum of *Rigved*. There is a strong possibility that during the Early *Vedic* Period (26-20 Ka) there was a single *ved* with *Dyavaprithivi* and Sindhu as the main deities while the Upper *Vedic* Period (15-11 Ka) with Indra, Agni and a plethora of other gods had a differentiation of *veds* into three or four for a long time, during this period *Atharvved* was referred as *Atharvangiras vidya*.

Vedic samhitas, excluding parts of *Yajus* and *Atharv*, are all poetic compositions and their material is placed strictly within fourteen types of meters like *gayatri*, *jagati*, *tristup* etc. (Dwivedi, 1982). Further for every word there is a specific pronunciation style through the classification of vowels first into three: short, long and very long (*hrasva*, *deergh*, *plut*) and into high, low and medium tones (*udatt*, *anudatt* and *swarit*) within low or high pitch (*vivrit*, *samvrit*). Memorization of *vedic* text, therefore, is not a simple process. It requires the highest degree of concentration and caution for correct memorization and accurate reproduction of each word where pronunciation would change with the meaning of a word.

It was ingrained in the *vedic* culture to be most careful about correct pronunciation. The famous grammarian Patanjali (2 Ka) explains it through a story in his commentary on the aphorisms of Astadhyayi. The *asurs* lost their war to Gods owing to wrong pronunciation of a single word.

Rigved

The *ved* relates to the people of Riu-K or Rik identifiable today with Ka Riu or Kori (Creek), which is the left over channel of Indus between Kachchh and Sindh. Northwards it extended as a K-ab-ud or River Kabul in Afghanistan. Accordingly, *Rigved* is the *ved* of the Indus River people. The first contributors to the *Rigved* were the settlers along the main course of Sindhu between Hyderabad in Pakistan and Dwarka in Saurashtra. Some of its verses, however, are related to far northerly lands even north of Afghanistan and Gods like *Trit* or *Tarkshya* are apparently from the far western lands of Turkey. No wonder *Rigved* is the most voluminous among *samhitas*.

The *samhita* part of *Rigved* includes nearly ten thousand verses in the prayer of gods that fall under three broad categories of Earthly, e.g. Fire God; Heavenly, e.g. Sun God; and, Gods related to Horizon, e.g. *Indra* and *Vayu*. These verses are placed under ten *mandals* (chapters). Their composition has been enlarged at different periods, it is quite obvious. Most of these enlargements were introduced after the battles for land came in vogue involving chariots. These dates lie between 5 Ka and 3 Ka. *Brahmans, aranyaks* and *upanishads* that form a part of *Rigvedic* literature, are referred to as: *Aittareya* and *Shankhayan (Kaushitaki). Aranyaks* of *Rigved* also have the same names. A part of the *Shankhayan Aranyak* has been considered as Kaushitaki Upanishad. To this are added *Aittareya* and another eight *upanishads* to complete the whole list of ten *upanishads* of *Rigved*.

Yajusved or *Yajurved*

Yajurved has a typical pronunciation where *y* and *sh* of *Rigved* are invariably changed as *j* and *kh*. Thus *yajman* is pronounced as *jajman* and *Rigvedic* pronunciation *shirsha* changes to *shirkha*. Even *Yajurved*, accordingly, has to be pronounced as *jajurved*. Transformed backwards, the *yajurved* becomes *jajurved* and *gajarved*, relatable to the river Ghaggar and men of Ghaggar. This river was the main constituent of Saraswati with catchment area in Himalaya, eastern Punjab and western Uttar Pradesh. Even now the typical pronunciation of *yajman* is *jajman* in the Ganges plains which happens to be the original home of *Yajurved* people, i.e., land between the present Ghaggar and Ganga. The highly ritualistic *Yajurved* has seemingly been composed mostly between 16 Ka to 12 Ka, i.e. during the Upper *Vedic* times of *Yajniodesh* when its recitation was as common in the valley of Volga as in Ganga.

Yajurved has two divisions *Krishn* and *Shukl* (=*Madhyandin*= *Vajsaneyee*). The latter contains compositions of *mantras* without rituals while the *Krishn yajurved* include a mix of rituals as well as

mantras. Once upon a time this was the most extensive among *the veds* but it is much receded now. In the *Shukl Yajurved* there are nearly four thousand *mantras*. In the *Krishn Yajurved, mantras* are nearly seven thousand which include nearly one thousand and seven hundred borrowed from *Rigved* (Dwivedi, 1982).

Yajurved is basically the *ved* for rituals and those who were seeking heavenly attainments besides the earthly enjoyments. *Brahmans* included here are Shatpath and Taittiriya. The *aranyaks* of this *ved* are *Vrihadarankyak* (which is also classified as a *upanishad)*, Taittiriya and Maitrayaniya. Forty one *upanishads* are placed under *Yajurved.*

Samved

The terrain of River Sam was the land where *Samved* first flourished. There is no river of this name today but an old course of Luni passes close to Sanchor-which literally means township on Sam River [*Chor=Sohr* of Khasi =township; *Chor* at a paleoconfluence of Ganga-Yamuna-Saraswati lies in Pakistan]. The big wide of valley of present day Luni which formed the southward drainage during the upper *vedic* period and could thus be River Sam of southern Rajasthan. However, more appropriately, the western *Samved* country was around the Sam township on the course of Saraswati in western Rajasthan. This course of dried up River Saraswati Vinashan was probably called Sam. Both Sam rivers are now lost to obscurity due to post-*vedic* tectonics and desertification of Rajasthan. *Samved* contains 1875 verses, of which 1771 belong to *Rigved.* It is a *ved* specialising in music and in that sense an extension of *Rigved*, supporting a different vocal presentation. There are nine *brahmans* in this *ved*; *arankyaks* are two while *upanishads* are sixteen.

Vedangs: Background Literature of *Veds*

Complex meters and grammar of the *vedic* works are not a part of *veds* as listed above. These are classified as *vedangs* which include works related to education of pronunciation and recitation of *vedic* hymns, grammar, composition of meters, vocabulary, astronomy, and guidance for rituals. Memorization of these documents was as necessary as those of *veds* for deciding correct recitation and action at any moment of rituals. These constitute invaluable literature of the *vedic* tradition.

Smritis

The *vedic* material was to be memorized and recited with specified sounds and pronunciations, especially for worships. These included even the *brahmans*. The *vedic* people, however, also had books of code of conduct mainly for students and householders. These too were to be memorized and acted upon but had no strict bindings on phonetics during recitation. Nor was it to be recited with reference to rituals. It was a work of dos and don'ts on the path of life starting with birth and ending with death. Such works are named as *smiriti.* First among these, decidedly as old as the upper *vedic* age, is Manusmriti. *Man-eu* (man with water) or Manu literally means a noble man corresponding to *jan-ab* of Persian. The word Manu persists even now though slightly deformed as *Manai* (in Bhojpuri). The text of Manusmriti relates to the conduct for such noble people who are disinterested in sex and worldly possessions. Initial composition of the work was probably limited to about 150 verses commencing with instruction for rituals of new born to abandonment of home and leaving behind the body in a forest at the time of death (Chapter-8). The book, however, has added instructions through ages and now acquires a much more voluminous form than what it originally was. Several chapters and hundreds of verses have been appended in this work during the last twelve thousand years as the cultures and civilizations progressed towards more colonial ends.

Many other *smrities* have been casted later, on the lines of Manusmriti.

Vedic Mathematics

Astronomy and mathematics, as already mentioned, are not a part of the *vedic* material referred above. These are mostly placed under *vedang*. In the ultimate development of mental acumen related to astronomy and mathematics, the ancient *rishis* evolved aphorisms or *sutras* for computation. For appreciation of their achievement, it is thought more prudent to lift a small passage from the introductory chapter of Vedic Arithmetic by Tirth (1965) for highlighting the past achievement of the *vedic* land. As Tirth states:

"i) The *sutras* (aphorisms) apply to and cover each and every part of each and every chapter of each and every branch of mathematics (including arithmetic, algebra, geometry—plane and solid, trigonometry—plane and spherical, conics—geometrical and analytical, astronomy, calculus—differential and integral etc.). In fact, there is no branch of mathematics, pure or applied, which is beyond their jurisdiction.

ii) The *sutras* are easy to understand, easy to apply and easy to remember; and the whole work can be truthfully summarised in one word **'mental'**!

iii) Even as regards complex problems involving a good number of mathematical operations (consecutively or even simultaneously to be performed), the time taken by the *vedic* method will be a third, a fourth, a tenth or even a much smaller fraction of the time required according to modern (i.e. current) western methods.

iv) And, in some very important and striking cases, sums requiring 30, 50, 100 or even more numerous and cumbrous 'steps' of working (according to the current western methods) can be answered in a single and simple step of work by the *vedic* method! And little children (of only 10 or 12 years of age) merely look at the sums written on the blackboard (on the platform) and immediately shout out and dictate the answers from the body of the convocation hall (or other venue of the demonstration). And this is because, as a matter of fact, each digit automatically yields its predecessor and its successor! and the children have merely to go on tossing off (or reeling off) the digits one after another (forwards or backwards) by mere mental arithmetic (without needing pen or pencil, paper or slate etc.)!

v) On seeing this kind of work actually being performed by the little children, the doctors, professors and other 'big-guns' of mathematics are wonder struck and exclaim: 'Is this mathematics or magic?' And we invariably answer and say: 'It is both. It is magic until you understand it; and it is mathematics thereafter'; and then we proceed to substantiate and prove the correctness of this reply of ours".

The profoundness of mental acumen above is unique in human history for two reasons. A very high level of mental calibre was essential to evolve these formulae or aphorisms on one hand, and a long time necessarily taken by such men to conduct a very large number of computations mentally on the other. This requires necessarily a very long period of evolution in the numerological domain by the bards who were *suganaks* (good mathematician), with potential to remember very long sequences of numbers as may be visualized by the example of multiplication of 87265 and 32117 using aphorism *"urdhwa tiryagbhyam*". They had to keep in mind constantly 87265x32117, then apply aphorism and conduct mental exercise and finally reach to the result 2802690005—a ten digit number.

Mathematics in the above situation proved to be highly absorbing for *vedic* men and it accelerated their concentration. *Vedic* bards were so accustomed to the difficult subject of arithmetic that it could be simplified to the extent of aphorisms of remarkable simplicity. The genius of west simplified calculations through evolution of logarithms and calculus but the mind that began counting on a clay ball ended on a paper adding hardly any substance in the evolution of concentration—an attribute of memory-locked consciousness.

Grammar

The evolutionary stratum of a language and its level of perfection is reflected in its grammar. Sanskrit reaches to the highest level in this context. The grammar is perfect and the language is artificialized to near completeness. Most words in the language are tied to the base of verb-roots and word formation carried through elaborate exercise of adding and modifying prepositions. Thus, it is possible to derive **wish** (*chikirsha*) out of root **do** (*kri*) through fifteen steps of grammatical exercise involving an intermediate word *chikirshati* (intends to do). Sanskrit grammar has rules for deriving almost every word in this way. Such a complex grammar, must have its roots in deep antiquity of *vedic* age; and, it is confirmed through a story in Tattiriya Samhita (6.4.7.3). It is Indra who classified the words, established etymology, and put them to use. Accordingly, Indra of *Rigvedic* period is the first grammarian. The composition of *vedic* hymns in the *Samhitas* is quite complex and demonstrates that there was a highly evolved and complex grammar behind the composition of *vedic* verses between 26 Ka and 11 Ka. In fact, Sanskrit grammar of today, is simpler than those of the *vedic* times.

Inspite of such a well developed grammatical system of *veds*, one is wonder struck to note a complete absence of a book of grammar in Sanskrit relating exclusively to *veds* even though the *vedic* material running into thousands of verses are brought down to the present through memorization. There are some mentions of etymological derivation in the Gopath Brahman of *Atharvved* but no reference to a regular treatise on the subject exists except in the Astadhyayi of Panini (Sharma, 1977). Agarwal (1965) in his detailed treatment of Panini and th then India during his period has placed Panini as an individual in the 5th Century BC. Nevertheless, his own treatment of nomenclature related to Panini (p.13-p.14) and stories about him may lead us to conclude that Panini as an individual is as fictitious as Manu of Manusmriti. The latter, the western scholars place as a composition by Patanjali during the regime of Pushyamitra around 1.7 Ka ignoring the intrinsic evidence of antiquity of the then society in some of its verses. On the same lines, Panini too has been conceived by many people as a person around 2.5 Ka in Afghanistan. Unfortunately, most men are not in position to imagine that aphorisms of Panini are a collection of grammatical rules coming from the time of *Indra*, i.e., the Sindhu culture and continuing in time when the rules related to *kumar-sharmana* [nuns] were framed during the Buddhist era around 2.5 Ka.

Inferences relating to Panini and his period may be visualized in the material used by Agarwal for the analysis of the period of Panini as well as in the aphorisms of Astadhyayi. Agarwal recounts that Panini, the composer of Astadhyayi, according to *Bouddhayan Shrout-sutra* is a *gotra* (sub-clan) within the higher *gotra* or clan *Vatsa-Bhrigu.* Panini himself has established *Panin-Paanin* relationship in the sense of a progenic derivation. Again names like *Ahik, Shalanki, Daxi-putra* and *Shalaturiy* are traditionally used for Panini. A good discussion on these geographic names is provided by Agarwal who also suggested, since Shalatur belongs to Afghanistan, Panini must belong to this country. What is most obvious, however, in the treatment of Panini by Agarwal is the antiquity of this name and also the uncertainty about its being a name of an individual. Again, the place of the individual or the clan which is responsible for erecting this grammar and the time span traversed by the grammar are equally uncertain. Agarwal, however, concludes Panini was an individual. **The idea of Panini being an individual is unacceptable because of the treatment of several words in Astadhyayi** which must have been coined during *vedic* period between 26 and 12 Ka and could never have been relevant around 3.5 Ka if we consider Panini as an individual related to his date.

Panini has often been called Daxi-*putra* or son of (river) Daxi as Bhishma of Mahabharat is referred as Ganga-*putra*, son of (river) Ganga. With this parlance we can link the name Panini easily to the river Vaxini—the last southerly tributary river of Sindhu because *Va-Axini* proves to be same as *Da-Akshi* in the Mundari (*Va*=*Da*=River). Panini, then, as a clan or *gotra* name is identifiable with the last of the three trunk rivers of Sindhu, farthest in the south and occupied mostly by the people of Munda affinity (Chapter-6). Accordingly, Panini reflects a clan related to River Vaxini like *Saraswat* with *Saraswati, Gangeya* with *Ganga* and *Kapisthal* with *Kapi* (Cambay). The grammar adopted by the Panini clan of people at the

southern tip of Sindhu land constituted the standard reference for others. Possibly, it was first compiled as *Astadhyayi* or eight chaptered book of aphorisms for a grammar documented first by Indra, the God-man of river Indus in the northern part of Sindhu Land. It may be recollected that this area comprised the main seat of *Rigved.* Additions of words, however, continued during all times to come till the Buddhist era.

Agarwal has also conceived that in the long list of names of the asterisms in the Astadhyayi [AST:4.3.34], counting begins with *Sravistha* (=*Dhanistha*). This must be the time when *Dhanistha* was the *nakshatra* rising in the eastern sky on vernal equinox and the asterisms were being counted with *Dhanistha* as first. This assumption is similar to the *Uttara Phalguni,* as the vernal equinoctical star during the Shatpath Brahman. As discussed earlier these two dates fall around 22.5 Ka and 12.5 Ka respectively and the aphorism in Astadhyayi cover both the equinoctical positions [AST :4.3.34 and 4.2.22] This shows atleast a time gap of 10 Ka between the first point of the vernal equinoxes when rules in Astadhyayi were framed and its continuation thereafter so long as the Sanskrit grammar was in vogue. Accordingly, the *Daxi-Putra* grammar or Panini grammar dates back to at least 22.5 Ka when Vaxini was really flowing. Real antiquity of Indra-Panini grammar, however, has to be accordingly, placed at the base of the Sindhu River population of *vedic* people, i.e., around 26 Ka. It may be said specifically, so because the aphorisms 6.3.28-29 in the Astadhyayi relate to the derivation of a single deity name as *Dyavaprithivi* which dates back to the days of the common duel deity of heaven and earth as depicted in the Upper Perigordian statue of Rajasthan (Fig.5.9). The grammar accordingly arose as early as 26 Ka and has been actively followed with addition of *sutras* like *Vibhasha Phalguni* [AST. 4.2.22] that brought formation of words like *Phalgunik, Sravanik, Kartikik, Chatrik,* in addition to normal derivation like *Sravan* etc. Panini, the supposed author of the book Astadhyayi thus proves to be no individual but a clan dwelling on the banks of river Vaxini. The book concludes at the Buddhist period around 2.5 Ka—the period considered to be the date of Panini by Agarwal. Thereafter no additional names figure in the book due to the parallel set of *vartiks.* A famous one of these, *devanampriya iti cha murkhe* meaning that the designation **'favourite of gods'** be used for a fool, mocks at Emperor Ashok. It was coined no earlier than Ashok i.e., around 2.2 Ka. The addition of *vartiks* in the Sanskrit grammar, as distinct from Astadhyayi, preserves the pre-Buddhist format of the Astadhyayi.

The daily recitation of the Panini and related subject material of grammar *(gan-path)* consumes nearly four hours per day. These four hours of memorization of grammar per day was a morning-walk without invocation of *vedic mantras* by grammarians. It fell in near zero zone of neutral consciousness of *brahm* and *atta* and gathered by the reciter for the next birth. Memorization of grammar, however, demanded extremes of concentration, it led to introversion of mind better than recitation of *veds.* It was rigorously followed by the intelligent individuals of the *vedic* land. **Sanskrit grammar and arithmetic are certainly the best intellectual exercise of an intelligent human mind towards *sadhana* for *brahm* and *moksh*.** These were developed assiduously by the *vedic* people. The two, together, enabled them to focus their consciousness precisely on contemplating upon the goals of life and adhering to the operations during the *yogic* or *tantric sadhana.*

Paleolithic Observatories in India

Discussion about past dates of *vedic* culture on the basis of astronomical calculations may look exaggerated and unbelievable to many, because there has been little effort in recognizing the achievement of the past Indian astronomy and calculations which grew basically in pursuance of astronomical computations. The development of astronomy during the Upper Paleolithic of India, however, has been profound as suggested by the Paleolithic observatories scattered all over the country. To remove the lacuna, a systematic record and description of a few of these sites are documented here. This would suggest that *vedic* people had attained a high level of proficiency in astronomy, long before urbanized settlements commenced in India, western Asia and Europe. Stone henges of Europe constitute later continuation of these observatories.

During the course of geological field trips in various parts of the country the author came across several

astronomical equipments relatable mainly to be Upper Paleolithic but extending down into the Middle Paleolithic also. These observatories and sites in Rajasthan and Kachchh have survived mainly due to sparse population, religious attitude of people and mysterious stories of one kind or the other among the locals relating to these sites. The studied equipments fall under the following categories:

1. **Mid-day marker and winter solstice indicator systems**
   A) Two stone-crude system
   B) Single-stone refined system
2. **Equinox indicator systems**
   A) Season linked Equinox finder
   B) Month linked Equinox finder
3. **Complex observatories**

1A: Season and Mid-day Indicator at the Bank of Paleo-Saraswati

In the area of Bhadsar, west of the main meander and wide river bed of the Mitha Rann, is seen a small menhir on the desert plateau (Fig.7.2). It is slightly titled to the east (Fig.7.3). On the easterly inclined side of the menhir is buried a linear vertical stone oriented north-south (Fig. 7.4). The shadow of the menhir fell vertically upon this stone at the mid day. The day, accordingly, was divided into two halves forenoon and afternoon. In addition there is a stone buried due north of the menhir where its shadow would fall on winter solstice. An exact near vertical mark of the solar shadow on the summer solstice is also etched on the mid-day marker. The stone continues some distance ahead of this mark suggesting an important secular change related to the southerly solar declination after the longest day. It marks the dates of autumnal and vernal equinoxes. *Abd* or Year in *Yajurved*, means literally, *Ap+d* or flooding of river. Rise of water in Himalayan rivers sets in around the end of May in Varanasi and the same could have been true of Bhadsar area on the banks of the then Saraswati. This is the date of the near vertical sun. The near vertical notch of the stone accordingly marked *Abd* or year. This nomenclature *abd* for year in the *Yajurved* followed this system seemingly from an early or pre-*vedic* days of Rajasthan. Probably, the crude Sanskrit speaking people who used *Ap* for water have adapted Mundari *da* for water or river to coin a word like *Abd*. Unlike the Khasis who chose the day of summer-solstice for year marking, the year of these men is connected with flooding of Bhadsar or Saraswati River. It was marked by this method since Middle Paleolithic and *Abd* of *Yajurved* was coined by the pre-*vedic* or semi-*vedic* people and continued by *vedic* men. Even the three main seasons—summer, rain, winter—were best defined here. Summer lasted from the vernal equinox to summer solstice; then followed the rains upto autumnal equinox. Six months of winter lay between the two equinoxes when the sun was in the south.

The apparatus of Bhadsar is quite crude but by now the men had inferred the annual climatic cycles probably without counting the days and months in a year. Paleolithic tools around the menhir include some flattened crude stones referable to Mousterian (Fig.7.6). Accordingly, the level of this population is assigned as higher part of Middle Paleolithic around 40 Ka. A slightly bigger crude tilted stone of this type is also seen in Kachchh near the village Kuriani. It also has stone on the ground. It is inclined towards west and has served the same purpose as the menhir of Rajasthan. The equipment of Bhadsar has evolved from this simple type (Fig.7.5). Looking at the geographic position of the Rajasthan site one can think of a Munda like population living there in the past. The equinoctical termination of southerly stone may be conceived as providing a basis to divide the year into large segments of summer, rain and winter, as seen in the Mundari villages of North India. The equinoctical mark was used by the people to divide the year into segments of rain, winter and summer in association with the phases of moon repeating at fixed duration within each season. Month in Mundari means a large time segment of seasons and not a lunar month, viz. *Raba Chandu* (winter month),*Jargi Chandu* (rainy month) and *Jate Chandu* (summer month). The word *Chandu* itself is related to moon (*Chand*). Counting of month from first moon to the last vanishing moon needed merely a

figure of twenty seven (with-two days of no moon). Such a lowly counting system persists even now among the Munda tribes. They have ten (*gele-a*) and twenty (*hinsi*) but no thirty. Possibly, the summer of Bhadsar observatory commenced with the new moon after the vernal equinox and continued till new moon after summer solstice. It was followed by the month of rains till the autumn equinox when the rains weakened. The new moon after this event mark their winter month. This winter continued till the return of sun to the vernal equinox.

1B: Flat Stone Apparatus of Rajasthan and Kachchh

A considerably refined tool of independent line of development in astronomy is a flat, megalith standing vertical, thin and sharpened at the top. The thin edge of the menhir is aligned north-south. This is seen 17 Km from Jaisalmer on Jaisalmer/Pokharan road two kilometres before the village Basanbir which is possibly same as Basanpir in the toposheet (Fig.7.2). This stone is seen standing north of the road on a small hill feature which also contains a pair of *Dyavaprithivi* stones of astronomical relevance. A similar fallen stone is also seen in Kachchh on the bank of Berwali River where a number of flat megalithic stones exist associated with fire pits. Among the stone implements there is also a bolas for hunting birds and small animals (Fig.7.7). A comparable megalithic culture still lives in the Khasi Hills of Meghalaya (Fig.7.8). Commonness of the river names like Umium or Umia and Jowai in Kachchh-Rajasthan and Meghalaya suggest the migration of Khasis from Kachchh-Rajasthan tract alongwith vocabulary and names. The vertical stones in Kachchh and Rajasthan appear to be a Khasi heritage of the land left behind by the Khasis as they migrated away.

The vertical stone of Basanbir marked mid-day by its thinnest shadow since it is oriented north-south. The summer solstice was identified by the absence of shadow of this stone because the northern face of the stone is so shaped that sun will not cast any shadow on summer solstice. Its slope marked the angle of incidence for the local mid day sun on the summer solstice. The longest mid-day shadow of this stone marked winter solstice. The scattered tools on the hill belong to Early Perigordian and associated with erection date of the *Dyavaprithivi* figures. Since the Khasi population is older than *Dyavaprithivi* figures in the equinox finder pillars of the Lower Perigordian (approx. 26

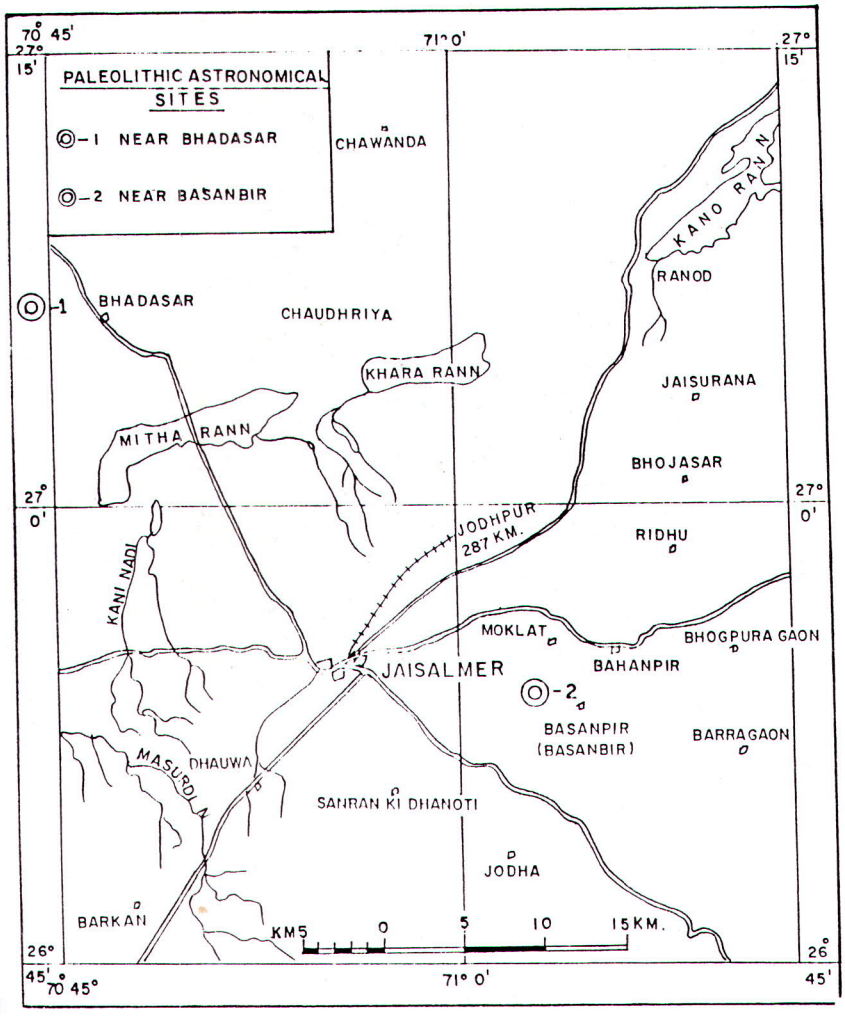
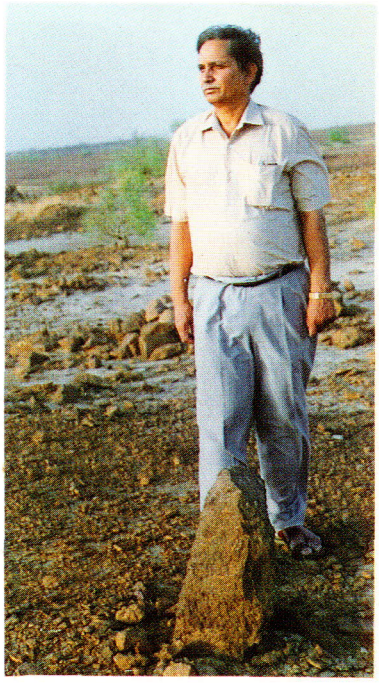


Fig. 7.2 : Paleolithic astronomical sites of Jaisalmer area.



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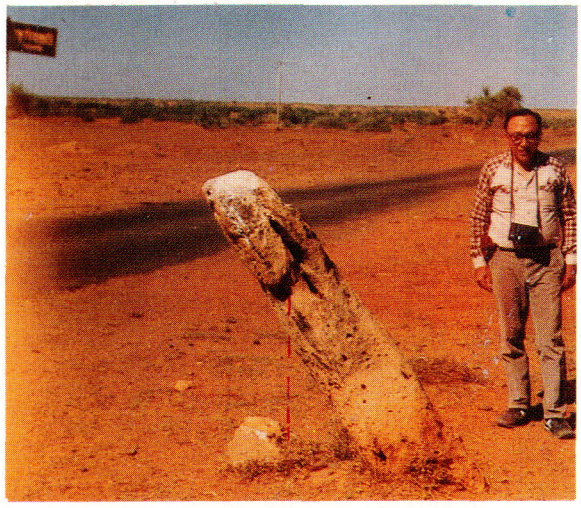


7.5

7.4

Figs. 7.3, 4 & 5: Early Menhirs in Rajasthan and Kachchh. *3- The little menhir of Bhadsar inclined to the east lies in a country now inhabited by none but once supporting a population with abundant Middle Paleolithic tools; 4- The mid-day maker stone has a notch marking the summer solstice and terminates close to the equinoctial point of shadow. Another sandstone marks the winter solstice; 5 - inclined stone by the side of the road near village Kuriani in Kachchh. Vertical shadow of the Kachchh menhir, on the summer solstice marked the beginning of year. The stone inclined due west casts an east-west shadow on the equinoctical day. The shadow of the southern edge of the inclined stone falls on a mark on the marker stone on the ground on summer solstice. Thus, the people of Kuriani were also observing the same division of the year—summer, rain and winter. The year in Kachchh, however, was designated as varsha or rain (again) because the vertical sun of 21st June was followed, on the same day with clouds and rains. Abd of Rajasthan was not applicable to this area.*

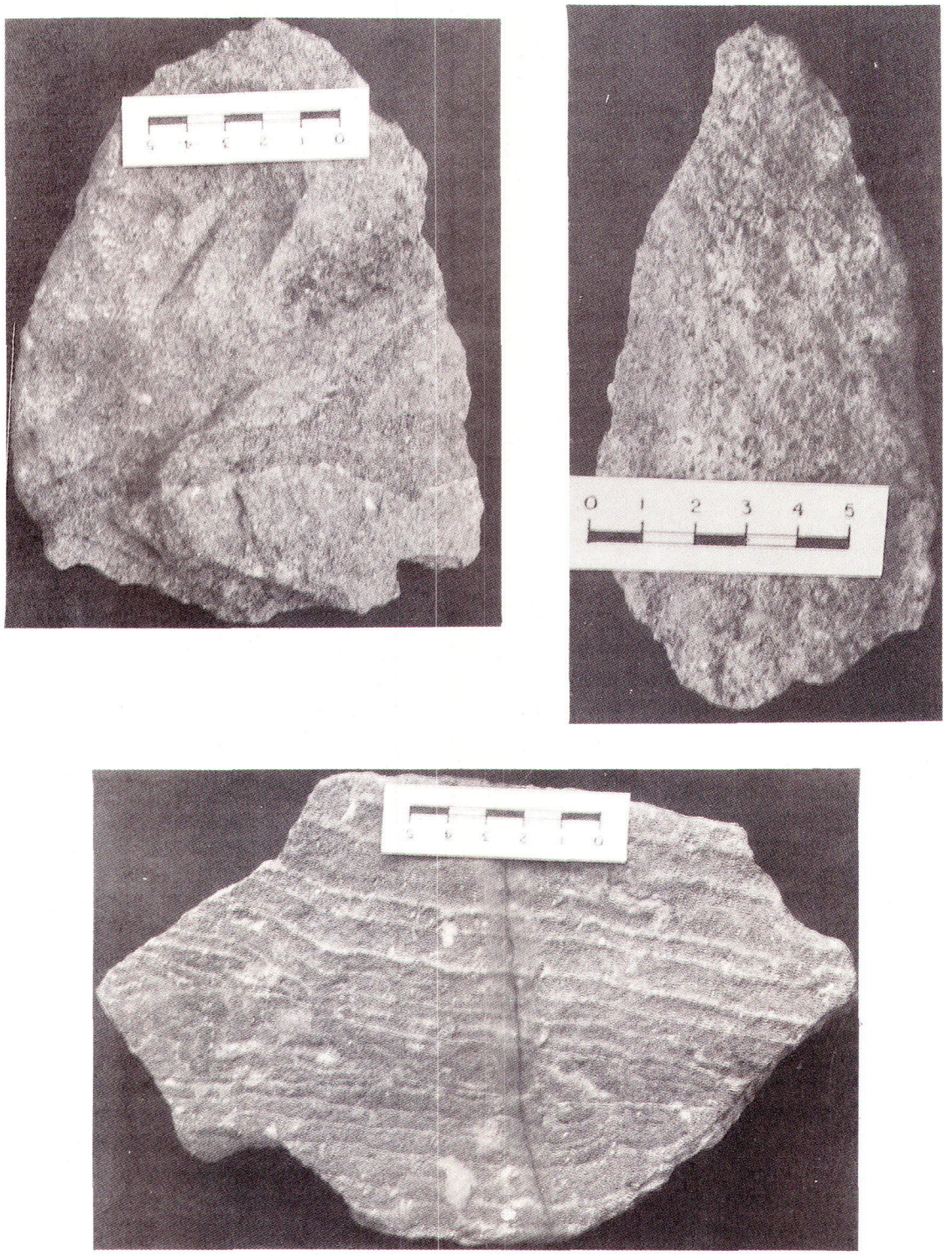


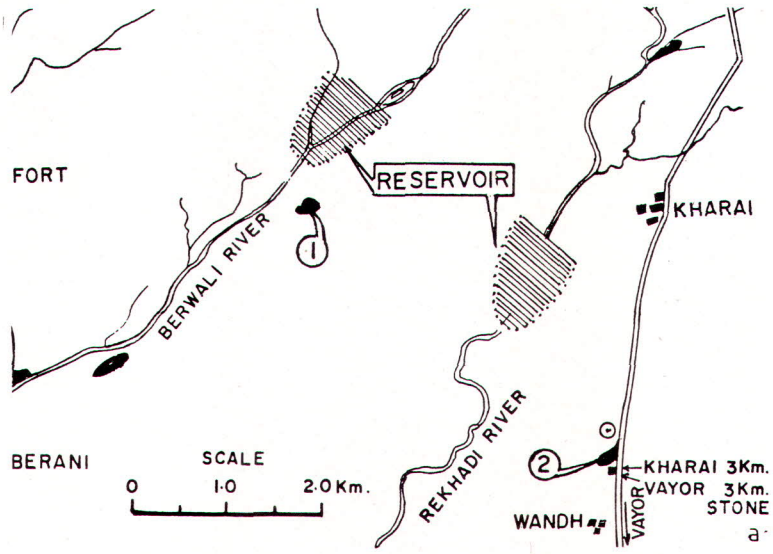
Fig. 7.6 : Primitive moustarian hand axes of Bhadsar. *These are fairly massive and crudely finished flake tools made out of the local sandstones.*

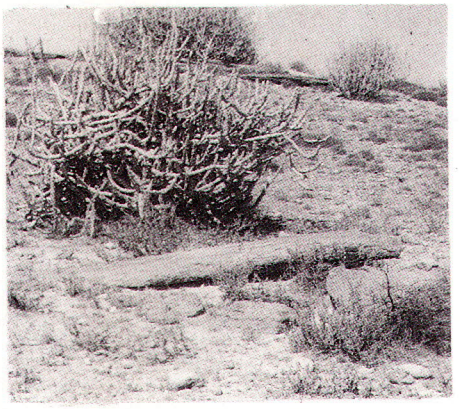
Ka) just to the north of this megalith, a notional date of 35 Ka is given for the Middle Paleolithic equipment of Basanbir. In Kachchh, the megalith may date back to even 40 Ka in view of the tools scattered around the megalith.

The structure of the megalith and its disposition at Basanbir suggests that the people related to the observatory would have been in a position to count the number of days between the two shadowless days repeating after a year.

The inhabitants in the Khasi Hills of Meghalaya, when conceived as migrants related to the megalithic heritage of Rajasthan, provide a fair idea about the achievements of those people living in Kachchh and Rajasthan during the Middle Paleolithic. The existing Khasi population contain a large mongoloid element migrating from the east (Gurdon, 1990). Subsequent to their migration to the Khasi hills, racial morphology has changed due to the dominance of Mongoloid trait even though the Khasi features are somewhat distinct (Fig.7.9).

Khasis have independent digit counts upto hundred: and, *hazar* has been adopted for thousand from Urdu. Apparently the megalithic people of the Khasi hills, related to megalithic men of Kachchh-Rajasthan, have the potential of counting 365 days in a year and also recognise the lunar divisions of a year with their calibre of counting. Since *bnai* in Khasi stands both for moon as





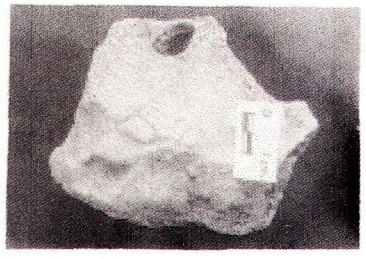


Fig. 7. 7: Megalithic remains of Berwali River, Kachchh. *a- map of the area showing locality; b- a flat megalith with fire pits; c- megalith comparable to the one in Rajasthan but much bigger; d- a hole bearing bolas for tying the string or rope.*

a

b

c

Fig. 7.8 : Megaliths of Rajasthan and Khasi hills; *a, b- Basanbir megalith; c- a grave yard near Cherrapunji in Meghalaya showing megaliths.*

well as month, these people could be taken to have been counting the moon related periods with reference to winter or summer solstices. This is strongly indicated by the initial names of months in a year as current among Khasis today. The year at Basanbir commences with summer solstice followed by rains. *Naithing, Naillar* and *Naillur* are the first three months of the year indicating the target, second and third. (cf. I: *nai*= *bnai*=month; thing = target, i.e., no shadow on target stone; II: *ar*-two in *Naillar*; III: *lur* three in *Naillur*). Target month, second month and third month correlate the megalithic men of Khasi hills with the megalithic astronomers of Rajasthan. Flourishing during the higher rain fall period in Kachchh-Rajasthan (Wurm II/III Interglacial) these people moved partly to Meghalaya when severe draught hit this area in Perigordian. The land left behind was, however, quickly occupied by *vedic* settlers from the Middle East migrating to the south in the wake of severe cold in north. Khasi people have continued later in the *vedic* tradition and retained their identity as *bynnars* or *vanars* till as late as 10 Ka, when *Ajs*, represented by Ram, turn to be the common rulers of this country.

2A:Primitive Equinox Indicator System

The target-stone system of marking the beginning of year by megalithic people by no shadow on the

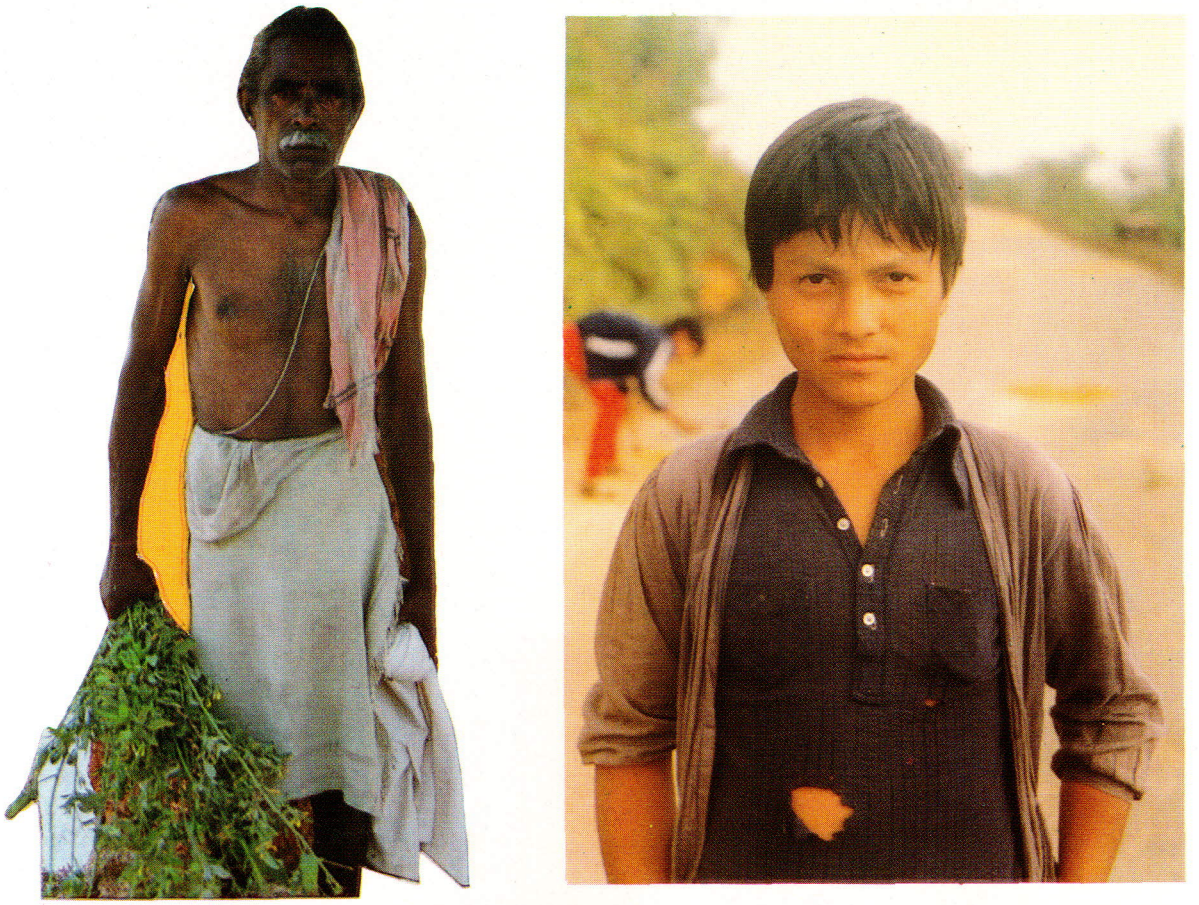


Fig. 7.9 : Migrated and modified Khasi population. *The initial migrants of Khasi Hills were possibly narrow headed people with sharp prominent nose as seen in the aborigines at Gujarat-Madhya Pradesh boundary (left). Interaction with mongoloid stock from the east has produced a mongoloid from with long face, sharp nose and poorly developed mongol fold of the eye lids (right).*

longest day of the year had a practical disadvantage. The no-shadow-period included a number of days. Marking of a year beginning was somewhat imprecise, therefore. This difficulty of annual periodicity was solved by the very ancient astronomers through another method—choosing the day of the east-west shadow of the first rising sun. It was only on two dates in a year, i.e. on vernal equinox (21st March) and autumnal equinox (23rd September). The astronomers also observed that solar movement from north to south or south to north was fast on these dates and both were comparatively better defined. Thus, there arose a new system of marking the beginning of the year based on the equinoctical position of the sun in combination with the pre-existing system of the longest and the shortest shadow. A composite instrument could divide the year into four parts. Such a device is seen close to the village Tendu Kheda in Madhya Pradesh (Fig.7.10).

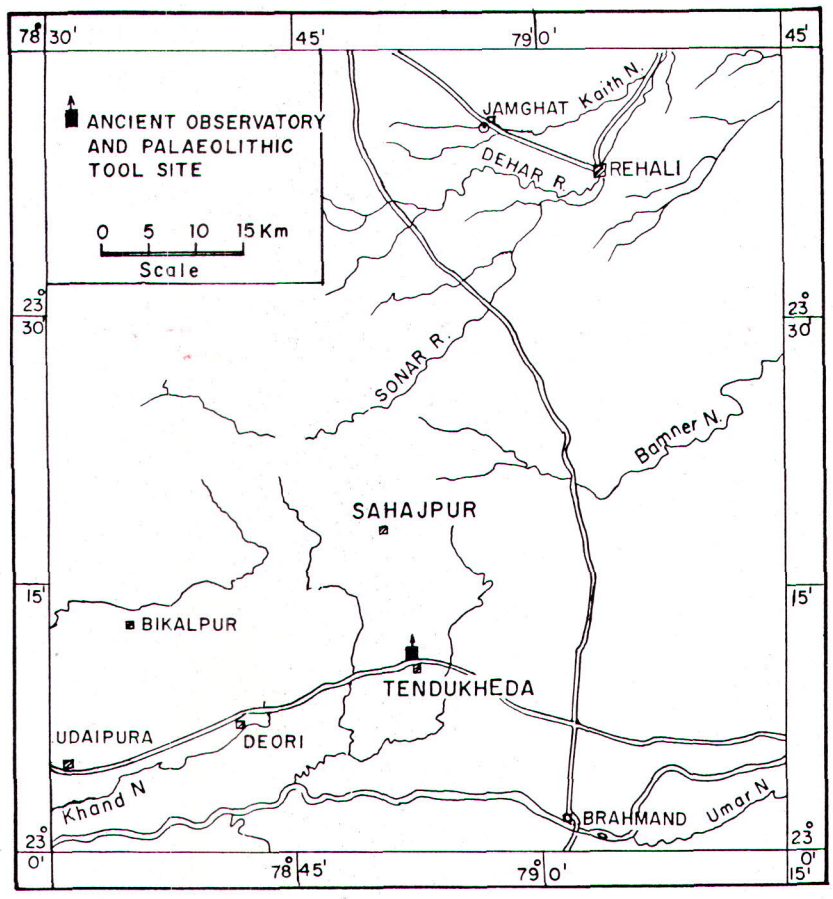


Fig.7.10 : Location map of Tendukheda astronomical site.

The Tendu Kheda astronomical site contains a large rough pillar to mark the day of longest shadow at the winter solstice (*Utran)* and the vertical shadow to mark the summer solstice (Fig.7.11). Two pairs of nearby east-west aligned stones cast exact east-west shadows on vernal and autumnal equinoxes (Fig. 7.12).

The associated tools with observatory site date back to Moustarian and the population is notionally assigned a date around 40-45 Ka (Fig.7.13). It is difficult to fix the exact affinity of these people. Probably they were Santhals or their kin some 45 thousand years ago.

2B: Vedic Equinoctical System of Dyavaprithivi

There is another astronomical apparatus at the megalithic bearing hillock of Basanbir comprising of a pair of engraved Perigordian pillars. It lies a few metres to the north of the megalith. Made of a rather neatly finished pair of north-south aligned pillars, where the southern pillar is higher than the northern, these are provided with carvings of human figures near the top (Figs. 7.5, 7.14). The head of the lower pillar contains a carving of the Mother Earth with unmistakable symbols of the Sun (left) and the full moon (right) on either side of her indicating a simultaneous rising of full moon when sun is setting. The male figure on the larger stone to the south of the goddess-earth-pillar denotes her husband in the *vedic* system (wife to the left in the Indian system). It could thus be only *Dyaus* the god of heaven. The pair relates, therefore,

unmistakably to dual God *Dyavaprithivi.* This notation also reflects the *vedic* level of substratum as indicated by the carving and identification of the *Dyavaprithivi.*

The disposition of male and female stones and their unmistakable identity with the *vedic* gods reflect the male dominating trend, typical of *vedic* people in contrast to the Venus worshippers of Europe during the corresponding Perigordian who were migrants from India at an earlier date. The long stone to the south casts its shadow every day on the small stone during mid-day.

The symbolization of sun-moon position, with the sun setting in west and the moon rising in the east denotes the date of *Poorn-masi* (full-moon) when the sun just sets on the western sky and the moon rises on the eastern horizon once in a lunar cycle of 29.5 days. Again, this is linkable to the aphorism *Sasmin Pournmasiti* [AST: 4.2.20].

7.11

7.12

Figs. 7.11, 12 : Astronomical equipment of Tendukheda. *11-Solstice marker on the shortest day of the year the stone cast the longest shadow on the white stone at the midday. The recorded position of the shadow on the mid-day of 16.1.94 is close to this stone. On the shortest day (23rd December), this shadow touches the crest of the marker stone. On the summer solstice, the shadow stone slightly inclined to the north, casts vertical shadow on the ground (Latitude 23° 10' of the spot). 12- Paired stones to the north and south of the solstice marker are aligned east-west and helped to determined the day of the east-west shadow or the equinoxes quite precisely.*

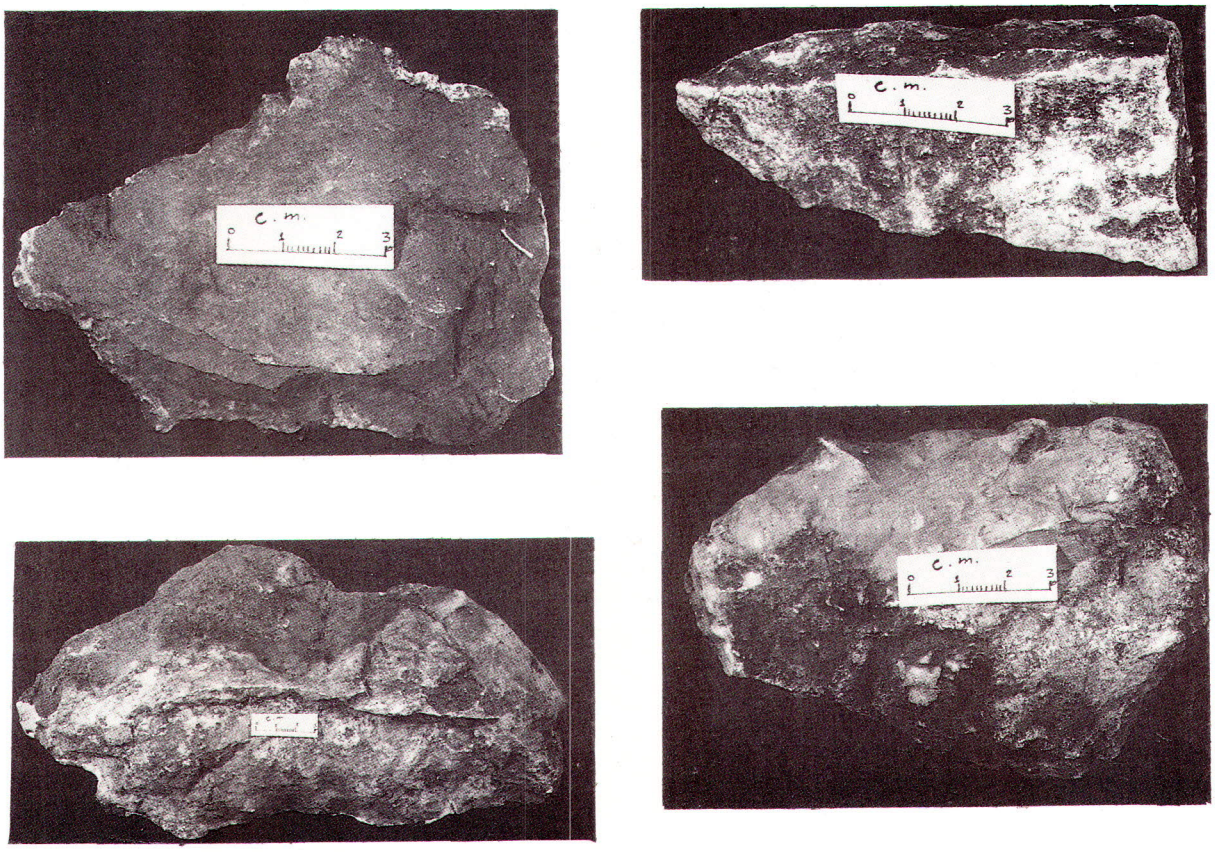


Fig. 7.13 : Implements of Tendukheda astronomers. *Typically these are very crude flake based tools and may accordingly be taken notionally around 45 Ka.*

The equipment of the two vertical pillars lies on a hill feature where the early morning shadows extend far to the west and there are markings of the equinoctical east-west shadow of early morning on the stones due west of these pillars. Also, the shadow of the taller stone on the smaller stone has been calibrated on this equinoctical day (mark X) while it was moving up (winters) and down (summers). This up-down movement of shadow is related to change in solar declination as indicated by enlarging or reducing shadows of the Khasi stone to the south of the paired stone. An accurate equinoctical mark was the best calibration point for defining a full moon and the beginning of a new month closest to the equinox with reference to the dates of rising stars or asterisms. Some marks are seen on the right side of the stone indicating the dates of rising stars or asterisms (Fig.7.15).

The *vedic* astronomers of Basanbir determined months and seasons by the inclination of the mid-day shadow of the pillar *Dyaus* on the pillar *Prithivi.* The twelve months of moon were counted with reference to the asterisms and equinoxes. An occasional 13th intercalary months therefore, for balancing the periodicity between the twelve months of moon and tropical months was invariably inserted in the calendar close to the nearest equinox.

The *vedic* people with this two-pillared observatory also noticed that asterisms of reference months were shifting from equinoctial position gradually. There are marks on the stone below the first marked equinoctical positions of asterism which relate to gradual shift of the sideral month if the star for the month remains the same. It is so because the shift of all the stars is nearly the same.

It is seen that a faint horizontal mark connecting the position of the solar mid-day shadow, denoting a key asterism rising on the day of equinox has shifted by 2° and 3°. The shift is also seen in other stars by the same degree. The key star of Basanbir that appeared on the eastern horizon exactly on the equinox day,

Fig. 7.14 :Stone implements and goddess of the lower pillar at Basanbir. *The implements - all flake type relate to the Perigordian. The feminine figure of goddess Prithivi shows the shadow of larger pillar Dyava, reaching to the navel while passing between her breasts on winter solstice.*

when the observatory was made, arrived about five days after equinox in the first case (2° solar declination shift) and seven days later in the second (3°shift). Accordingly, the observatory worked for nearly five hundred years.

Before the *vedic* people tried a tie up of asterism and equinoxes they had a calendar of twelve solar months as under:

Vedic months		Month beginning
Tapas	- Winter solstice	December 22
Tapasya	-	January 20
Madhu	-	February 20
Madhava	- Vernal equinox,	March 21
Sukra	-	April 20
Suci	-	May 21
Nabhas	- Summer solstice	June 21
Nabhasya	-	July 23
Isa	-	August 23
Urja	- Autumnal Equinox	September 23
Sahas	-	October 23
Sahasya	-	November 22

The gap between the two primary stars of the asterism demarcating the vernal equinox is around 17° of longitude as indicated by the *Prithivi* pillar. The asterism is accordingly *Uttara Bhadrapad* and date of the observatory around 24.5 Ka [Box 7.1].

Advance Paleolithic Observatory of Kachchh

In Kachchh, on the Naliya-Narayan Sarovar Road, just west of the mile-stone mark Kharai 3 Km—Waior 3 Km lies a mound like feature with five astronomical equipments (Fig.7.16). Three of these are clear, the fourth is obscure, and broken lately while the fifth is probably a counting stone only. The observatory owes its preservation for long time because of local superstitions and stories. These were located by the author in 1984, then studied occasionally. The equipments seen at mound are:

1. Equinox and Asterism Logger

This equipment contains a central pit with a burin inside that must have been standing vertically when the observatory was in use. The pit could have been filled with water, if so needed, for reflection of stars in the water. East of this pit lies a mark-stone and to the west a measuring slab (Fig.7.17-7.21). These two slabs and the burin are aligned eastwest (and at the present moment the compass reading is N 6° W and S 6 E° owing to the magnetic pole position shift). The measuring slab 12.3 cm in width, at the circumference size of circle with a radius of 3.14 cms, marks 2°15' as standard unit since another slab of the same width was also seen nearby (Fig. 7.22). These people thus were working on 160 units of a circle rather than 360°. This basic unit was nearly one fourth of the minimum angle between the sun and the first visibility of the mercury in morning sky.

There are a set of linear stones arranged north-south in alignment with the marker stone (Fig.7.20). One of these is to the north and the others to the south. Location wise these stones marked the longitude of the important asterisms (Fig.7.16). Rear point of the southernmost stone was at the angular point of 21 units, from the marker stone while the other to the north was three units apart. Accordingly, these people were aware of the rising latitudinal position of key asterisms and the limits of the principle ones have between *Jyestha* and *Kratu* (Fig.7.20). In between lay other asterisms. The above equipment was to calculate precisely the regular year (*samvatsar*) and after every fourth year, the leap year (*parivatsar*). They were also aware of a missed leap year, after four hundred years (*anuvatsar*). It may be seen that this equipment was a radical

Fig. 7.15 Relationship of solar declination, asterisms and equinoxes as indicated by *Dyavaprithivi* pillars of Basanbir. *X - equinoctical shadow; PB Purv Bhadrapad; UB Uttar Bhadrapad; A-B-C, limits of equinoctical full moon of Bhadrapad.*

The mid-day shadow of the male *Dyaus* pillar over the female *Prithivi* pillar reaches maximum height on the winter solstice when it falls between the two breasts of *Prithivi.* From this point it gradually travels downward, touches the ground with the commencement of summer and reached near vertical (87°) on the day of summer solstice. In between on the vernal and autumnal equinoxes, marked by the due-west-shadow of the *Dyavaprithivi* stones on the rock face yonder in the west, the shadow of *Dyaus* fell on a specific mark on the *Prithivi* stone. A distinct notch is seen in the stone here. Three marks appear to be related to this mark - one near the foot of *Prithivi* (I) 3° above the equinoctical mark, the other (II) 3° below from this reference datum while the third (III) is 7.5° below this datum. When these declinations are converted into degrees in solar longitude and days before and after the equinox they work out as tabulated below:

	Declination	Longitude	Days
I:	-3	-6°58′	-7
	(2°54′)		
	0 Equinoctical Mark: 0°08′ 20th March 1996		
I:	+3	+7°56′8″	+8
	(3°01′)		
III:	7.5°	+19°46	+20
	(7°36′)		

Total Duration between I & III: 28 days

There are marks too on the rightside of the *Prithivi* pillar. These are marks and lines that may be related to asterisms. Most prominent of these extend upto the middle of the pillar and were marked on the date of the construction or erection of the pillar.

The table shows that the duration between the time-lines I & III marks 28 days with a near mid point on 15th day from the first. It may be visualized that this was the duration of the lunar month when the one commencing with the full moon on mark -I would terminate on a second full moon on the III mark. If the full moon fell is in the first half, it is the *Purnima* of *Purva-nakshatra,* if later it was the *Purnima Uttar-nakshatra.* Fixing the nakshatra in the present case is not difficult. The longitudinal difference between the *nakshatra* before and after the equinoctial sun works out to be about 16°. This fits only with one set of *Purva* and *Uttara* asterisms among the three in the Indian astronomy. It is the pair of *Purva bhadrapad* and *Uttar Bhadapad* with longitudinal gap of 14°20' minutes. In contrast the other two pairs are separated by nearly 10° and 8° respectively. Accordingly the equinoctical month those days was *Bhadrapad.* The opposite or vernal equinox was marked by the pair of *Phalguni.* Logically, *Phalguni* means *Pa+laghum* or receding sun which was true when Basanbir equipment was made.

Among the three stars below the *U. Bhadrapad* longitudinal gap of 10° 47' between this star and the lower most is closely comparable to be gap between *Uttar Bhadrapad* and *Rewati,* i.e. 10°44'. *Rewati,* accordingly, marked the spring bloom those days.

Moon taking 28 days to pass between Full Moon to Full Moon was enabled naming of 28 *nakshatras* in a month. Every quarter of this lunar month makes a week. Seven days were possibly were named by the stories and other observations. Speculatively, Sun and moon are most prominant. They are figuring on either side of Earth, followed by Mars (*Bhaum* - son of *Prithivi*) and the favourites of Sun never reaching mid-heaven i.e., Mercury and Venus. To these are added the slow movers Jupiter and Saturn characterised by largeness (*guru*) and slowness (*sani-char*).

Box 7. 1: Key asterisms of *Dyavaprithivi* pillars of Basanbir.

improvement over the vertical pillars in Rajasthan because the latter measured the declination of sun and not its N-S shift. The measurements of the former equipment were never so accurate. Again, there was no measurement for longitudes of stars in the Rajasthan observatory.

Equinox Based Year Definer

This equipment intact during 1984, is now broken and fragmented (Figs.7.23, 7.24).It is compose of two parallel stones measuring six feet each and oriented in N68°E-S 68° W, standing about 80 cm above ground. Morning rising sun cast shadow of the easterly stone on the westerly stone. Every day the shadow of the easterly stone fell on the westerly stone with rising sun and that of the westerly stone on the easterly stone with the setting sun on different angles. There were two days in the year, the days of equinoxes, when there was only one shadow cast by both the stones. It was east-west connecting exactly eastern most edge of the southern stone and western-most edge of the northern stone (Fig.7.23). Again the setting shadows of winter solstice and summer solstice were on specific spots and these respective dates marked the beginning of the solar tropical months commencing with the month *Tapas*.

This apparatus was marker of the tropical year without invocation of *nakshatras* and the months were being counted with reference to the winter-solstice or *Tapas* which was marked 91 (or 92) days after autumnal equinox.

Solstice Indicator

The equipment is made of an inclined flat stone, dipping 24° in S 70° E (Fig.7.24). Its principle of indicating winter or summer solstice is based upon its longest shadow on winter solstice (Fig.7.25). If a pendulum is hung from the apical

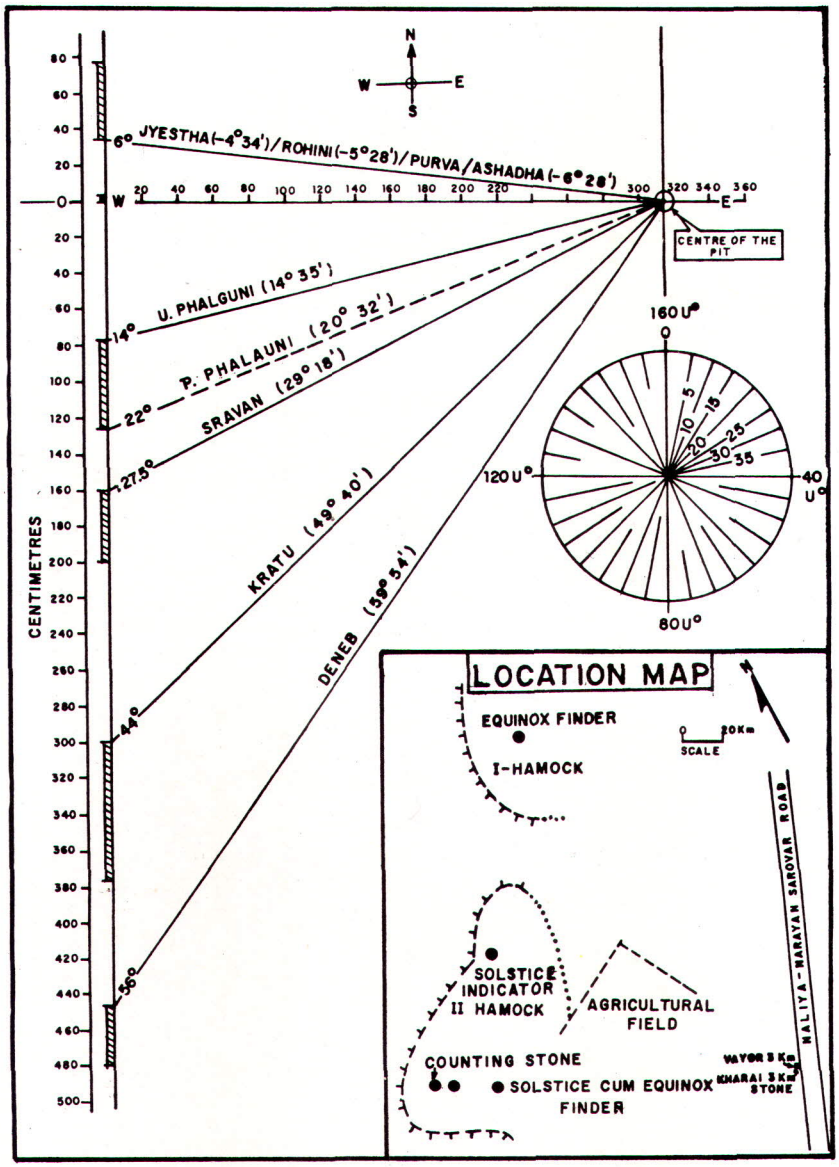


Fig. 7. 16 : Location of Wandh equipment near Kharai-Waior 3 Km mark and important asterisms indicated by the asterism logger.

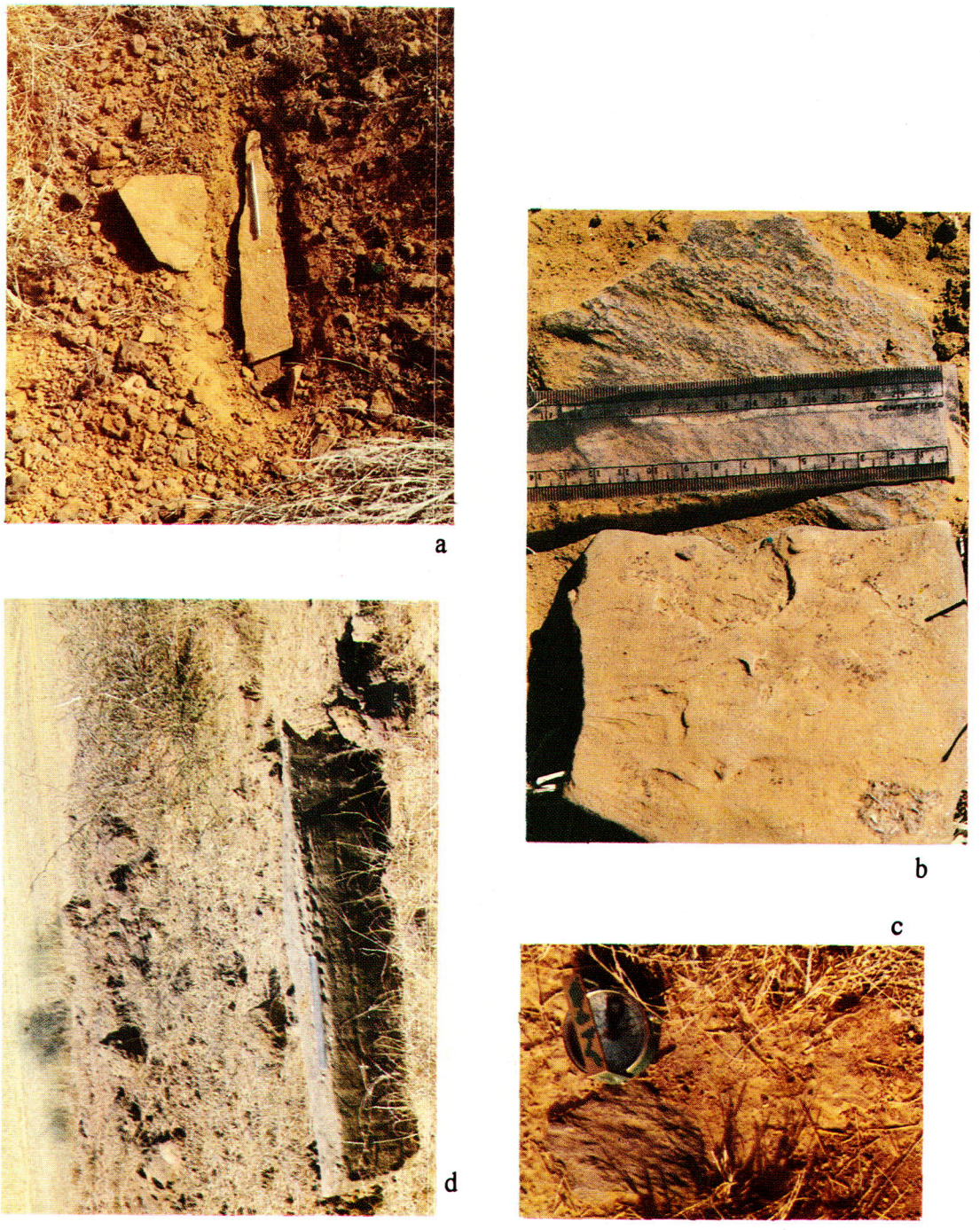


Fig. 7.17 : Measuring artifacts of Wandh astronomers. *a- burin in the pit of asterism logger; the artifact was dug out of the pit and placed exactly on the spot where from it was recovered, b- degree measuring stone representing basic unit of 2.25°; c- orientation of the marker stone to the west of pit; d- Counting pillar.*

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Fig. 7. 18-21: Equinoxes and asterism marking equipment . 18- *The marker pillars are to the east (➔) and west of the pit, nearly knee deep pit from which a burin was dug out (Fig. 17a) ,* **19** *Disposition of easterly and westerly measuring stones, ;***20.** *East-west alignment of the easterly reference stone (➔) with reference to the pit (➔) and marking stone (➔) as seen from the west;* **21**- *same objects as seen from east, A is the reference stone.*

mid point of the stone it makes a shadow at right angle to the mid point of the shadow on winter solstice. The shortest shadow made by the exactly vertical sun, had a specific angle with reference to the perpendicular point and the base of the longest shadow. These two points were monitored regularly for the *Uttarayan* festival and setting of rain or *varsha* which just followed the summer solstice. Instead of length, however, they measured angles. *Varsh* (year) and *varsha* (rain) are interlinked since ages. *Nabhas* beginning on 21st June also means the same—the cloud and rain. Remarkably, the date of Monsoon in Kachchh is too close to summer solstice (Fig.7.26). Accordingly, *Nabhas* as year was as available to them as *Tapas* marking the travel of sun from south to north when the original calendar was set around 25 Ka.

Obscure and Broken Chronometer

A pair of parallel thin stones oriented north south (350°-170°) are seen on the ground separated at a distance of about 121 cm (Fig.7.27). It was possibly a time-measuring equipment or some kind of clock. Its preservation, however, is too poor to give any definite idea about the equipment.

Counting Stone

It is a linear stone with ten prominent grooves. Probably it was used in connection with long time count like the periodicity of Saturn or Jupiter which involves several years. Also probably the stone was used systematically for marking long cyclicity involving *Parivatsar* in four and *Anuvatsar* in four hundred years. There are streaks and marks on the stone suggesting that such an exercise was being attempted regularly during those days.

Period of Construction

The stone implements and the burin in the pit suggest that these instruments belong to Upper Paleolithic. Since the observatory is fairly advanced and devoid of Perigordian figures, it was much younger than the Perigordian system of Basanbir. The identification stones denote three asterisms precisely *Purva ashada*, *Purva Phalguni*, *Purva Bhadrapa* (Fig.7.20). *Purva Phalguni* was the eqinoctical star during Shatpath Brahman. Hence the date of this advanced observatory is fixed around 11600 years BP. There is no reference anywhere in the *vedic jyotish* about a system of 160 units in a circle. It must have disappeared along with hundreds of branches of *vedic* knowledge.

Emergence of *Vedic* Arithmetic

The *vedic* people while counting the periods of planets like Saturn or Jupiter and attributes of asterisms, planets, sun and moon were involved in complex computations—all of oral and of mnemonic type. *Vedic* arithmetic apparently was their invention at this stage of evolution and is an outcome of such an exercise carried out for hundreds of generations during Upper *Vedic* period between 15 Ka and 11 Ka.

Impact on the Evolution of Consciousness

The *vedic* period has its relevance mainly in establishing a new era of the human existence with exalted consciousness. Man ascended beyond the physique and physical self of an animal. The *vedic* population excelled in intellect, memory, training of mind, language, grammar, astronomical observations, computations and classification of the heavenly bodies. There were no written words those days and memory and logic were the wealth of men combined with the faculty of extremely focused mind. Such a mind acquired potential for introversion of consciousness. The consciousness so focused proceeded on three fronts. Firstly, in intellectual excellence involving astronomy, arithmetic, language and grammar; secondly, rituals for *vedic*

gods and goddesses, and, thirdly, penances and *yog* to attain *brahm*. The then population of Sindhudesh was content and there was not much of material to allure them. The Perigordian figures are seen to disappear when we reach to observatory of 12 Ka. There are no figures, there are no beads and no efforts for beautification of a human body. Strangely enough, the idolatry and figure-building which entered India with the figure of *Dyavaprithivi* in the early *vedic* period seems to have disappeared during the later *vedic* age. The later astronomical sites in Kachchh are devoid of any figure on the stone blocks. The faculty of concentrating on the material and divine forms has, thus, vanished in the later *vedic* population due to their intense mental activity for grammar and arithmetic leading to introversion. Introversion, in turn, was tied to the egoless-ness that was a major shift from the external world of open eyes and ego-building involvements. Closed eyes during intense memorization facilitated the consciousness to move toward meditation and *samadhi*. The memorization of the *vedic* texts, also lead to unfolding of the previous births, says Manusmriti. This gave a conviction among the men that human life is not merely a one-time chemical reaction. An individual lives beyond the physical body after crossing the fence of death and then gets reborn. The concept reached far and wide in the *Yajniodesh* and has its echo in the drawings of Catal Huyuk.

The evolutionary process in the man, thus, gave birth to a new lineage of men defined by their mind, traits and actions and not by physical morphology. It was a *yogi* during the Upper *Vedic* Period.

The over all philosophy among the men, ultimately, shifted during the upper *vedic* period from worldly enjoyments to improvement of the next birth and discovery of *brahm* as final goal. Carrying out a dutiful householders life with rituals was followed rigorously all life till the last ritual of the father at the death-bed gifting away every thing to the progeny. The rituals generated strong moral pressure on each individual for a life of good conduct.

In the organization of *vedic* community, recapitulation of past births was as much a driving force as memorization and meditation for gathering the consciousness energy to ensure a better birth. The *vedic* learning, therefore, established a quality of life among men which the west could never think of.

Atharvved and *Tantra*

The upper *vedic* generation of *brahmans* settled in *Brahmarshidesh* and elsewhere, developed extraordinary understanding about consciousness as an energy regime . They discovered the power of consciousness that could be operated upon by concentration on *mantras*. They could, through this energy, cure a sick or kill a healthy man.

It was in this scenario that the tradition of *vidya* which was dormant during lower *vedic* age, emerged as a powerful culture for attainment of *brahm*. *Vidya* was not classified as *ved* during the initial phase of Manusmriti, i.e., around 14 Ka. *Upanishads* refer it to as *Atharvangiras vidya*. Later, during the Mahabharat period around 7 Ka, the *Atharvangiras vidya* was named as *Brahm*, *Mahi* or *Atharvved*. Its value for enlightenment as also *tantra* was a well established fact in the *vedic* society.

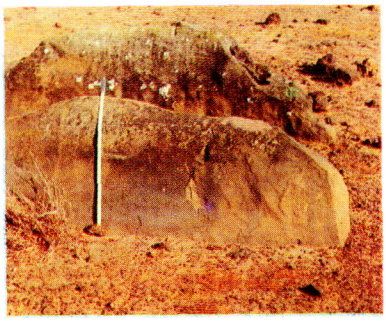
The *Atharvved* contains 5987 *mantras*. About 1/6th of these are in prose and the remaining are composed in the same fourteen meters as in other *veds*. Copious material in this *ved* is also seen as a modification from the *Rigvedic* verses.

The *ved* dwells considerably on matters related to *brahm*, enlightenment and eternal life. Of equal importance in the *ved* are *mantras* related to *tantra*. Considerable mistakes have been committed by the western scholars in the study and interpretation of the *mantras* in *Atharvved* due to their complete ignorance of the meanings as applicable with respect to *tantra*.

The *brahman* associated with *Atharvved* is only one—the Gopath Brahman. There are no *aranyaks* in this *ved* and it has to be assumed essentially due to synonymy of *aranyaks* and *upanishads*. Thirty one *upanishads* are ascribed to *Atharvved*.

The *tantra* and *yog* have similar type of penances to begin with and, for long time the *sadhana* also goes

parallel. *Sadhana* for *yog*, relates to astral body and *brahm* while that of *tantra* to *buddh* body and *atta*. However, in *sadhana* for the *yog*, one is not permitted to go beyond *dhyan* till *sat-dharana* (pure-inner self)



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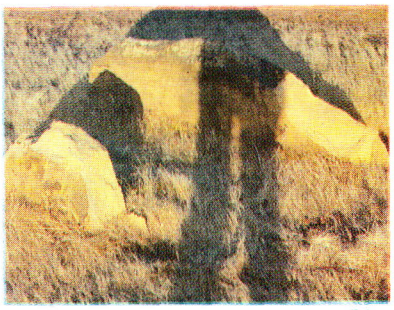

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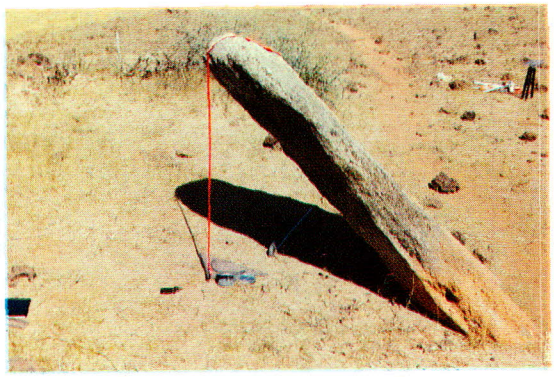

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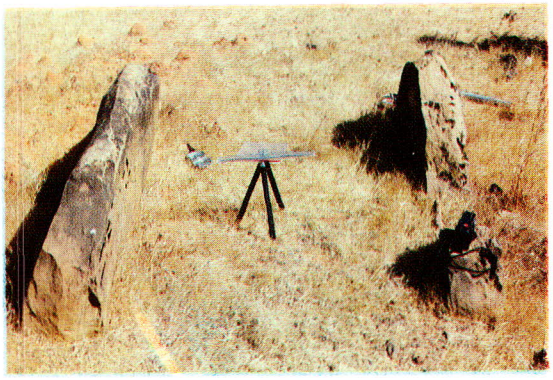

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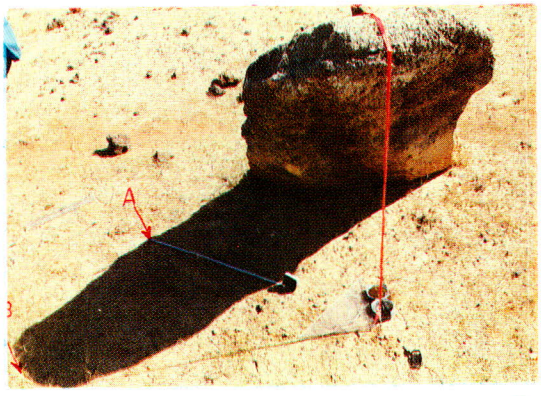

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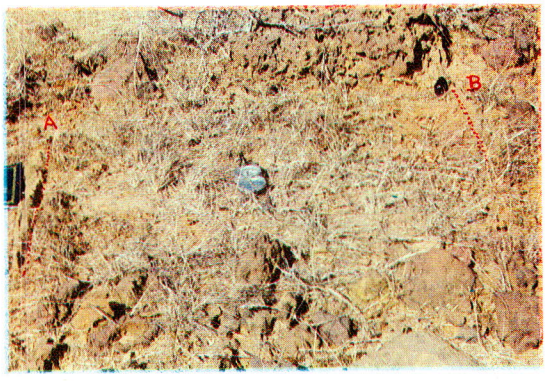

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Fig. 7.22-28 :Ancillary astronomical equipments of Wandh. *22-25 - Solstice-cum equinox indicator; 22, 23 - Complete equipment as seen from north and west (1984) marked with shadow direction (↔) of the rising and setting sun on the equinoctial days (1991) broken equipments showing the shadow of early rising sun on the winter solstice day and the direction of shadowless early morning on summer solstice.*

is reached. *Dhyan* when carried further could lead to *samadhi* and later to *brahm*. *Tantra* includes essentially the operations for *moksh* after reaching to *brahm* and dissolution of astral body. Much corruption, however, crept into this system of *sadhana* and a *tantrik* became most feared and despicated man of society due to the fallen sensuous practices and vile acts in a later deterioration of *Atharvved.*