# Vedic River Systems

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#### ABSTRACT

Tradition of learning and memorization in India has passed down the most ancient knowledge of the world in the form of four books in Sanskrit - Rigved, Samved, Yajurved and Atharvaved. The first among these is most extensive and voluminous, comprising of over 10000 verses. A Perigordian sculpture of Dyaavaaprithivee on Jaisalmer-Jodhpur highway near Basanbir, 17 kilometers to the east of Jaisalmer, suggests worship of Vedic Gods during Upper Paleolithic, around 25 thousand years ago (Jagadishomrityunjay, 1997). The upper limit of Vedic culture is 3.5 Ka, later than the appearance of chariots. Span of Vedic period is, thus, over 21000 years between 25 thousand years (Ka) and 3.5 Ka.

Rigved provides extensive and, at times, elaborate descriptions of the paleochannels in the Western India and Pakistan during the Vedic age. For the paleochannel systems, verses of Rigved have to be analyzed as per the traditional Sanskrit grammar and interpreted within the scope of geology.

The author examined Rigved for good descriptions of rivers. Twenty one stanzas of Rigved, describing the past water arteries in detail, are translated for the paper. The cited verses mention more than fifty paleochannels in the Northwestern India – Pakistan between 25Ka and 3.5 Ka. These fall under six river systems or river clusters:

Brihatsindhu System	6.5-3.5 Ka
Brihadashvina System	8.5-6.5 Ka
Brihachchhutudree System	11.5 <b>-8</b> .5 Ka
Brihatpureeshaani System	14.5 -11.5 Ka
Brihatsarasvatee System	20-14.5 Ka
Brihanmarut System	25 -20 Ka

A reconstruction of past channels shows that there have been merely 14 - 16 main rivers in the Western India-Pakistan, which are named differently during successive river systems. There are physical, astronomical and intrinsic descriptions in Rigved to decipher the order of superposition of Vedic River Systems also and the life span of individual river systems.

Major catastrophes, tectonic events and sea level changes are responsible for disappearance of older and appearance of new river systems. New names, however, are linked to appearance of new human populations after a little gap of time.

A major cultural and population shift is seen around 8.5 Ka near the Pleistocene/ Holocene boundary corresponding to a sudden fall of temperature in the Arabian Sea. At this level, the earlier ratio of 1:1 between the masculine and feminine river names falls below 1:25. This datum also forms the boundary between the Lower and Upper Rigved.

Migration of astronomers during the period of uppermost Paleolithic shows a close

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fit with the global lowering of temperature between 14.7 Ka and 11.6 Ka. The Perigordian figurines of Basanbir were also scratched by the new migrants from north during the Last Glaciation.

The channels of the six river systems are reconstructed after considering the tectonics of the region as evidenced by the deep sea data, deltas and shorelines besides overlap of relict channels on the land.

The much discussed lost channel of 'Sarasvati' was a contributory of River Sindhu between 6.5 and 3.5 Ka. It has neither dried nor disappeared. Its present name is Beas. There are two sets of drying and disappearing 'Sarasyatees' - distinct in association of channels. The younger set among the two was between 8.5 Ka and 6.5 Ka. Formed firstly by Beas and Sutlej together, it joined the triplet of Sarasvatee-Apaya-Drishadvatee near Delhi. It ended as a stagnant Sarasvatee (Vinashan S.) when Beas-Sutlej joined the Indus drainage. Then, Apaya or the present Yamuna was renamed as Sarasvatee, to justify its literal meaning - mighty river. It was named subsequently as Seelamavatee around 6.5 Ka, and then Yamuna as of today. The second set of Sarasvatee constituted the Brihatsarasvatee System during 20 and 14.5 Ka. The whole of this river system was renamed as Pureeshaani drainage between 14.5 and 11.5 Ka. The vestige of the once mighty Sarasvatee is now a defunct Sarasvatee in Gujarat.

#### **INTRODUCTION**

Most ancient prayers and rituals in Sanskrit have moved from one generation to other through memorization since ages. The ancient information is now called Ved or Shruti (memorized knowledge). Veds are four in number – Rik, Yajus, Sam and Atharv. The first among these or Rigved is most voluminous and comprises of over ten thousand verses. There are ten chapters (mandals) in the book. It is commonly believed that chapters 2 to 7 of the Ved constitute the older Rigved while the remaining chapters 1, 8, 9 and 10 were composed later (Dwivedi, 1982).

The Vedic cult, culture, people and paleorivers attracted the western scholars soon after translation of Veds in European languages (Oldham, 1886). The Vedic rivers turned out to be the objects of primary focus by many investigators and erudite (Avasthi, 1953). Macdonell and Keith (1912), the authors of 'Vedic Index' assumed and believed that the Vedic period was very short. Their Vedic land or the home of the 'Indo-Aryans of the earliest period' commences with 1200 BC and ends around 500 BC between 35° N and 28 N° and 70 E° and 78 E°. In their opinion, description of various Vedic rivers and tribes covers merely a duration of 700 years. Their map of paleochannels of Vedic land is based merely on presumptions and beliefs that do not meet strict scientific requirement for fixing the names and courses of Vedic Rivers in geomorphology.

Analysis and conjectures of Vedic Rivers by Avasthi (1953) are in no way technically different in approach than Macdonell and Keith (1912) and fundamental deficiency and errors in the identification and mapping of channels exist because the assumed period of Veds remains small. The trend has traveled from early twentieth century to its end when geoscientists are at the helm. As a result, River 'Sarasvati' of Macdonell and Keith (1912), Valdiya (1996) and Sridhar et al. (1999) are different on map since none of them mentions first why do they consider two rivers of Rigved – Sarasvatee and Sarasvati as same - as required in Science; and, which verse of Rigved provides the type description of their 'Sarasvati' among over two hundred verses devoted to Sarasvati and Sarasvatee. Due to same deficiencies in every reconstruction of Vedic rivers during twentieth century, these cannot be treated as scientifically constrained or credible. Any attempt in the reconstruction of the Vedic rivers must probe first precisely the total duration of Rigvedic culture based on every scientific information available.

It is now being realized that the duration of Vedic period was far beyond the 700 years assigned by Macdonell and Keith (1912). Radhakrishna (1999) assumes the period as 6000 years between 4 Ka and 10 Ka, but there is no basis. The beginning of the Vedic period, on the artifact evidence of Dyaavaaprithivee pillars with Perigordian carving (20 Ka - 30 Ka) is already noted (Jagadishomrityunjay, 1997). The pillars on a mound near Basanbir on Jaisalmer - Jodhpur highway, 17 kilometers east of Jaisalmer, suggest an astronomical date of 24.5 Ka (Fig. 1). There is another artifact evidence in a room of Harappan city of Dholavira in Kachchh, which fits with the 'solar-movement-house' described in Rigved (RIK.10.75.1). Dholavira habitation dates back to 4.2 Ka to 4.5 Ka as per the literature on the excavation site.

The upper limit of the Vedic culture is, however, younger than Dholavira habitation. The intrinsic evidence in Rigved itself fixes it. Profuse mention of war chariots in Rigved and their first appearance in history around 3.6 Ka (Reader's Digest, 1983, p. 118) establish that the upper boundary of Rigved is younger than 3.6 Ka.



Fig. 1. Dyaavaaprithivee (Heaven & Earth) Pillars of Basanbir. The female figure of Earth has a large spheroid of sun to her left (A) and a small one of moon to her right (B). In her pose of reference direction (looking north), the scene depicts a setting sun on western horizon and a full moon on the eastern horizon. Apparently this was the date when people marked a new month or a new year.

Vedic period is traditionally treated as older than Purans wherein date of Mahaabhaarat war / coronation of Pareekshit is a good date for separating the two. This event is around 3.4 Ka in view of the chronology in Purans which specify a gap of 1050 years between Nand and Pareekshit (Bhargava, 1956). Upper age limit of the Vedic period is fixed here as at 3.5 Ka accordingly.

With the new evaluation of chronology, the ten chapters of Rigved were not composed in just 700 years after 3.5 Ka. They cover a geologic span of around 21000 years before 3.5 Ka. Veds are primarily a document of events and cultures of Upper Stone age through New Stone age. This was the period when people composed and memorized the Vedic hymns through generations of bards. They sang about the polar star being circled by the bears in the Caspian Sea region as well as the croaking of frogs in tropical India (RIK. 7.103.1-10; RIK. 1.24.10). Contrary to the hypothesis of Macdonell and Keith (1912) and prevailing belief which still takes the date of Rigved a short duration around 3.5 Ka, the Vedic culture covers a very long duration of 21 Ka and a wide stretch of land geographically. In the east, it extended up to Hazaribagh where Harappan seals have been recorded (Jagadishomrityunjay, 1997), and in the west, up to Ankara in Turkey. A ritual measure of Swastika found in Alakahoyuk dates back to 4 Ka - 5 Ka (Temizer, 1969, fig. 57). Swastika seal has been found in Harappan culture (Mahadevan, 1977, fig. 118). Thus, there was a period in past when Vedic culture spread between east to west for a distance of about 5000 kilometers and from the tropics of Gujarat to chilly lands around Caspian Sea in the north.

Seemingly, the Vedic land has seen a period of tectonic activity, sea level changes and major shifts of river courses in Northwestern India and adjacent Gangetic plains. The people dwelling there for long twenty one millennia passed through roughs of climate during glacial and warm epochs of Late Stone age besides the blistering heat at the beginning of Holocene. They have indicated the dates of their existence in the Vedic literature and grammar. Evidence is also available about their large scale movements and migrations.

Rivers and their courses were the first objects man has cared to understand in his pursuit of geography – especially in Northwestern India with fourteen long and perennial water arteries. These were the waterways inhabited by people and helping them to move about to long distances. Care was also given by them that a truthful person describes them accurately.

Indus of today is an example of a River System where five major tributaries form the trunk river. Such systems have existed in Northwestern India and Pakistan even during Vedic past. The bards describe these in detail. In their descriptions, six major River Systems have appeared and disappeared during the Vedic age. The people who lived during their existence described each of these as an object of worship.

The paper looks into the chronology of Rigved emerging from astrological data, artifact evidence and some key similes, related to human prehistory. A probe is attempted into the human response to catastrophes and harsh climatic changes during the Vedic past. The data were finally integrated with the author's own translation of twenty one stanzas of Rigved to establish a succession of River Systems in Northwestern India. The River Systems are informal chronostratigraphic units. The author reconstructs the important shorelines and deltas of Vedic period and then fixes the likely course of the six River Systems on the land between their origination in the hills and termination in deltas. Their dating takes into account the levels of tectonic activity and catastrophes in the

geologically active and climatically responsive region.

# TRANSLITERATION OF SANSKRIT WORDS

The paper deals with the Vedic works Sanskrit language. Some of these words in are mentioned in the Roman script, here and there. A deformation in pronunciation of Sanskrit words is seen in their transliteration into Roman script without special notations. It is quite common with the terminal letter of Sanskrit words because of a consonant (very short), short, medium, and long termination of words (Vvanjan, Hrasv, Deergh, Plut). These cannot be easily reflected in the short or medium terminations of consonants in English, e.g in but or plate. Special notations (Macdonell, 1916) are used for transliteration of Sanskrit words in English. In such a system, a terminal 'a' is added commonly for a medium terminal sound corresponding to 'd' in played. In absence of special notations, however, a transliteration with a terminal 'a' changes a masculine word like Aj (goat) into its feminine form Aia (she goat) in Sanskrit. Such is the difference between actual pronunciation of Ved to Veda (when the latter is read out from OED).

In the paper, an approximate phonetic expression of Sanskrit words is provided in the Roman script without special symbols or notations. However, since the Roman script lacks consonant termination of Sanskrit, the last letter of a word is added an asterisk ('\*') to denote consonant termination. Thus, in Marut\*, Marut and Maruta the first indicates a consonant ending almost corresponding to 't' in *but*, the Marut has a 'vowel', as the 't' in *boat* and, lastly, Maruta has a long 'a' as in *villa*. In conformity with this usage, Veda in OED has been spelt as Ved. In the transliteration, the short and long sound of I, EE, U, OO correspond to sit, sweet, put and boot. A long 'a' has been spelt as 'aa' in the middle of the word, where it is emphasized, e.g., in Mahaabhaarat. E is seldom short in Sanskrit as in bet; it denotes the vowel sound in *gate* or *wait*. There is no 'v' like sound in Sanskrit corresponding to Vat; it is used uniformly here for 'w' in water. In Box 1, Sanskrit text is given in Devanaagaree script to facilitate a better analysis and understanding by a grammarian.

#### **DEFICIENCIES IN PREVIOUS WORK**

Translation and interpretation of Veds commenced in the nineteenth century in Europe for a diametrically different purpose for which they were memorized and then carried forward for thousands of years. Devout Vedic men chanted them for the power of mantras. European scholars were keen to learn about the people, land and culture of the Vedic tribes. Western understanding of Veds misses this point. The mindset of the intellectual West cannot go beyond the literal meaning of the Veds.

In general, the earlier western translations of Veds are hurried, lax and, often, incorrect due to cultural distinction of the western scholars and their followers from the actual composers of hymns in Veds. An exemplary case in the 'Brahman is the Master among Ten Husbands' is discussed elsewhere (Jagadishomrityunjay, 2002). Aim of these translations was not to render a text, conforming strictly to the scientific, cultural and grammatical understanding of the surviving Sanskrit texts, but an approximate knowledge of the bulky Veds in shortest possible time for historical and cultural background of the past people. These translations have found their way in several interpretations related to cultural evolution of men, River Systems and life styles of people in ancient India (Majumdar, 1951 and Macdonell and Keith, 1912).

There are innumerable shortcomings in the western translations. Their application for reconstruction of past lands, rivers or cultural frames is bound to introduce errors. Unless the errors get rectified, credibility of any inference from a western Vedic text will remain far from perfection.

#### Later Alteration of Hymns

In the Veds, as also traditional Sanskrit, knowledge has moved for thousands of years through memorization. The process has introduced addition of new compositions gradually as the material has moved in time. Thus, the original 'Jayam' with 8000 verses now stands as Mahaabhaarat with above 100000 verses (Iyer, 1977). The same is also seen in Manusmriti, wherein the initial instructions for life style were composed in about 150 verses, now spread in chapters 2 to 6 (Jagadishomrityunjay, 1997). In the primitive society domesticating cows, gifting only cow or vak (mithun) to father-in-law was in vogue (MAN.3.29). Present form of book covers even royal functions. It includes 2677 verses in all and 1055 verses in chapters 2 to 6. It is a seven fold increase in original composition of chapters 2 to 6 and eighteen fold increase by addition of new chapters.

Veds are no exception in later alterations of hymns. It was immaterial so long alterations were in prayer of a deity and used as mantr. They exhibit multiple insertions of verses and alteration of original text in different hymns. In Rigved, most ubiquitous and occupying about two thirds of hymns, are stanzas related to wealth (no older than  $\sim 7$  Ka), fancy dress materials (< 5 Ka), fast moving war chariots and associated items (< 3.6 Ka). The other part of the same hymn, intrinsic evidence shows, is much older.

Chariots, as mentioned earlier, appear merely around 3.6 Ka in human pre history. Being much younger in age, their ubiquitous presence in Rigved, in almost one third of hymns, leaves us with no options but to treat the verses with chariots, gold and wealth as later insertions. Either such hymns are wholly post chariot compositions by wealth chasing priests or, as it seems in a good number of verses, chariots are younger insertions in the older hymns. Two examples of intrinsic evidence for older compositions in the Rigved are here.

In the chapter 6 (Older Rigved), one of the hymns contains type description of River Sarasvatee (Box-1, items 5-9), which describes the river as 'vaajebhis\* pravaajineevatee' (RIK.6.61.4) or copiously watery through multiple channels. The same hymn also prays another river merely as 'vaajineevatee' or watery, which is also named differently as Sarasvati (RIK. 6.61.3). Sarasvatee and Sarasvati are two different rivers with distinct spellings and defining attributes. The first one is copiously affluent channel with several contributories, while the other existed only as a watery river. The latter or Sarasvati is described as a tributary of Sindhu in chapter 10 (Younger Rigved; Box-1, item 20). Its prayer is inserted in chapter 6, during the lifetime of Sindhu around 4.2 Ka as a discrete river of Indus System. At this period the mighty Sarasyatee was no more there in the Vedic land, as discussed later.

Likewise, just before the type description of Marut wherein River Sindhu figures as a tributary (Box 1, item 4), even an independent description of (Seven) Sindhu Rivers is given with a qualifier 'Ri-Da-Na' or 'major rivers' referring to the period of Saptsindhu (seven channels) much later. Time of the verse, as per the description, is after cows were seen moving together (undomesticated?) and horses formed a 'captured and roped food' before their domestication ~ 10 Ka (RIK 5.53.7). The same hymn also contains a reference of chariots, no older than 3.6 Ka (RIK. 5.53.10). Thus, the cited verse of Older Rigved (RIK.6.61) shows two distinct additions and alterations, inserted several thousand years after the original prayer was sung describing River Marut.

Whole of the Rigved is replete with additions and later alterations of hymns, which have not been considered for analysis in past in the reconstruction of Vedic past. The unfiltered information of Rigved is untenable in any scientific work relating to past people and their cultures.

#### **Causes of Alteration**

Rigved is a collection of prayers for several deities numbering over a hundred. Logically, there was no harm to a devotee when he added a few more verses in the prayer of his revered deity; instead, a reward was expected. Hence there was no bar in adding new verses. At the same time, due to long time span of the book, if a river had disappeared or changed its configuration, the new description had a logical insertion with a new defining adjective or a distinct spelling, e.g., Sarasvatee and Sarasvati.

#### **Erroneous Translation**

Tradition of Vedic cult, it may be mentioned, flourished basically for accreting the power of mantr. Mantras are used for three purposes: firstly, for the self purification and peace, secondly, for desired achievements earthy, heavenly and mixed; and, thirdly, for eating the healthy food of consciousness (CHH. 5.18.1). Veds were merely a reservoir of mantr power and were memorized for the same. Only those qualified in traditional grammar owed the responsibility of protecting Veds by its correct pronunciation or interpretation (VMP, Anh. 1).

Fascination of western scholars for the meaning of Veds was for inferring the living conditions, traditions and history of Vedic people. It resulted ultimately into a quick look and guesswork understanding of Veds through erroneous translations of hymns. Avasthi (1953) has pointed out several errors in the western translations in context of Vedic geography.

Translation of Veds is a complex topic (Sharma, 1977). Western scholars see defects even in the most acceptable traditional explanations of Saayanaachaary (14<sup>th</sup> Century AD) because he gives different meanings of the same word at different places. Only a person who possesses a time free mind to memorize Veds was permitted to go for their interpretation only if a grammarian.Bulky 'Vedic Concordance' (Bloomfield, 1906) and its likes were not to be touched in such an exercise.The traditional approach is missing in the western translations and these are no credible documents for reconstruction of Vedic past.

#### **Fallacy of Aryans Migration**

On account of hurried and erroneous translation of Veds, the western scholars floated

a fanciful idea about the origin of Vedic people in Europe. They propagated a catchy theory of Aryan migration from European region to India (Chatterji, 1951 and Ghosh, 1951). It relates to a bias of nineteenth century European mindset, because in the Aryan Theory "one group of North European race is declared as a higher race" (Nesturkh, 1963).

In a careful and critical evaluation of Rigved, one of the verses translates "He who laughs at Rikshaads or is (our) liberator from Aaryaas (dwelling) in Saptasindhu, O Vinrimn! bend upon for killing the Daasas too" (Box 1, item 1). Aryans constituted a tribe in Saptasindhu country like Rikshaads and Daasas in other parts of Vedic land. The three were aliens to a fourth tribe, which occupied Rajasthan and figures in the next stanza in They were Vyashvas (Box the same verse. 1, item 2). The Saptasindhu country covered Pakistan with seven water arteries-River Sindhu, Payas\*, Shutudree, Subhaga, Vipaash, Vipaat\* and Urvi. Vyashvas were dwellers of Rajasthan of today, it appears. As discussed later, it was a time when Daasas were migrating to north due to rise of sea level in Gujarat during 10 Ka rise of sea level.

Aryan theory is blasted in its face by an illustration in Catal Hoyuk, Turkey, dating back between <sup>14</sup>C 7.5 - 8.8 Ka (Calendar year 8.5 and 10 Ka) (Jagadishomrityunjay, 1997, fig. 5.1Bi). In a scene of hunting of stag and pig, there are ten participants - 7 blacks and 3 whites. The level of Catal Hoyuk correlates approximately with the Aryan habitation in the Saptasindhu country of India. The then Turkey region, believed to be a cradle of Aryan migration (Ghosh, 1951), was flooded with blacks migrating from tropics in south. Contrary to the Aryan migration of whites to India, Turkey was dominated by blacks those days. Rigved does not support migration of Aryans to India. Instead, a grammatically correct translation and available data from Turkey support their endemic habitation in India (Sastri, 1951, Jagadishomrityunjay, 1997 and Frawley, 1999).

#### Lost Traditions and Word Meanings

In a verse of Rigved, the bard compares the meandering movement of Sindhus or 'Seven Sindhu Rivers' with the 'ropedfood-horses' (Syannas\* Ashvaas\*) being dragged slowly to their enclosure near a human habitation. The rivers were meandering from the straight path like such horses jumping to the left and right of the way while men were dragging them as prey. The stanza denotes a time when there was no cultivation and horses were hunted for food during Magdalenian before their domestication. Roussot (1978, fig.29) has illustrated the head of one such horse. The described situation and simile relates to around 10 Ka. Unless we look into pre historic aspects of Vedic culture, there is no chance of inferring precisely the meaning of Si (tie) +Annas\* (food)+Ashvaas\* (horses). Similarly, it is impossible to render exact meaning of 'Karurvochaatisadane vivasvatas\*' till discovery of a solar movement temple at Dholavira (Fig. 2)

In the verse cited above, Da-Na in the word Ri-da-na refers to River-Male or Big River. It has evolved into Nad (River masculine) with a feminine form Nadee. Its contemporaneous word Vaana (Va: water + Na: male) does not evolve this way, however, there are innumerable such examples in Rigved related to etymology and grammar which need right evaluation for a realistic translation. A good translation of the Vedic text needs far more analysis and skill in grammar if it is for use as a scientific document. Jagadishomrityunjay



**Fig. 2. Stone chronometer in the solar movement house of Dholavira.** *A: View of the room, B: Crown of Northern pillar.* The lathe finished Sualings or solar pillars, oriented north-south, were kept in a room about 5m high. A circular beam of sun fell in the room from a hole vertically above the southern pillar S in a 5m high ceiling. Position of site on 23°52'35''N: 70°12'04''E is almost half a degree north of Tropic of Cancer. On summer solstice (21st June), shadow from the crown of pillar S fell on point P between the marks below and above. On winter solstice (21st December), crown of northern pillar N exhibited a shadow of its head on the rim (Incl. ~47°). Due to their morphological similarity with male genital organs Sualings became Siv-lings in Pauranic tales.

# No Concept of Type Description

Those who attempted reconstruction of Vedic rivers were unaware of the concept of type description of rivers before attempting their layout on a map. There are hymns in the Rigved, which provide a good, coherent and detail description of river clusters with main river and its tributaries. Mostly, however, there are enumerations of the same river names as deities alone with other deities. The earlier reconstructions of water arteries miss this point and get lost in comparing or making synonyms of the rivers separated by time gaps due to the lack of a concept of type description.

#### Incorrectly Fixed Names of Vedic Rivers

Macdonell and Keith (1912) provide the course of paleorivers in the map of Vedic India. However, there is a disparity between the position and number of channels in the descriptions of Rigved (RIK.10.75.5) and the map. For instance, in the tributaries of Sindhu, the hymn declines rivers Ganga, Yamuna, Marudvridha and Arjeekeeya as duel. It suggests that each of these channels had two rivers - great and lesser. In their reconstruction, authors have not only shown them as single rivers but also as unrelated to the original description. Whereas Arjeekeeya and Marudvridha are tributaries of Sindhu in conformity with the original description, Ganga and Yamuna are same as modern rivers, more than 800 kilometers east of Sindhu. These two rivers are not described as independent channels outside Sindhu drainage in Rigved. Hence their depiction in map is baseless.

Again, Sarasvatee River, by spelling and description, falls in four river systems, discussed later. First, it figures as Sarasvati along with Gange (two Gangas), Yamune (two Yamunas) and Shutudree as a tributary of Sindhu (RIK.10.75.5). Second, spelled as Sarasvatee it lies in three other systems. It is in the cluster of Sarasvatee System (RIK.6.61.11). Then, it is one of the nine rivers constituting the Brihatpureeshaani System (RIK. 6.49.7). Lastly, it is a river in the triplet of Aapaya-Drishadvatee-Sarasvatee (RIK.3.23.4). In addition, there is a non Vedic reference of Sarasvatee in Manusmriti (2.17), associated with Drishadvatee but without Aapaya.

In the reconstruction of Sarasvatee Rivers, Macdonell and Keith (1912) pick up only a single Sarasvati, nearly corresponding to the now defunct and dry channel of Ghaggar. If there are no two Maruts, Arjeekeeyas, Gangas and Yamunas in their map, no wonder when four Sarasvatees are also understood as only one river. Though scientifically untenable, their depiction is accepted widely either as such (Majumdar, 1951) or as a concept of a singular Sarasvatee that is dried up now (Radhakrishna and Merh, 1999).

A new dimension was added to the study of paleorivers of Northwestern India with the arrival of satellite data, especially LANDSAT. A regional analysis of Vedic paleochannels, their shifts and piracies is now better understood with the availability of space imageries. These have been critically analyzed by leading geoscientists and a state-of-the-art contribution presented in the papers of 'Vedic Sarasvati' edited by Radhakrishna and Merh (1999). Sankaran (1999) has summed up the overall progress in resolving the issues related to geological understanding of making and unmaking of a Sarasvati, now believed to be lost in the deserts of Rajasthan. A moot

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question, however, remains unanswered at this stage. Which of the four Vedic Sarasvatees is shown on map as a defunct channel and which have remained unnoticed by Sarasvatee fans?

There are over fifty channels described in the type descriptions of Rigved (Fig. 3, Box 1). Presently or even in past, merely 14-16 major channels were flowing at each time plane in the Western India and Pakistan. Of these, name of only one channel has survived till date that retains almost the same geographic locale since its last Vedic course. It is Sindhu. All other names have disappeared. Why, then,



Fig. 3. Paleoriver traces between Aravalli Range and westernmost Aravalli lineament. Delhi-Sargodha ridge seems to have a major role initially. Later, subsidence along westernmost Aravalli lineament acquired importance in a gradual shift in the main drainage from east to west.

are we searching only the Vedic Sarasvatee? What about other fifty and odd Vedic channels in time and space?

Sarasvatee is important in religion because bards have regarded her as a goddess of intellect and prayed fervently; but in geology, it is just one of the fifty two names of channels that need their placement on a map of Vedic land. Scientifically, we must dwell upon the total scenario of river courses during Upper Paleolithic and Holocene of Northwestern India and not only one river.

#### APPROACH AND METHODOLOGY

There are shortcomings in the previous studies mainly on account of: a) erroneous translation of Vedic text, b) allocation of very short duration to Vedic period without any basis, and, c) geologically unconstrained placement of Vedic channels on a map on the basis of present names and geographic position of rivers. In the reconstruction of Vedic geography and rivers, there are three areas of attention: a) the boundaries of Rigvedic land to which the river were restricted, b) date which separates the Older and Younger Rigved and river systems within each, and, c) chronology and drainage area of each river system.

In the new approach, attempt is first to fix the chronicle of Vedic events for establishing the duration of the Vedic period. This is possible through refinement in the astronomical dating based on Rigved, Paanini Grammar and other works. Physical proof of Rigvedic deities like Dyavaaprithivee at Basanbir near Jaisalmer and that of the solar movement house at Dholavira in Khadir Island prove very useful in this context. Thirdly, use of specific words like 'spun Sarasvatee' or the 'tied-food-horses', in the similes of Rigved have specific time connotation and help in the dating of past channels.

For mapping the paleochannels, their names have been established through original descriptions from Rigved (Box 1). Verses of Rigved were scrutinized for coherent and elaborate description of main channels and their tributaries. Later description of the channels as goddesses and ensuing alteration were eliminated. Through the original descriptions, main channel and supporting tributaries comparable to the present day Indus System are identified as a river system

There are only 20 stanzas in the chapters 3, 5, 6, 8 and 10 of Rigved that fulfill criteria for erecting channel systems. These were translated by the author in the traditional method for descriptions of rivers (Box 1, items 3-22). Type descriptions provide over fifty five names of rivers (Boxes 1 & 2). Fifty two of these belong to the six River Systems during Rigved. The Northwestern India and Pakistan was the region where the rivers originated and traversed through its terrain during the Vedic past when bards of Rigved have lived and sung hymns. They have left behind a series of dry channels in their past land (Fig. 3)

The territory of the Rigved land is almost same during the six River Systems. Hence, descriptions of major channels and their tributaries in the different chapters of Older and Younger Rigved are due to their different names at different time levels of Vedic age, it is inferred.

The systems are arranged in the order of superposition with the help of nomenclature pattern. Sanskrit grammar and commonness of river names between two systems. Besides evolution and likely shift of drainage during Rigved was also considered (Fig. 4). Some help is also available from the history of the occupants of the Vedic land and their migrations. Ages could be assigned to each system based on astronomical dating, artifacts and similes in Rigved besides migration of people.

There is an anastomosing network of defunct channels in the space imageries of Northwestern India, once the land of Rigved people. Identification of past rivers or tracking their courses is challenging due to their large number. Shorelines and sedimentation pattern of the past in the adjacent Arabian Sea and Gulf of Cambay extends a helping hand in the reconstruction of Vedic channels. Based on the available data, the six River Systems have been described and mapped. Nevertheless, the courses of the past channels are merely an approximation to their reality of a bygone era.

An evaluation of changes in the language and culture of pre historic Vedic population shows some significant levels when men seems to have arrived as new comers to the Vedic land or, at times, moved away suddenly from this territory to some safer heavens to mitigate the adverse developments in the Western India and Pakistan. Since the tectonic activity and catastrophes responsible for change in the channel courses or termination of river systems are not the only factor in naming of the channels, and human migrations have their equal share in the process, the paper dwells on the stress and migrations before attempting the chronostratigrapy of the River Systems.

The dates mentioned in the paper are in calendar year before present unless

mentioned otherwise. For this purpose, earlier reported dates of Upper Paleolithic and Holocene, related to <sup>14</sup>C dating, have been updated applying a generalized correction.

#### CHRONOLOGY OF VEDIC EVENTS

Macdonell and Keith (1912) place the chronicle of Vedic events only between 3.2 Ka and 2.5 Ka and restrict the Vedic cult to Northwestern India alone. They refuse to accept the names of Vedic deities in the excavations of Bogazkoy, Turkey, dating back to 1700 BC. Discovery of the sign of Swastika in Harappan seals of Indus valley and in a ritual standard from Alacahoyuk establish that such beliefs and convictions are erroneous. Vedic religion was far more extensive between India and Circum-Mediterranean countries during 4 Ka and 5 Ka.

With a better understanding of Indian protohistory and Quaternary geology of Northwestern India, there has been a tendency for downward revision of Vedic period although conservative view that Veds are younger than Harappan period is still accepted (Pandey et al., 2003). Attempted below is an updating of the chronology of salient events during the Vedic period based on the relevant data under three heads – Astronomical dating of Veds and Paanini grammar, human artifacts and similes in Vedic hymns.

#### Vedic Chronicles in Astronomy

One of the methods used for Vedic chronicles relates to the precession of equinoxes with reference to nearly fixed stars like Chitra (Spica). For instance, on the new moon day of the vernal equinox of 22<sup>nd</sup> March 285 AD, sun and moon were occupying same longitudes in

ссрыкін AN- MARUT (I)	SAL	SARASV ATEE		SARAS		PUF	REE-			HUT- REE )	ASH- VINA	SINDHU (VI)	RIVER SYST	E <b>M</b> S	RIVERS		
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											Div	2	-	5.53.8			
_											Krumu	3	Narmada	5.53.9			
											Kubha	4	-	5.53.9			
_											Marut	5	-	5.53.8			
											Pureeshinee	6	•	5.53.9			
											Rasa	7	Jhelum	5.53.9			
											Sarayu	8	-	5.53.9			
		_									Antariksham	9	-	5.53.8			
											Sindhu	10	Sindhu	5.53.9			
			_								Ai	11	-	6.61.11			
											Aapaprushee	12	Sindhu	6.61.11			
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	+										Subnaga	20	Jnieum	3.33.3			
											Vipaasn	21	Ravi	3.33.3			
											Vipaat	20	ramuna	3.33.1			
											Urvi	29	Chenab	3.33.3			
											Asnvina	30	Jneium	8.26.19			
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	200	\a		0.5 1	\a 3.0						Shubhra	32	-	8.20.19			
							1				Shveta	33	Ravi/Swat	8.26.18			
							2	2			Silveta Varee	34	Chand	8.26.18			
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					V		8	5			Gomatee	40	-	10.75.5			
						-	9				Mehatnu	41	Mahi	1075.6			
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Fig. 4. Succession of river systems during Vedic period

sky in a planetary aspect called conjunction. Fixed star Chitra lay just opposite to them (Lahiri, 1984) on the daybreak, when sun was rising on eastern sky, Chitra was setting in the west, 180° apart. After 1715 years, on the vernal equinox of 21st March 2000 AD, fixed star Chitra did not have the same relationship with sun. Due to slow westward movement of the equinoctial position of sun with reference to 'fixed' stars or Nakshatras, Spica was 24° above the western horizon and the gap between Chitra and sun was about 156°. In 2000 AD, Chitra set in the west 24 days after vernal equinox, that is, on 14th April (Lahiri, 1999). This principle of shifting of equinoxes towards west, 1° in 72 years, is used for dating the events in Vedic calendar (Dixit, 1969) as also Ashtaadyaayi of Paanini (Agrawal, 1955). The dates calculated this way are, however, far too young compared to those indicated by human artifacts of Basanbir, Paleolithic observatory of Kachchh (Jagadishomrityunjay, 1997), and the 'Solar Movement House' of Dholavira besides endemic similes in Rigved. Pundits did not care, while carrying out the exercise of dating the Vedic past, that their parameters are not the same as used by the Vedic astronomers in fixing the beginning of nakshatr based month.

Jagadishomrityunjay (1997) detected a basic error in the computation of astronomical chronicles of Vedic literature and Ashtaadyaayee of Paanini. It relates to difference of parameters for a new year during Vedic age and current Indian calendar after 285 AD. In the existing tradition of Indian astronomy, the daybreak marks the beginning of a tithi (date), month or year. During Vedic period, the new year or the first date of the first month commenced with the night of full moon nearest to the vernal equinox as evident from "Esha h samvatsarasy prathama raatris\*: this verily is the first night of the year" (SPB.6.2.2.18). This is also indicated in the telltale picture of Basanbir pillars (Fig. 1). An aphorism of Ashtaadyaayee defines "Saasmin\* Paurnamaaseeti" (It is the full moon of that nakshatr by which the new month is named; AST. 4.2.20).

The present practice since 285 AD marks the first month of the New Year or the Chaitr when Chitra sets in the west at the daybreak. It is not the way, the star Spica defined the first evening of New Year during Vedic age. Then the new month of the year was named after a star setting with the equinox-day-sun while moon was rising on the eastern sky. Ideally, the vernal equinox was defined by the evening of full moon or near full moon, when Chitra was setting with sun while full moon was rising on the eastern horizon. Then alone the Vedic New Year commenced with the month of Chaitr. This date is around 13000 years before the vernal equinox of 285 AD.

As per the concept of Vedic tradition, the new year of 285 AD commenced on the full moon night of Saturday, the 6<sup>th</sup> March, when moon was at the eastern horizon while sun was setting. This was the Vedic month of Saatabhisaj, not Chaitr, by Vedic tradition.

The calendar reforming astronomers of 285 AD have simply omitted the Vedic principles about marking the New Year or naming the months. Accordingly, the available calculations of Vedic events based on westerly shift of equinoxes are in error. Unless the conceptual error of 285 AD is corrected, the dates calculated without correction, reach hardly beyond 3500 years. It is contrary to the

find of Dholavira artifact, described in Younger Rigved and dating back to 4200 to 4500 years ago - a thousand years before the earliest astronomical date calculated till date. Jagadishomrityunjay (1997) introduced required corrections and tabulated some prominent dates in Vedic chronology. These are arranged in Table 1 with some other important dates about Vedic past.

#### Table 1. Important events during Vedic period

- I. Prayer of Paired Ashvinees (RIK.1.157.1) 3.5 Ka
- II. Sookt 19.7 of ATH. 4.3 Ka
- III. Solar movement house of Dholavira 4.2 - 4.5 Ka
- IV. Year commencing with Purva Phaalguni conformed through artifact evidence of Kachchh astronomers (SPB.6.2.2.18) 11.6 Ka.
- V. Year commencing with Uttara Phaalguni (SPB. 6.2.2.18) 12.5 Ka
- VI. Samvatsar commencing with Chaitriki (AST. 4.2.20) 14.7 Ka
- VII. Induction of Swati as a Nakshatr (Spica-Arcturus separation  $\sim 13^{\circ}$ ) 20.3 Ka
- VIII. Year commencing with Shravistha (AST. 4.3.34) 22.8 Ka
- IX. Asterism marking at Basanbir 24.5 Ka

In the above sequence, date of Basanbir pillars around 24.5 Ka and its astronomical signatures could not be seen in the descriptions of Rigved. However, in the chapter 5 verses 41 to 60 though highly altered and inserted with multiple Gods (Vishvedevas\*), there are prayers of Dayus\* (deity Heaven and Prithivee (deity Earth) besides River Marut. The last has been confused by later composer with the war gods Marut\*.

The artifact evidence of the astronomers of Kachchh constitutes the best

evolution of a Paleolithic observatory. It shows the acumen of astronomers. They were using 160 divisions in a circle (Jagadishomrityunjay, 1997, fig. 7.16). The new find of the solarmovement-house figures in Rigved clearly (RIK.10.75.1; Box 1, item 18).

The highest date of Rigved relates to the paired Ashvinis (Arietis Beta and Alpha) seen and prayed in Braahm muhoort (early morning). These were nearly 15° above the sun in east on the then vernal equinox around 3.5 Ka (RIK. 1.157.1). The low magnitude stars were lost in the glow of sun soon. The date is after the first chariots were in vogue around 3.6 Ka.

#### **ARTIFACT DATES**

#### Dyaavaaprithivee Pillars of Basanbir

The dual deity pillars of Basanbir constitute an astronomical apparatus just north stone chronometer on the of a still older same mound (Jagadishomrityunjay, 1997, fig. 7.8a, b). During the Vedic period, the New Year commenced with the full moon just after or before vernal equinox. The figurine of deity Earth has a large circle of sun to her left and small circle of moon to the right in her standard orientation of looking north (Fig.1). It defines an evening of full moon when sun sets in the west and moon rises in the east. Such was the basis of marking the beginning of month or year by a full moon. The mid day shadow of the Dyaus pillar was on the navel of Prithivee on the winter solstice (Jagadishomrityunjay, 1997, fig.7.14) while the vernal equinox shadow fell on the foot of the earth-pillar (Jagadishomrityunjaya, 1997 fig. 15).

There are marks on the Earth pillar suggesting the 28 days span when a full moon

could define the New Year when the shadow of Dyaus pillar coincided with foot of Prithivee pillar. There are also marks of asterisms of Earth pillar, and by the identification of asterisms and applying the principle of precession of equinoxes, the erection date of Dyaavaaprithivee chronometer is fixed around 24.5 Ka (Jagadishomrityunjaya, 1997, box 7.1). The date falls in the Perigordian (32 Ka – 20 Ka), indicated by scratched carvings.

#### Paleolithic Observatory of Kachchh

Jagadishomrityunjay (1997) has reported an advance observatory from village Wandh of Kuchchh. The observatory has several elements for complex observations and computation of movement of stars and marking the days of equinoxes and solstices (Jagadishomrityunjaya, 1997, figs. 7.17-21). The astronomers of those days were working with 160 divisions in a circle. The advance observatory of Paleolithic was constructed around 11600 years ago or even a thousand years earlier.

# Solar Movement House of Dholavira

In 1990, the author was struck with the astronomical relevance of a pair of lathe finished Sua-lings or Siva-lings of stone in a room at the Harappan excavation site of Dholavira, aligned north-south [Suan: Sun + Ling: indicator]. The room harboring them is without a roof now, and partially buried pillars do not indicate their exact height (Fig. 5). The room served the purpose of monitoring annual motion of sun and counting the days between two summer solstices.

Conceivably, a beam of mid day sun fell on the head of the southern pillar from a

hole in the roof. It is almost for three days on summer solstice when sun is nearly stationary on latitude 23° 26'(Tropic of Cancer). The shadow of the southern rim of the pillar touched point P (Fig. 2). Then it moved towards northern pillar where the same phenomenon was repeated on winter solstice after 180 days. The year had, thus, normally 360 days of moving sun and five days of stationary sun designated possibly as 'Sua-ling days'. The Kaba temple of Mecca worked on the same principle of 5 days of stationary sun and had 360 idols for 360 days. Mohammad destroyed the idols when he runs over the Sun temple of Mecca in 612 AD (Mian, 1968). The lathe finished heads of the two pillars fixed the Sua-ling days precisely.

There is a reference of a solarmovement-house in Rigved. It could either be of Dholavira itself where stone artifacts could have been easily erected or some other township on the banks of the then Sindhu. The keeper or astronomer of the solar-movementhouse narrated precisely the grandeur of River Sindhu in a verse of Rigved (Box 1, item 18). Age of the Dholavira township is 4.5 to 4.2 Ka vide the documents on the site of excavation.

Discovery of a solar-movement-house at Dholavira has two positive contributions; first, that Sindhu and its tributaries of Brihatsindhu System were live channels around 4.5 - 4 Ka; and, second, there is a physical proof of Rigvedic culture in the Western India during Kalibangan-Dholavira-Lothal cultures. However, on the observational and computational plane, the astronomers of the Paleolithic at Wandh and Basanbir both were far more advance mentally than the metal-age men at Dholavira; technology is more advanced



Fig. 5. Shorelines and rivers of Kachchh-Sindh region during Vedic period. A : Shorelines and deltas off Saurashtra-Kuchchh coast. Most significant channel and delta in the area is that of Pureeshaani River around 14 Ka. The river was destroyed by 10 Ka transgression and tectonics. The 7 Ka regression developed only a minor delta by the new river Lunva (= destroyed channel) or Luneem => Luni River. B : Course of Lunva River between Great Rann of Kachchh and Gulf of Kachchh via village of same name. C: 10 Ka shoreline and mouths of Rivers Sindhu and Payas\*

#### Jagadishomrityunjay

at Dholavira though. The earlier men were observing stars, sun and moon together while the weathermen of Dholavira were chasing merely the shadow of sun for accretion of wealth after harvest.

# **CULTURAL DATES IN RIGVED**

#### Magnificent Days of a Rope

Ropes and threads are uncared objects today. In the Upper Paleolithic, however, the multiple-yarn-rope was an important invention and used as a respectable simile in 'Spun is our Sarasvatee with multiple channels' like a rope (Box 1, item 6). It replaces a common expression 'made of the channels flowing together' in the description of River Marut (Box 1, item 3). When was this date in human prehistory? The answer will fix the time when the Grand River was flowing due south till it joined the sea.

Invention of multiple yarn rope was surely during the Magdalenian (20 Ka-10 Ka) as a figure of head of a horse belonging to this period shows (Roussot, 1978, fig. 29). Oldest multiple-yarn-ropes were possibly discovered during early Magdalenian, a little earlier than their common use in the first bow around 15 Ka (13 Ka in Korovkin, 1985). The Vedic simile, therefore, gives a date of about 16-17 Ka when the hymn about Sarasvatee describes the magnificent river.

#### The Tied-Food-Horses of Saptasindhu

The Vedic period witnessed once an Indus with seven main tributaries: Sindhu, Payas\*, Subhaga, Shutudree, Vipash, Vipat\* and Urvi (Box 1, items 13-16). These were called Seven Sindhu Rivers or Saptasindhu, which joined sea ultimately through Mother Sindhu in a daughter-mother relationship. Their terrain constituted Saptasindhu land occupied by Aryans (Box 1, item 1). The rivers have been described once as:

Tatridanas\* Sindhvas\* kshodasa rajas\* prasasrur- dhenavo yatha.

Syanna ashwa iv adhvano vimochanevi yadvarartant enyas\*. (RIK: 5.53.7).

[Affluently moving mega rivers are the (seven) Sindhus over their pounded sands like cows (white). On the path in their liberation they meander on their course like a tied-food-horse in ropes (jumping to the left and right of straight path)].

The description is obviously before the domestication of horse. Then the animal was hunted, caught and dragged forcibly to an enclosure or compound as a live food to be killed later. It was a common scene of the highest level of Magdalenian, continuing in the earliest Holocene when the practice of domesticating the animals turned common after  $\sim 9$  Ka. The simile of Saptasindhu and tied-food-horses is referred to the uppermost Pleistocene of Western India around 10-11 Ka before the major transgression of Arabian Sea around 10 Ka. Thereafter, the shoreline of the Arabian Sea submerged Saptasindhu country partially and Mother Sindhu was truncated.

#### SHORELINES AND TECTONICS

#### Western Indian Shelf

During the Upper Paleolithic and Holocene, there have been some major sea level changes in Northwestern India (Nigam et al., 1992, Hashimi et al., 1995 and



Fig. 6. Elevation levels of 10 Ka and 4 Ka shorelines west of Gulf of Cambay

Jagadishomrityunjay, 1997). These changes, related mainly to regional tectonics of the western Indian coast, resulted into regional rise and fall of sea levels, and a corresponding shifts of shoreline in Sindh – Gujarat. It was established that there was a marked lowstand around 14.5 <sup>14</sup> C Year B.P. when sea level was nearly 100m lower and, subsequently, it

stood close to the present level around  $10^{-14}$ C Year B.P. (Nigam et al. 1992). The corresponding calendar year. dates of the events were around 11 and 17 Ka. In the sea level curve (Hashimi et al., 1995), the still stand between 11.5<sup>-14</sup>C Year B.P. and 14.5<sup>-14</sup>C Year B.P. could be a continuation of low sea level at Last Glacial Maximum ~ 18 Ka



Fig. 7. Elevation levels of 10 Ka and 4 Ka shorelines in Banni Rann

The highstand of 11 Ka, within <sup>14</sup>C range of 8.3 to 9.6 Ka was the period when terrestrial wood and peat in the coastal belt were entombed. They occur now in a water depth between 17 and 32m on the Western Indian Shelf south of Saurashtra (Hashimi et al. 1995, table 1). In Calendar Year, the highstand period spans, approximately, between 9 and 11 Ka (on a rough interpolation of younger Arabian Sea dates from Staubwasser et al., 2003). The period is designated here as 10 Ka transgression.

Trace of the 10 Ka shoreline is visible in Indus delta area in space imagery (Fig. 5) at an approximate elevation of 10m. The areas has risen almost 10m since highstand of 10 Ka. In the Kuchchh-Saurashtra region of Gujarat, the rocky country does not display the 10 Ka shoreline clearly. The transgression, however, forms a narrow (5km) belt of recent coastal sediments parallel to the shoreline of Gulf of Cambay at an elevation of 20-25m. It is traversed with numerous rivulets perpendicular to the present coast (Fig. 6). The southern margin of the Great Rann of Kachchh also displays similar features (Fig. 7). In Nirona area the present elevation of the shoreline of 10 Ka transgression is at an elevation between 25m and 40m on the consideration of spot heights. Its near average value may lie between 25-35m. Accordingly, the Kachchh mainland south of the Kachchh mainland fault has risen above 25m or more above the then sea level. The Saurashtra region has also risen 25m above the then highstand due to relative uplift of the Kachchh-Saurashtra block during the Holocene. Areas of Cambay Graben are the sites of active subsidence during the period while Banni Halfgraben (Fig. 8) sank after 4 Ka.

The Holocene tectonics has affected the Indus plains south of Chor area, Kachchh-

Saurashtra and coast of Maharashtra differently. The shoreline trace in the first has added an elevation of 10m with reference to transgression highstand of 10 Ka; the second segment is uplifted even more - 15m or more above the first. The last has submerged around 25m after the rise of sea level. The uplift of the first and second segments after the 10 Ka event has a great relevance in the evolution of Vedic River System because the observed rising trend of Kachchh-Saurashtra block up to the Khadir-Sehwan fault could date down to Middle Paleolithic/Upper Paleolithic boundary. It has controlled the Vedic drainage system and course of rivers, as discussed later. The configuration of the present day Great Rann of Kachchh is no older than the tectonics associated with 4 Ka event, discussed below.



Fig. 8. Relationship between Kachchh mainland fault, Khadir-Sehwan fault and Banni Half-graben (Base map : Biswas, 2002)

There is a second minor rise in sea level during the Upper Holocene when littoral concretes were deposited even up to 6m above the sea level on the western coast of India (Hashimi et al., 1995) and Rann of Kachchh logged a rise of sea level between 6 and 10m (Fig. 7). The event spans between 1.7 and 4.3 <sup>14</sup>C Ka (~ 1.1 to 4.1 Cal. Yr. B.P.). The beginning of event coincides with the doom of Urban Harappan culture of Dholavira, Surkotada and Lothal. It is a significant geological event in the history of Vedic River Systems. It is designated here as 4 Ka highstand.

There is no specific data on regression maximum or lowstand between 10 Ka and 4 Ka highstands. It was possibly around 7 Ka when the shoreline in the Gulf of Kachchh formed a minor delta close to 30m isobath (Fig. 5A).

#### Indus Deep Sea Fan

In a recent study from the deep sea sediments off the Mekran coast and Indus fan, first appearance of turbidite dominated clastic succession is logged at 8m below the sea bed in the Indus fan and 3m below sea bed off the Mekran coast (Prins and Postma, 2000). On the Indus fan site there is a significant thinning turbidites above the boundary. These of turbidites were emanating from older Indus sediments on the continental slope and not by new clastic supply from Indus drainage. The core shows a <sup>14</sup>C date of 24.8 Ka at 5.3m and interpolated date at the top of the clastic sediments is around 32 <sup>14</sup>C Ka (Prins and Postma, 2000, fig.2).

The date of the clastic / nonclastic boundary in the Indus cone falls close to the

Middle and Upper Paleolithic boundary when cessation of direct flux from the delta of Indus River occurred in a major tectonic activity in the region. In the core off the Mekran coast, away from Indus delta regime, the cessation of clastic flux, at 3m, is dated as <sup>14</sup>C 7.5 Ka. The paradox is already noted by the authors as "Neither the size nor geographic position of the Mekran and Indus drainage basins can account for higher clastic supply rates in the Mekran turbidite system compared to the Indus fan during the Holocene" (Prins and Postma, 2000, p. 377). There is no satisfactory explanation in the deep sea for the sudden termination of Indus clastic and turbidite regime around <sup>14</sup>C 32 Ka; its answer is related to a tectonic event at the mouths of Indus at that time.

A direct correlation is possible between the 32 Ka event at the mouths of Indus and the tectonics of Kachchh and adjacent territory to the north. A quick uplift of Kachchh mainland and its western extension, south of Kachchh mainland fault (KMF), around <sup>14</sup>C 32 Ka and modest uplift between KMF a and corresponding elevation south of Khadir-Sehwan fault (Fig. 8) could terminate the Middle Paleolithic course of Indus River to its past delta - now a fossil (Fig. 5A). New course of Indus and its tributaries were formed after the Middle Paleolithic uplift in Kachchh-Sulaiman region forcing the waters of Indus to drain either in the Gulf of Cambay or in the Gulf of Kachchh. This was a significant tectonic manifestation in the Western India prior to the establishment of Vedic drainage.

Sedimentation history in the Western Rann of Kachchh supports the idea of a shift in the course of Indus north of the Khadir-Sehwan fault. The well control and seismic



**Fig. 9.** Superposition of relict channels of Holocene in Cambay Gulf, submerged after 4 Ka transgression. A: Mahi (I) and Sindhu (2) during Brihadash vina Drainage (8.5 Ka - 6.5 Ka). B : Same during Brihatsindhu Drainage till its destruction (6.5 Ka - 4 Ka).

profile of the area shows negligible thickness of the Quaternary sediments west of Pachchham Island - barely 50m or less. It was not possible unless the Indus sediments bypassed western Rann of Kachchh south of the Khadir-Sehwan fault due to its elevation. The fault, acting as an effective barrier for the southward movement of Indus sediments, moved the river and its load to enter either Gulf of Cambay or Gulf of Kachchh in the southeast.

#### Submerged Channels and Deltas

In the Rakesh Sharma's photograph of the Gulf of Cambay, the two sets of past river courses or relict channels are seen, the one to the east is older (Fig. 9). Both of these are older than 4 Ka event and the shift of river course relates either to the violent tectonic event of 6.5 Ka at the Brihadashvina / Brihatsindhu boundary. Both the relict courses were joined to a major channel to the northwest contributing sediments once, but now disappeared. The upper reach of this westerly channel passed by the Harappan site of Lothal and was responsible for the prosperity of the town.

Another important relict channel of Vedic past is seen connecting the Great Rann of Kachchh and Gulf of Kachchh passing through village Lunva (Fig.5B). Lun-va means, etymologically, a dried channel in Sanskrit. The conduit between the northern and southern Rann of Kachchh is named so because it was a channel once that dried later.

The Western Indian Shelf has a width of about a hundred kilometers off the Kachchh-Saurashtra coast (Fig. 5A). On the shelf the lowstand of LGM and <sup>14</sup>.C 14.4 Ka run close to 100m isobath. The shoreline passes trough two deltas – a relict delta of Middle Paleolithic opposite the mouths of Indus and an Upper Paleolithic delta associated with the regression at LGM. Signatures of a minor delta are also seen opposite Gulf of Kachchh at 30m isobath. Possibly it represents 7 Ka lowstand between, the 10 Ka and 4 Ka highstands.

#### STRESS AND MIGRATION

During the Vedic period, human habitation was not consistently in same strength in Northwestern India and Pakistan. It is reflected by periods of human activity expressed by dates in the hymns and artifacts and gaps in their activities. The Table -2 summarises the events and brings out short periods of knowledge building through a swell in the population of Vedic bards, grammarians and astrologers. The swells are separated by their near absence in the intervening periods.

A perusal of the above succession suggests that the population of the Vedic men never stabilized beyond a few thousand years as a prosperous community with copious population due to global changes in climate and other ecological conditions. They brought new populations in the Vedic land as also forced their departures (Table - 3). These movements have taken place in a cause-effect pattern of the human response to climatic, tectonic or sea level changes. Changes and human responses during the Vedic period are touched upon below.

#### **Impact of Cooling Events**

The three astronomical dates of the Middle Vedic prosperity relate to best astronomical potential of Vedic men when they lived during the Brihatpureeshaani System. Vedic River Systems

Table 2. Temporal distribution of as	tronomer bards
Ashvinee's Prayer (RIK.1.157.1) 3.5 Ka Sookt 19.7 of ATH. 4.3 Ka Sun Temple 4.2 – 4.5 Ka	Upper Vedic Prosperity
Upper Gap in Description	
Year of P. Phlg. (SPB.6.2.2.18) 11.6 Ka Year of U. Phlg. (SPB. 6.2.2.18) 12.5Ka Year of Chaitr. (AST.4.2.20) 14.7Ka	Middle Vedic Prosperity
Lower Gap in Description	
Swati as a Nakshatr 20.3 Ka Year of Sravistha (AST) 22.8 Ka First Asterism marking 24.5 Ka	Lower Vedic Prosperity

Their grammar is typical and advanced compared to the people of older river systems. For deriving a feminine river name from neuter Pureesham\*(water), they do not simply modify the word as Pureeshinee, done earlier during Marut System. Instead, they converted the neuter word first into a masculine to form Pureeshat\*, comparable to their other words for river names like Angirasvat\* or Marut\*; and, then give a feminine form Pureeshaani. Even their adjective jinvatam for river Pureeshaani involves a complex grammatical exercise, deviating slightly from the Paanini grammar (jin: respectable old + u for definite + tam as superlative). The astronomers built an advance observatory at village Wandh in Kachchh, which used 160 divisions in a circle for demarcation (Jagadishomrityunjay, 1997, fig. 7.16). The date of the observatory, through its own intrinsic evidence, is fixed around 11600 years before present (Jagadishomrityunjay, 1997). The period between 11.6 Ka and 14.7 Ka, thus, displays the most fertile brain of the Paleolithic men on the Indian soil. Their

numerical strength suggests the prosperity of the Vedic population those days.

The astronomical dates of the Middle Vedic prosperity form best fit points on a sharply declining global temperature curve at the close of Paleolithic, which was followed by an equally steep rise after 11.6 Ka (Fig. 10). A telltale of the whole episode suggests an entry of the astronomers in India from another Vedic land. They migrated to India from colder latitudes of north when there was a rapid and severe decline of global temperature. They went back to their homeland (around Caspian?), merely after 3000 years when Kachchh - Rajasthan became ovens after 11Ka. Fall of global temperature, thus, brought new brains to India in an exodus once. Rise of temperature sent these men out of the country. There is an exactly similar situation at the entry of another group of astronomers when Basanbir pillars were erected. Their migration is seemingly in response to the fall of temperature during the

Table 3. Migration of population

			3.5 Ka↑
Sindhu	Varun		
M 1	Arjeekeeya, Ganga, Marudvridha,		
F 17 A 0.6	Sachata, Vitasta, Yamauna, Kubha: 7		SUALING
	Asiktee, Gomatee, Parushnee,		4.5 Ka
$A \ge 0.5$	<i>Shvetee</i> : <b>5</b> , Shutudri, Sarasvati, Mehatnu, Sindhu, Susartu.: <b>5</b>		
Ashvina	Ashvina, Dhiya, Shubhra, Shweta,		GIFT OF
M 0	Vaana: 5, Shwetaavaree,	II MIGRATIO	N YAK~8 Ka
F9A0.7	(Sarasvatee-ii): 1/(2), Sukeerti, Sindhu	u: 2	
			SARASVATEE-II
	FEMALE NAME EXCLUSIVENESS	R. Martin and S. Shara and S	0.3 Ka===
Shutudree	Payas*, Vipash, Vipat*:3		TIED-FOOD-
<b>M 3</b> (?1,0)	Subhaga: 1, Shutudree: 1,	- * - E	HORSES ~ 10 Ka
F 4 A 0.5	Urvi, Sindhu: 2	SH	UTUDREE
Pureeshaani	Angirasvat*, Marut*, Nar,	I	KACHCHH ORSERVATORY
M 4	(Pureeshat*), Chitraayu: 4	ILMIGRAT	10N 12.5 - 11.5 Ka
F 5 A 0.25	Kanya: 1, Paveeravee, Sarasvatee,	SINDH	U
A < 0.5	Veerpatnee: 3, Pureeshaani: 1		
	CONSONANT TERMINATION EXCLUS	IVENESS	<b>1</b> 4.5 Ka
Sarasvatee	Antariksh, Aj, Uru: 3		
M 3	Aapaprushee, Paarthivaanee,	Ν	<b>IULTI-YARN</b>
F 3 A 0	Sarasvatee: 3	1	ROPE ~ 16 Ka
Marut	Div, Krumu, Marut, Sarayu, SARA	SVA-	
M 6	Antarirksh, Sindhu: 6	DY.	AAVAAPR. ~ 24.5 Ka
F 4 A 0.75	Anitbha, Kubha, Rasa: <b>3</b> ANTARIKS <i>Pureeshinee</i> : 1	H I MIGRA	TION 25 Ka $\downarrow$

Last Glaciation (32 Ka to 18 Ka). Drop of temperature was gradual and less drastic initially (Ghosh and Bhattacharya, 2003). Acceleration of cooling around 25 Ka brought the Heaven-Earth worshiping astronomers to Rajasthan. They stayed there for almost 5000 years but moved towards sunny South India when the chill was too high during the Last Glacial Maximum when Himalayan streams froze, stagnated or went dry (Box 1, item 4).

#### Impact of 10 Ka Event

During the *Upper Gap in description*, the seven main water arteries of Saptasindhu, which formed the tributaries of



Fig. 10. Global temperature change and its impact on human response exemplified in the Vedic land during highest Pleistocene

Brihachchhutudree System, occupied time span of 11.5 Ka to 8.5 Ka. Their final stream was Sindhu. During the transgression acme of 10 Ka, the set was truncated west of Chor due to rise of sea level. The then sea level had risen almost a hundred meters above the lowstand of Last Glacial Maximum. The present day Western Indian Shelf was a broad meadow or forest before the transgression with a width of nearly 150 kilometers. Not only this coastal land but also a substantial part of Gujarat was submerged under the sea during the 10 Ka highstand. Total land of Sindh-Gujarat region inundated by the sea was over a hundred thousand square kilometers. The displaced human population, at half the number of the west coast density of early twentieth century (Field, 1946), exceeded 40 million people.

The Saptasindhu period is restricted etymologically between 11.5 and 10 Ka. It was a time when people were catching the horses and other animals and preserving them as a live food for consumption in near future. The animal could be a delicacy of 'tied-food-horse' as described in Rigved or any other animal approved as a food item by their community.

Possibly at this period of transgression, Vyashvas in Rajasthan were praying to Vinrimn for destruction of Daasas (Box-1, item 1). It was the time when the Vyashvas in the safe heaven of Rajasthan fought the uprooted Daasas from south. While moving northwards, the displaced men were settling in southern Rajasthan adjacent to Gujarat and naming localities like Dasapa and Dasuri. Since there was no cultivation those days, they were also hunting and gathering the mammals. The large population of Daasas was a direct competitor of Vyashvas for the hunted food. The Vedic prayer reflects the response of human mind during an unexpected struggle for existence due to 10 Ka transgression.

#### 4 Ka Transgression

During the Holocene transgression in the coastal areas of Arabian Sea, littoral concretes were deposited up to six meters above the present sea level on the Western Coast (Hashimi et al.,1995). The highstand spans between 1.7 and 4.3 <sup>14</sup>C Ka ( $\sim 1.1 - 4.1$  Cal. Yr.). It is designated here as 4 Ka transgression.

The lower boundary of the event coincides with an arid phase in the Middle East

between 4.2 and 3.6 Ka (Cullen et al., 2000) and northwestern Indian subcontinent (Rad et al., 1999). The arid phase has brought '4.2 Ka termination of the Indus Valley civilization', it is believed (Staubwasser et al., 2003). However, more relevant in the context of the Vedic River Systems is the tectonic destruction associated with the sea level rise after the prosperity of Brihatsindhu System established through agricultural economy and export. Although aridity was a contributor to the disappearance of Harappan trading centers like Harappa, Kalibangan and a large number of townships in Punjab-Rajasthan plains (Mahadevan, 1977, fig.1), Sindh-Gujarat were affected more drastically by 4 Ka transgression and tectonics, which established the present configuration of the Great Rann of Kachchh.

After the 4 Ka rise of sea level and accompanying tectonics, a marshy, muddy and salty Great Rann of Kachchh appeared in place of a level land north of the Kachchh mainland fault and south of Nagar Parkar fault (Biswas, 2002, fig. 2). Before this date, it was a level fertile ground about 10m above the sea level supporting the granary of Harappan towns of Dholavira and Surkotada.

In the 4 Ka event, mouths of Indus opened in the western Rann of Kachchh. The long course of Indus, joining Mohenjodaro with Lothal through Dholavira and Surkotada, came to an end. The Rann, at its peak development, severed the Indus trade channel as the river found a new opening to the sea near Lakhpat at the western tip of Kachchh.

The Harappan township of Khadir Island, i.e., Dholavira lost its agricultural support and also ran short of drinking water. Its cotton crop acreage promoting its export was finished. Condition of Surkotada was no better than Dholavira. Stagnation of Sindhu north of Lothal set in. Also, there was an emergence of Sabarmati drainage in associated tectonic activity, which finished Lothal as a city of trade. The tract of the fossil Indus River joining the port with Gulf of Cambay is still preserved as a dry channel. Thus the trade towns in the lower reaches of Sindhu came to an end in a cause and effect relationship of 4 Ka event of the Vedic past.

#### SUCCESSION OF RIVER SYSTEMS

Establishing type descriptions from Rigved (Box 1) brings out over fifty names of rivers in different verses (Box 2). These fall under six River Systems. Each has a main trunk and tributaries. Number of tributaries within each system varies between 7 and 22. The variation in their number possibly relates to three factors: first, length of the main channel; second, its usefulness to the contemporary men; and; third, geographic restrictions over the bards in their knowledge gathering due to territorial restrictions between the tribes. In view of the dependence of nomenclature of rivers not only on the actual number of rivers in the system but also on the then bards describing them, fewer channels in a river system may imply geographic limitation of the poets describing them.

#### Stratigraphic Status and Nomenclature

The river systems are time denoting units defined by the breaks in the knowledge of human species about the flowing rivers in the Vedic land at different levels of time. It is not that main channels have appeared and disappeared during the span of Vedic period. The space imagery shows merely the migration of river courses and left over dry beds in abundance in the Vedic land (Fig. 3). It also brings out that there has been no major shift of channels since the Harappan times or 4.5 Ka as the locations like Harappa, Mohenjodaro, Kalibangan and Alamgirpur remain still too close to their river banks of past (Fig. 3). The changes of river courses were also not too frequent during the stable periods of Vedic past. The change in the names of rivers, related essentially to new occupations and new tribes.

For naming the River Systems, a uniform procedure has been followed. The main channel of the system has been prefixed with Brihat\* meaning extensive. The channel systems are arranged in the order of reducing number of tributaries as below:

1Brihatsindhu(Brihat\* + Sindhu)222Brihanmarut (Brihat\* + Marut)103Brihadashvina (Brihat\* + Ashvina)94Brihatpureeshaani (Brihat\* + Pureeshaani)95Brihachchhutudree (Brihat\* + Shutudree)76Brihatsarasvatee (Brihat\* + Sarasvatee)7

The penultimate cluster of the River System constitutes Saptasindhu or Seven Sindhu Rivers (Fig.4 v). Equally famous is the cluster of seven Sarasvatees (Fig. 4 ii). Among the remaining four River Systems, the Brihatsindhu has found attention of river pundits because it contains existing channel names like Sindhu, Ganga Yamuna and defunct Sarasvatee (Fig.4 vi). Three other systems are newly recognized. Among the systems, four belong to the older Rigved and two to the younger Rigved (Fig. 4 inset ).

There is a distinct etymological break between the name of rivers of Older and Younger Rigved and they are linked to two distinct people of cultural identity. In the Older Rigved, the ratio between the masculine and feminine names of rivers is almost 1:1. In the Younger Rigved masculine rivers are absent with exception of River Varun that is masculine in grammar. This distinction, not only helps in fixing the chronology of river systems but also helps to divide the Vedic period into two chronological units: Lower Vedic and Upper Vedic. Informally the Vedic River System is equivalent to a series while Lower and Upper Vedic subdivisions correspond to stages. The six river systems are substage equivalents.

Mappability of the Vedic River Systems is all over the Vedic land. At the present, however, the units cover only the Rigved country of Western India and Pakistan with Gujarat as the southern limit.

#### Order of Superposition

Between the two river systems of the Upper Rigved, there is material evidence of solar-movement-house at Dholavira described in the type description of Brihatsindhu System. This is, therefore, the uppermost or youngest system of Rigved. The Brihadashvina System is placed earlier than Brihatsindhu System.

Among the four river systems of Older Rigved, the Saptasindhu cluster of rivers in the Brihachchhutudree System is related intimately to the Brihadashvina System on account of commonness of name Sindhu between the three systems and its absence (in the same sense) in the other three. A total discontinuity of culture and river names is seen between the Brihachchhutudree System and the other river systems of Lower Rigved. Brihachchhuturee System is, therefore, the highest river system of the Lower Rigved. Of the remaining three river systems in the Lower Rigved, Brihanmarut System belongs to chapter 5 and the other two to chapter 6 of Rigved (Fig.4 inset). The latter two, obviously constitute one set with name Sarasvatee common to both and name Sindhu absent in either. Again, a river Antariksh is common to only Brihanmarut and Brihatsarasvatee System and absent in the third system. Thus, in the order of superposition, the Brihatsarasvatee System lies in the middle.

Grammar used in the nomenclature of rivers establishes the relative age between the Brihanmarut and Brihatpureeshaani Systems. The two systems use two basic words in the names of rivers – Marut and Pureesham\*. One group of bards (chapter 5) usages simplest form of grammar in these two words and declines them as Marutas\* in a masculine form and Pureeshini in feminine form. The other group, seemingly aware of the pre existing words through chanting, derives the masculine and feminine forms through a different route. Marut\* replaces Marut (masculine with a consonant termination). It is analogous to Angirasvat\* river of Pureeshaani cluster. Derivation of Pureeshaani also takes a complex route: Pureesham\* (water neuter) → Pureeshat\*  $\rightarrow$  Pureeshaan\* (water masculine) → Purishaani (Water feminine). Interestingly, they move first from a neuter form like Pureesham\* to a masculine form Pureeshat\* as in Marut\* or Angirasvat\*. The Pureeshaani River System is therefore, younger in age. The Brihanmarut System proves to be the oldest among the Vedic River Systems.

An overall order of superposition among the Vedic channels works out as: Brihanmarut (oldest) $\rightarrow$  Brihatsarasvatee  $\rightarrow$  Brihatpureeshaani  $\rightarrow$  Brihachchhutudree  $\rightarrow$  Brihadashvina  $\rightarrow$ Brihatsindhu (youngest).

#### Superposition of Relict Channels

The Vedic land constituted a tectonically hyperactive region with short periods of intense tectonic activity. Compressive forces were operating due to northward movement of Kachchh-Saurashtra block south of Kachchh mainland fault in Kachchh-Sindh region. Sulaiman Range in the northwest had their ultimate impact. Terrain between Sutlej and Ganga was a scene of another active tectonic activity due to arching Himalayas in the north. The two areas were the sites of active changes in river courses that are reflected in space imageries through defunct river courses. Inferences from the shift in river courses, related directly to the tectonics of the recent geological past, go a long way in the reconstruction of rivers of past and their evolution in time.

The eastern margin of the Vedic land adjacent to Aravallies, was comparatively stable but it was also a scene of slow westward migration of channels during Upper Paleolithic. Later, in the Holocene, all the channels flowing through this land disappeared leaving their dry beds, visible still in LANDSAT imageries. The paragraphs below give an account of the changes in river courses of the Vedic systems.

# Channels of Basanbir

There are a number of abandoned, dry paleochannels between Indo-Pak border and Aravalli Range. One of these passed close to the now abandoned Basanbir hill feature. Since the hill has two astronomical equipment dated around 24.5 and 35 Ka+ (Jagadishomrityunjay, 1997), likely date of the Basanbir habitation and paleochannel is Middle Paleolithic through Perigordian (>35 Ka – 20 Ka). The river of Basanbir, drained ultimately into Gulf of Cambay (Fig.11). To the west and east of the Basanbir channel there are other northsouth channel traces. Channel of Basanbir evolved by a westward shift of a river close to Aravalli Hills. River Luni is its vestige with locality Luni on its course. Some distance to the north of Luni is another locality on the same dry bed near Jodhpur. It is Merta (River Mar). Merta and Marut (River Mar) have same meaning. The river of Basanbir is, accordingly, Marut of Perigordian and older period. Even there is a village Marli (Marti à Mardi à Marli =River Mar) on the channel of Basanbir.

There is also a westward shifted channel of Basanbir in the later course of Marut. It runs almost parallel to its forerunner but in North Gujarat it takes the trend of defunct Sarasvatee River and drains into Arabian Sea through Gulf of Kachchh, which was a land. Since a dry Sarasvatee is on its course the long river is identified as Sarasvatee of type description.

The moderate sized delta off the Saurashtra coast possibly relates to Vedic Sarasvatee and its successor Pureeshaani The main channel of Pureeshaani was to the west of Sarasvatee reaching even to the west of Jaisalmer. It entered the Gulf of Kachchh either following the eastern margin of mainland Kachchh or through the left over track of Lunva (Fig.5). It retained the earlier name of River Sarasvatee, which would have joined the trunk channel of Pureeshaani cluster as a tributary.

#### Eastward Course of Indus

Indus drainage was mighty and a sediment load carrier to Arabian Sea before



Fig. 11. Upper Paleolithic drainage of Rajasthan and Gujarat

32 Ka. However, as the deep-sea evidence suggests, its sediment has disappeared and the river was joining the easterly drainage between 32 Ka and 4 Ka. River Indus and its past path passed through extensive dry desert and its course is not clearly identified. The river joined Marut and Sarasvatee in Rajasthan-Gujarat east of Kachchh while Pureeshaani joined Arabian



Fig. 12. Succession of paleochannel trends between rivers Sutlej and Yamuna. I: Vipaat\*-Shutudree Drainage, II : Sarasvatee Drainage, III : Oornaavatee Drainage, IV : Extant Channels.

Sea via Kachchh, (Fig. 5A). The latter course developed ultimately into the distal part of Sindhu draining into Gulf of Cambay since the beginning of Brihadashvina period. In the upper track of Indus, there was a piracy by two or three westward channels branching out from easterly main rivers during the initial days of Lower Vedic age. In the later part of the period, however, almost all the rivers of Northwestern India acquired a northeastsouthwest trend.

#### Sub Himalayan Plains

A frame of LANDSAT of Sutlej-Yamuna area shows, besides existing watery channels and dry beds, some clear lineaments of paleochannels (Fig. 12) These are : III. Nearly East-West flowing channels: Two channels parallel to Himalayas; one to the north is more prominent between Ambala and Saharanpur.

II. South-East flowing channels: Broad, discontinuous wet tracts.

I. South-West flowing channels: Several discontinuous, narrow wet tracts.

On smaller scale imagery, the second set of channels is seen to evolve from first. Ultimately they form a triplet of paleorivers that meet at Delhi (Fig. 13C). The newly formed three rivers are: i) a composite of Beas and Sutlej, ii) Yamuna, and iii) Ganga on the course of river Hindan.

A contemporary western drainage of Indus shows five tributaries between Jhelum and Sutlej at this level (Fig.13A). The westerly drainage has been identified as Brihadashvina System in view of a matching description from Rigved (Box 1, item 17).

There is no description in Rigved corresponding to the triplet of rivers at Delhi. However, there is a mention of a major triplet of rivers meeting at Maanush town (Box 1, item 23). This is the triplet of Drishadvatee -Aapaya - Sarasvatee. The Delhi Triplet is taken as the major triplet of Rigved, wherein the township of Maanush lay near Delhi. Among the three rivers, the easterly one was Rishat\* or Drishadwatee  $(D + Risat^* + vatee)$  and the middle was Aapaya - same as Aapap\* of earlier Brihatsarasvatee System. The western channel was Sarasvatee. The new channel formed after the tri-junction drained into Bay of Bengal and the Pureeshaani River System ends at this point as a mighty water artery.

The initial or first set of channels among the overlapping channels forms another prominent triplet again and ultimately joins Indus (Figs. 5C, 13B,C). Their description tallies with Shutudree -Vipat\*- Payas\* triplet which constitute the Brihachchhutudree System. It is necessary to mention here that rivers Shutudree and Shutudri are distinct in the same way as Sarasvatee and Sarasvati (Fig.13C). River Sarasvatee at this time plane, however, was not the same as earliest Sarsvatee. Sarasvti, as a tributary of Sindhu was unrelated physically and etymologically to Sarasvatee.

Two streams running towards east just parallel to Himalayas between Ambala and Moradabad constituted the third set of channels. They emerged in a Himalayan uplift activating a widespread foothill subsidence (Fig.13C). These channels are the forerunners of two main channels of eastern drainage mentioned in the type description of Sindhu - Oornaawatee and Seelamaawatee. During the description in the tenth chapter of Rigved the Seelamaavatee and Oornaawatee had acquired, in their upper reaches, the same geographic position as the present Yamuna and Ganga, respectively.

#### SPAN OF RIVER SYSTEMS

Astronomically, the upper boundary of the last Vedic hymn in the prayer of stars is around 3.5 Ka. The time coincides with the upper limit of dry spell in the Middle East (Cullen et al., 2000) and disappearance of Harappan community in India (Staubwasser, 2003, fig. 3). The evidence in Purans suggests that the Mahaabhaarat war / coronation of Pareekshit was 1050 years before Nand (Bhargava, 1956). In simple computation, it is around 3.4 Ka. The upper limit of the Vedic age at 3.5 Ka is before Purans when a non



Fig. 13. Holocene changes in the drainage of Sutlej-Yamuna area. A : Appearance of Brihadashivna System. B: Appearance of Sarasvatee Drainage. C: Appearance of Oornaavatee and Shutudri-Sarasvati Drainage. Tectonic activity lifts up the westernmost Aravalli lineament (~10 Ka) to form a drainage divide between Sindhu and Payas\*-Shutudree leading to westward shift of Ashvina and associated channels (A) and eastward shift of Payas\* through steps i, ii, iii, iv ends into Saravatee (v) of the Sarasvatee-Aapaya-Drishadvatee Triplet (B). Subsequently, activation of III Aravalli Lineament and Himalayan Foot-hill subsidence (~7Ka) establishes the new channels of Sarasvati and Shutudri in Brihatsindhu System as also Oornaavatee-Seelamaavatee Rivers (C).

Vedic cowherd Krishn was worshiped as a God and non Vedic cult of human reincarnations sets in the Indian mythology.

In the Indian geology 3.5 Ka is an equally important date as it marks the end of the Brihatsindhu System or Vedic River

#### Jagadishomrityunjay

Systems. Similarly, the lower horizon of the Vedic period, on account of the figure of Dyaavaaprithivee defines the lower boundary of the Brihanmarut System – the lowest of the six river systems. In view of its astronomical date 24.5 Ka, the lower boundary of the system is taken as 25 Ka. Astronomical evidence of identification of Swati as Nakshatr around 20.3 Ka defines the upper boundary of the Brihanmarut System at 20 Ka.

A classic fit is seen between the Vedic astronomical dates and falling global temperatures between 14.7 and 11.6 Ka (Fig.10) and its relationship with new migrants of the Brihatpureeshaani bards with complex grammar helps to fix the span of Pureeshaani cluster between 14.5 and 11.5 Ka. Its preceding Brihatsarasvatee System is accordingly placed between 14.5 and 20 Ka. The simile of Sarasvatee with a rope dating back to 16 - 17 Ka falls within this period.

During the Upper Vedic period evolution of the typical channels of the Brihadashvina System (Fig. 13A), after the Brihachchhutudree System, was possibly through an active and violent tectonic change when Shutudree, flowing to the west earlier, changed its course towards Delhi and was designated as Sarasvatee in the Sarasvatee-Aapaya-Drishadvattee cluster joining at Maanushteerth near Delhi (Fig.13C). Manusmriti mentions donation of Mithuns (Yaks), restricted now to the colder Himalayas at higher altitudes. The animal was living in

ш	Ge	eoch	rono	logial L	Inits	;	INDIAN GEOLOGY																
₽	GEOLOG		CLIMATIC		ARCHE- OLOGIC		CHRONO- UNITS		T	ECT. INT.	TECTONIC EVENTS												
-			SUBAT	UBATLANTIC		TOR.	HISTORICAL			0	EARTHQUAKES, MINOR RIVER SHIFT LOW TECTONIC ACTIVITY												
	E	LATE	SUBBOREAL		IRON BRONZ		PAURANIC		0		RUNN OF KACHCHH APP., SINDHU DESTROYED, TRANSGRESSION												
- <b>1</b> 0	HOLOCEN	EARLY	AT			ASPIAN	DIC Uppe	SINDHU ASHVINA SHUTUD-		0	MODEST SHIFT IN RIVER COURSES ASHVINA – SINDHU DRAINAGE TO CAMBAY GULF, NEW SARASVATEE												
10 EARS			PREBOREAL		EPIP	EPIP C		REE		0	DESTR. EASTERN N-S DRAINAGE APPEAR. WESTERN DRAINAGE												
15 ND YI	NE	LACIA	GOTHIA GLACIAI	GOTHIA GLACIAI	GOTHIA	GOTHIA	THIA	ACIA	ACIA	ACIA	ACIAI	ACIAI	ACIA	DRYAS ALL./BOL.	NAN	-	SHAANI		0	100 M RISE IN SEA LEVEL NE-SW ALIGNMENT OF DRAINAGE			
ASUC	TOCE	ARDIG						ILTHI	DLITH GDALI	ower	SARAS-			APPEARANCE OF LUNVA CHANNEL									
THO	LEIS.	GLACIAL TA	GLACIAL TA		GLACIAL TI		GLACIAL T					IAL T			CIAL		ALEO	MAG		VATEE		0	SHIFT OF DRAINAGE FROM GULF
- 7	ER P								GLA		TE P.	NAIC				0	OF CAMBAY TO G. OF KACHCHH						
	UPF	URM	ANIA		P	RIGORI		MARUT		<	TECTONIC INTENSITY 1:LOW 2:MEDIUM 3:HIGH												
- ~		3				PER	PR	EVEDIC			✓ 4: VERY HIGH 5:INTENSE <sup>+</sup> -MOST												

Fig. 14. Tectonic events and intensity magnitude during Vedic period.

plains of Northwestern India in a cold phase of Holocene when the trio of river joined at Delhi. In the geochronology, the temperature low during the age of primitive township of Maanushteerth may correspond to  $\delta^{18}$ O positive shift between 8.5 Ka and 8 Ka in the Arabian Sea (Staubwasser, 2003, fig.4). The lower boundary of the Brihadashvina System is placed, accordingly, at 8.5 Ka. The limits of the preceding Brihachchhudree System correspond to 11.5 Ka and 8.5 Ka. The event of 'tied-food-horses' falls within this period.

The span of 8.5 Ka and 3.5 Ka is covered by Brihadashvina and Btihatsindhu Systems. A tectonic event of some magnitude shifted the course of the forerunners of Yamuna and Ganga in the sub Himalayan belt. This must have preceded the first pre Harappan settlements of Kalibangan, which have set the present trend of Ghaggar and associated dry channels. Initial habitation of Kalibangan evolves into Harappan culture later. The earliest <sup>14</sup>C date of the pre Harappan settlement is 4.9 Ka (Lal, 1979) or calendar age ~6Ka. Boundary between the two systems is fixed at 6.5 Ka.

The base of Brihadashvina System is also the base of Upper Vedic period. The relationship between the subdivisions of Vedic period and the river systems are given in Fig14, which also summarizes the salient tectonic and other geological events of the Vedic country.

# NOTES ON RIVER SYSTEMS

The six river systems discussed in the preceding pages have been traced in space imageries approximately. The imageries are small scale and there is scope of refining the study considerably with a large scale image for the purposes of water resources or other economic uses.Important points about each river system are enumerated.

#### Brihanmarut System (+25 - 20 Ka, Fig. 15)

Type description of the system in two stanzas is sifted from Rigved mandal 5, sookt 53, stanzas 8 and 9. In common perception, deity Marut is now synonymous with Marutgans or the warrior deities (Pandey, 1978) belonging to Upper Vedic age. River deity Marut of Lower Vedic period is distinct and different from Marutgans. The latter is the basis for Brihat\* Marut System, which changes to Brihanmarut in unification. Mention is already made that the channel of Basanbir was draining ultimately into the then Arabian Sea via the Gulf of Cambay

Main channel of River Marut was made by River Div joining River Antariksh. Thereafter Rasa, Anitabha, Kubha, Krumu, Sindhu, Sarayu and Pureeshinee joined the river. Tying up names of the tributaries of Marut with the extant river names, is difficult. Possibly River Div relates to locality Deoband (Div+va+nad) and was formed by Ganga and Yamuna together. Its counterpart, Antariksh, was a common channel formed by Sutlej and Beas. Rasa was probably Jhelum joined by Anitabha, a poorly watery stream from Sohan Valley across Potwar Plateau. Sindhu River had a far different course in alignment with Sargodha ridge (Balakrishnan, 1997). Between the two westerly streams from Kirthar-Sulaiman Range, Pureeshinee represents a common channel of Bolan-Nari-Beji rivers joining it near Basanbir. Sarayu drained waters of river Baran via a channel reaching to the east of Kachchh mainland. Southernmost channels of Marut were Krumu corresponding



Fig. 15. Upper Paleolithic river systems of Vedic land. I. Marut System, II: Sarasvatee System, III Pureeshanni System. I: 1Marut, 2 Krumu, 3 Khubha, 4 Sarayu, 5 Pureehinee, 6 Div\*, 7 Antariksh, 8 Rasa, 9 Anitabha, 10 Sindhu. II. 1 Sarasvatee 2 Paarthivanee, 3 Aj, 4 Urud, 5 Ururaj, 6 Antariksh\*, 7 Aapaprushee.
III : 1 Pureeshaani, 2 Sarasvatee, 3 Veerapatnee, 4 Nar, 5 Angirasavat \*, 6 Marut\*, 7 Kanya, 8 Paaveeravee, 9, Chitraayu.

to River Narmada in east and Kubha in west. The latter is now a shrunk river Bhogawa in Saurashtra.

# Brihatsarasvatee System (20 - 14.5 Ka, Fig 13)

Sookt 61 of mandal 6 contains the type description. In the sookt, there are two, nearly similar looking but distinct rivers. The first is 'Sarasvati vaajineevatee' or a water bearing Sarasvati (stanzas 1 & 4) and second is 'Sarasvatee vaajebhis\* pravaajineevatee' or a Sarasvatee copiously affluent by several tributaries (stanzas 4, 7, 10, 11 & 12). They differ in spelling as also adjectives describing them. The former has the same spelling and matching description as Sarasvati in sookt 75 of mandal 10. It is a tributary of Sindhu. The second is type river of Brihatsarasvatee System.

Probably the two primary contributories which made the initial channel of Sarasvatee were Jhelum and Chenab. After their unification as Sarasvatee, it was joined by Antariksh formed by Beas, Sutlej and Aapaprushi (Aapap\* + Rishi) formed by fusion of Yamuna and Ganga. These channels of Brihatsarasvatee System are nearly same as that of Brihanmarut. However, some others have changed their course or lost. Sindhu of the Brihanmarut was either renamed or it was not accessible to the bards describing River Sarasvatee. The new river in its place was Ururaj made of two rivers - Uru and Aj. Paarthivaanee was a new name for the preceding Pureeshinee. These five main streams of the system, viz., Aapaprushee, Paarthivaanee, Ururaj, Antariksh and unified Sarasvatee constitute 'Panchajaata (or five daughters) 'of Himalayas' (RIK.6.61.12). In the same stanza, the river is referred as 'Santadhatu' or the 'holder' of seven principal

contributories. These appear to be Sarasvatee, Aapap\*, Rishi, Paarthivaanee, Uru, Aj and Antariksh.

**Other Sarasvatees** : River Sarasvatee has lingered in the Vedic literature even after the death of Brihatsarasvatee System around 14.5 Ka.-7 Ka. One or the other stream is named as Sarasvatee for the most part of the remaining Vedic period. The earliest of these was a tributary of Pureeshaani (Fig.15).

There are two other streams worshipped in Rigved as Sarasvatee but quite unrelated to Sarasvatee or Pureeshaani clusters. The first was a Sarasvatee in the triplet of Drishadvatee - Aapaya - Sarasvatee during Briahadashvina System (8.5 Ka - 6.5 Ka), draining ultimately in the Bay of Bengal. The new Sarasvatee, formed by Beas and Sutlej together during Brihadashvina period, joined the other two rivers near Delhi - Aapaya and Drishdvatee. They drained into Bay of Bengal. Later, around 6.5 Ka, Beas and Sutlej joined Indus as Sarasvati and Shutudri, respectively. Then Delhi Triplet was renamed, from west to east, as Vinashana sarasvatee - Sarasvatee - Drishadvatee during Manusmriti period (MAN.2.17, 21). The event was close to the transition of Brihadashvina and Brihatsindhu Systems. The new triplet does not figure in Rigved when the pre existing Sarasvatee Sarasvatee became a dving or Vinashanasaravatee and the Vedic bards designated Sutlej and Beas as Shutudri and Sarasvati, respectively. Aapaya of Rigved or Yamuna of today was christened as Sarasvatee by Smriti-men, culturally dominant in Delhi area. Drishadvatee was a channel from Rishikesh joining river Hindan. The short-lived names of Manusmriti disappeared when the Vedic Oornaavatee drainage stabilized around 6.5 Ka during Brihatsindhu System.

Sarasvati River, as a tributary of Brihatsindhu System, shows no change in its course later and Beas of today is the last Vedic Sarasvati. It has no physical disappearance due to drying up of its channel. It only appears to be lost for a single illusory reason. Its name Sarasvati has been dropped in preference to an earlier name of the same river, i.e., Payas\* - now transformed into Beas.

#### Brihatpureeshaani System (14.5 - 11.5 Ka Fig. 13)

Original description of the system in three stanzas (6, 7 & 11) lies sandwiched in a prayer of various gods in sookt 49, mandal 6. The system is made of two sets of contributories - one related to Marut and the other related to Sindhu. The principal channel of the river system - Pureeshaani - is the largest among the water arteries of rain showered, bull roaming country. Between the two sets of rivers, a westerly set of desert country, comprises of Angirasvat\*, Marut\* and Nar. Another, easterly set was flowing into a lush green bull country. It has six rivers : Pureeshaani, Paaveeravee, Kanya, Chitraayu, Sarasvatee and Veerpatni. A rough tie up of these names with the present day rivers is possible. River Angirasvat,\* made of Angi (= Amb) and Ras (= Jhelum), corresponds to Indus. Marut\* is Chenab while Nar is quite close to present day Nara though not the same river. In the easterly main branch, river Kanya corresponds to Ganga + Yamuna, Pureeshaani to Sutlej, Chitraayu to Beas + Ravi, Paveeravee to Degh and Veerpatni to Weer-wah. River Sarasvatee of Gujarat joined Pureeshaani last, River Pureeshaani drained in Arabian Sea through the now submerged tract of Gulf of Kachchh. Its contact point with the sea lay near 14.5 Ka delta (Fig. 5A). The system was disrupted and disappeared finally due to a major tectonic activity and sea level rise close to the Pleistocene / Holocene boundary.

#### Brihachchhutudree System (11.5 - 8.5Ka, Figs. 5C, 13B)

Brihat\* and Shutudree change to Brihachchhutudree when combined as a single word. Original description of the river system is in the first three stanzas of sookt 33 in mandal 3. The system, as a chrono - unit, includes two drainages that joined each other once but were severed by a transgressive Arabian Sea later. The first was a Shutudree drainage composed of Vipat\*, Shutudree and Payas,\* wherein the main channel Payas\* joined Arabian Sea near Chor in Pakistan. The second main channel was Sindhu constituted by Sindhu, Subhaga, Urvi and Vipaash. Thus, the system marks the beginning of extreme westward shift in Himalayan Rivers when main rivers lay even to the west of Rajasthan. This period marks the beginning of an independent Sindhu drainage joining Arabian Sea close to Nawabshah.

Present day counterparts of rivers constituting the Shutudree drainage are: Ganga +Yamuna (Vipat\*), Sutlej (Shutudree) and Beas (Payas\*). However, the then Shutudree was descending down to plains, from Himalayas, through the exit point of present day Markanda River. It was only later when the present exit point of Sutlej was established during Brihadashvina System. Then the river, joined by Beas, was named Sarasvatee. Name Shutudri, with a distinct spelling, was applied once again to this river when it turned to be a tributary of Sindhu during Brihatsindhu System. In the Sindhu drainage, Subhaga, Urvi and Vipash correspond respectively to Jhelum, Chenab and Ravi.

#### Vedic River Systems

# Brihadashvina System (8.5 – 6.5 Ka, Fig. 13A)

Original description of the river system has been picked up from a long composition attributed to Vishvaamitra. Type description of the river system is restricted to two stanzas RIK. 8. 26. 18-19. River Ashvina figures as one of the main tributaries of Sindhu drainage at this period.

Original description of Briahadashvina System names two clusters of the tributaries of Sindhu. In the first, the composer says "Shwetayaavaree" or the 'great' with Shweta. In other words, he names two rivers Shvetaavari and Shveta. These two rivers join a southerly moving Sindhu. The second cluster has six rivers in three pairs, Ashvina joined by Sukeerti, Dhiya joined by another Shveta and Vaana joined by Shubhra. Presently, Shveta of the first cluster is Swat and Shvetaavaree is labeled as River Kabul. Among the other six rivers. Ashvina is identifiable as Jhelum due to adjective 'trifuncating.' Its pair Sukeerti is Chenab. Similarly, Dhiya is River Degh and Shweta (ii) may be identified as Ravi. In the third pair, Vaana was a river from Bakloh -Pathankot following exactly the course of present day Beas-Sutlej. Its tributary Shubhra followed, approximately, the course of Ghaggar.

#### Brihatsindhu System (6.5 - 3.5 Ka, Fig. 16)

Original description of the system is taken from sookt 75 in mandal 10. The available form of the sookt shows even subsequent levels of composition. Brihatsindhu System (stanzas 1, 2, 6 & 7) belongs to the first level. The composition relating to Oornavatee drainage where a comparison is drawn between a fat lady River Sindhu (ii part of stanza 7) and the slim bride Oornaavati River (ii part of stanza 8) also relates to the same period.

Sindhu River of Brihatsindhu System was a mighty river joined by the poorly watery Varun in the early part. Main contributories of the river, however, were three clusters, of seven rivers each. Among these, two are physically existing as real clusters while the third is a technical cluster under the rule Aadiranten saheta (conclusion with beginning and end). This last cluster includes three initial and four terminal contributories of Sindhu. Among the two real clusters, first was Himalayan cluster and second a terrestrial one from Pakistan-Rajasthan

The three initial tributaries of Sindhu were Susartu. Rasa and Shvetee where Shvetee is River Swat. Rasa is the channel of Besud  $(Besud \Rightarrow Bas Ud \Rightarrow Basa \Rightarrow Rasa).$ Presently it is River Kabul. Susartu or River Sus (Ritu = water) is identifiable with Suh +Um (Um = water) combining as Sohan River. The Himalayan cluster of seven rivers included two paired streams Gan\* + Gan\* or Ganga, and Yamuna (Yam + Vana = paired stream)corresponding to Jhelum + Chenab and Degh + Ravi, respectively. There was also a last Vedic Sarasvati and a nearby Shutudri. Shutudri is identifiable with Sutlej, and, accordingly, Sarasvati was Beas. The seventh river of the cluster was Sachata, meaning a rainfed stream. It may be correlated with the dry bed of Ghaggar in Rajasthan. Often labelled as Vedic Sarasvatee, it is a lost Shutudree. Its tributory was Parushnee, the dry river of Ber.

There is no basis to correlate the names of seven rivers of terrestrial cluster. Their likely courses are indicated in the map approximately.

# Jagadishomrityunjay



**Fig. 16.** Sindhu River System. *A: Initial three rivers of upland. B: Other rivers. A:* 1 Sindhu, 2 Rasa, 3 Shvetee, 4 Susartu. *B: Himalayan cluster* - 1 Ganga (pair), 2 Yamuna (pair), 3 Sarasvati, 4 Shutudri, 5 Sachata, 6 Parushnee. Terrestrial cluster-1 Marudvridha (pair), 2 Asiktee, 3 Arjikeeya (pair), 4 Vitasta, 5 Shreeshuhee.

Vedic River Systems

The four terminal contributories of Sindhu lay near its mouths beyond the Gulf of Cambay. Here, it joins two sets of channels fed by the easterly sandy rivers of Gujarat. The easterly earlier set belonged to Brihadashvina System and the westerly one to Brihatsindhu (Fig. 9). Sindhu cluster of rivers, had more or less the same configuration between 8.5 Ka and 3.5 Ka, joining River Kabul in Afghanistan with Narmada in Gujarat.

In its southern end, four streams poured into Indus only by two mouths. Firstly, Krumu joined through slightly saline Mehatnu and secondly, through Kubha joined Gomtee. Identification of Mehatnu as Mehee => River Mahi and Krumu as Narmada are possible. Seemingly, Kubha joined the western bank of Sindhu near the confluence of rivers Bhogawa and Sabarmati. Bhogawa was a branch of Kubha. Its other branch probably lay close to locality Kuda (= Ku va => Kubha) in the coastal area of Gulf of Kachchh. Gomatee, from nearby land, is possibly submerged in Gulf of Kachchh.

The Sindhu cluster terminates in very strong tectonics in coastal areas but having little impact in Himalayas between 4.4 Ka and 3.5 Ka.

#### CONCLUSIONS

• A scientific re - evaluation of Rigved is possible considering available artifacts in the recent finds within two decades, a revision of its astronomical dates and information from other sources. It is suggested that the voluminous book is a highly altered composition of hymns between 25000 and 3500 years, or even later. It is a historical and cultural document which draws a simile of multi yarn rope for River Sarasvatee when ropes were invented around 16000 years ago while 'tied-food-horses' are in picture around 10000 years (10Ka) ago. Wealth of animals (8 - 9 Ka), clothes and metals (4 - 5 Ka) and use of chariots in wars for wealth (~3.5 Ka) help indicate approximate dates for the verses and help to judge the time of alteration in the initial hymns.

- The Vedic time had three periods of prosperity intervened by the thinning of population. The lower prosperity phase between 25-14.5 Ka covers the Last Glacial Maximum (20-18 Ka). It is a period of southerly migration of human beings due to global cooling. An exacting fit of astronomical dates of middle prosperity phase on dipping of global temperatures between 14.5 and 11.5 Ka also suggests a similar phenomenon. Such a correlation, however, does not apply to the pre Harappan and Harappan prosperity between 6.5 and 3.5 Ka. Then, man shifted places for wealth. Economic factor is important during the later Holocene migrations.
- River Systems were described by the bards as pathways for movement since beginning of the Vedic period. It is possible to reconstruct the Vedic River Systems based on their descriptions.
- There are six River Systems in Rigved covering duration of 21000 years. Their reconstruction and analysis is very fruitful in understanding past courses of channels and tectonics of Northwestern India and Pakistan.

- Indus stopped draining into Arabian Sea around <sup>14</sup>C 32000 years ago in a very severe tectonic activity. Since then its waters were draining either in Gulf of Camay or Gulf of Kachchh till appearance of Rann of Kachchh around 4 Ka. It was flowing to the Gulf of Cambay initially (32 Ka-20Ka) as a tributary of Marut and then between 8.5 and 4 Ka as Sindhu.
- The southeastern drainage of Marut Sarasvatee-Pureeshaani continued up to a major tectonic activity at 8.5 Ka when the triplet of Aapaya-Sarasvatee-Drishadvatee joining at Delhi proceed to Bay of Bengal. It was also the time when the westward shift of Himalayan rivers into Indus was complete.
- It is possible to estimate roughly the tectonic intensity of the Northwestern India through cause-effect relationship between the tectonic activity and response of the drainage system as a whole.
- There has been a gradual increase in the intensity of tectonic activity from levels of modest to strong to very strong and then severe between dates 20 Ka →14.5 Ka →11Ka → 8.5 Ka, respectively.
- Activity at 6.5 Ka is strong and 4 Ka very strong.

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#### SANSKRIT WORDS

Aachaary: Master. Aary: Aryan. Ashvinis: A deity linked to the paired stars Arietis Beta and Alpha. Ashtaadyaayee: A book of Sanskrit Grammar in Eight Chapters ascribed to Paanini. Atharvaved: One of the four streams of ancient Indian wisdom related mainly to occult and spiritual attainments in consciousness regime. Atmaswannam\* Healthy food of consciousness. Brihat\*: Great. Chitra: Star Spica, Daas: A tribe of southerly Vedic Land. Dyaavaaprithivee: Duel Deity of Heaven and Earth. Dyaus: Deity of Heaven, Heaven. Javam\*: Initial version of Mahaabharat. Kaneeya: Lesser. Mahaabhaarat: An Epic of Hindu culture, Mandal: Chapter, one of the ten segments constituting Rigved, Mantr: Psychic weapon for self protection and destruction of enemies. Manusmriti: Manu's drectives for human conduct, Marud\*, -t\*: A group of ferocious gods. Nakshatr: Star, Asterism, Paanini: A grammarian who collated the rules of Sanskrit grammar in the book form with eight chapters of aphorisms. Poorva Phalgunee: Star Delta Leonis. Puraan: Tales of the past. Prithivee: Deity of Earth, Earth. Rigved: One of the four streams of ancient Indian wisdom, related mainly to prayers of abstract gods for the power of mantr and success of rituals. Rudr: A group of ferocious deities, Richa: Stanza, Verse, Samvatsar: Year.. Sam Ved: A Ved of prayers in the mode of song. Saptasindhu: Northwestern India and Pakistan between

# BOX – 1 Translation of Key Hymns from Rigved

 य ऋक्षादंहसो मुचद्यो वार्यात्सप्त सिन्धुषु । वधर्दासस्य तुविनृम्ण नी नमः ।। RIK.8.24.27 ।।
 यः He who (is) ऋक्षादंहसः a laugher at Rishaads वा यः or who मुचद्यः (is) liberator आर्यात् from Aaryas सप्तसिन्धुषु in Sapt-Sindhu country, विनृम्ण O Vinrimn! वधर्दासस्य तु for killing Daasas too नीनमः bend upon. [विनृम्णः = वि + नृत् + नः = Great Dancing Warrior = Nataraj = Shiv].

The one laughing at Rikshaads or liberating us from Aaryas in Sapt–Sindhu country, O Vinrimn! Bend upon for killing Daasas as well.

 यथा वरो सुषाम्णे सनिभ्य आहवो रयिम् ! व्यश्वेम्यः सुभगे वाजिनीवति ।। RIK.8.24.28 ।। वरः O Great ! यथा As सुषाम्णे through good Saam recitation (you are) आहवः bringer (of) वाजिनीवति mare as रयिम wealth सानिभ्यः for Sani people (similarly) व्यश्वेभ्यः Vyashvas too सुभगे through devotion (you become). [Wealth is classified into four: Cows, elephants, horses and mined.]

O Great (Vinrimn)! You give mares as wealth for Sani tribe, through recitation of Samaved. Please, provide the same to Vyashvas through devotional prayers.

- आ यात मरुतो दिव आन्तरिक्षादमादुत । माव स्थात परावतः ।। RIK.5.53.8 ।। मरुतः (River) Marut as दिवः Div and आन्तरिक्षादमातुत Antariksh moving together आयात may arrive अवस्थात मा परावतः stay not like a stanger. River Marut as Div and Antariksh moving together may arrive but stay not, like a stranger (to become stagnant).
- 4. मा वो रसानितभा कुमा कुमुर्मा वः सिन्धुर्निः रीरमत् । मा वः परिष्टात्सरयुः पुरीषिण्यस्मे इत्सुम्नमस्तु वः ।। RIK.5.53.9 ।। वः रसा, अनितभा, कुमा क्रुमु: Your (tributories) Rasa, Anitabha, Kubha (and) Krumu मा निः ईरमत् (may turn) not stagnant व सिन्धु: your Sindhu (maynot trun stagnant). वः परिष्ठात् सरयुः Your peripheral Sarayu वः पुरीषिणी your Pureeshinee मा अस्तु may not become इत्सुम्नम् lustreless (dry). May your tributaries Rasa, Anitabha, Kubha, Krumu and Sindhu not turn stagnant. May your peripheral Sarayu and your (other tributary) Pureeshinee not turn dry.
- 5. प्र णो देवी सरस्वती वाजेभिर्वाजिनीवती । धीनामवित्रयवतु ।। RIK.6.61.4 ।। देवी Godess ( River) सरस्वती Sarasvatee प्रवाजिनीवती copiously watery वाजेभिः by multiple waters अवित्रयवतु may protect (our) धीनाम् intellect. River Sarasvatee, copiously watery by multiple streams, may protect our intellect.
- 6. उत स्या नः सरस्वती घोरा हिरण्यवर्तनिः । वृत्रघ्नी वष्टि सुष्टुतिम् ।। RIK.6.61.7 ।।

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उत स्या नः सरस्वती Our spun Sarasvatee घोरा हिरण्यवर्तनिः mostly moving due south (sun-ward), वृत्रघ्नी killer of darkness/ignorance (and) वष्टि सुष्टुतिम् most potential killer (of enemies). [उत = pp of वे = spun like a rope of many yarns; in case of rivers it implies a multi-contributory channel formed by several rivers].

Multi-contributory channel Sarasvatee, mostly moving due south, is killer of darkness and most potential killer of enemies.

7. उत नः प्रिया प्रियासु सप्तस्वसा सुजुष्टा । सरस्वती स्तोम्या भूत् ।। RIK.6.61.10 ।। उत सप्तस्वसा सरस्वती Sarasvatee spun of seven sisters, सुजुष्टा ever-happy (and) प्रिया प्रियासु beloved among beloveds नः स्तोम्या भूत् be our prayer-acceptor. Sarasvatee spun of seven sisters, ever happy and beloved among beloveds, accept our prayer.

 आपप्रुशी पार्थिवान्युरु रजो अन्तरिक्षम् । सरस्वती निदस्पातु ।। RIK.6.61.11 ।। सरस्वती Sarasvatee (spun of) आपप्रुशी, पार्थिवानी, उरुः, अजः अन्तरिक्षम् Aapaprushee, Paarthivaanee, Uru Aj and Antariksham\* निदस्पातु purify (us) from blames [Antariksham\* given a neuter termination under ' सामान्ये नपुंसकम् ' to suggest two river names – Antas\* and Rikshas\* making this river. The river is spelt as Aantariksh in Brihanmarut System but spelling Antariksh is taken standard for both. Apaprushee = Aapap\* + Rushi].
 Sarasvatee (spun of) Aapaprushee, Paarthivaane, Uru, Aj and Antariksham\* purify us from blames.

 त्रिधस्था सप्तधातुः पंचजाता वर्धयन्ती । वाजे वाजे हव्या भूत् ।। RIK.6.61.12 ।। त्रिधस्था सप्तधातुः Assimilator of seven ( channels) from three lands – snowy, rocky alluvial --पंचजाता वर्धयन्ती growing as five girl children वाजे वांजे mighty watery हव्या भूत be oblation acceptor. [Seven channels: Sarasvatee, Aapap\*, Rushi, Parthivaani, Uru, Aj, Antarikshasm; five girl children (of Himalayas); five streams Sarasvatee – Apaprushi – Parthivaani – Ururaj - Antariksh.]

Assimilator of seven channels from three lands – snowy, rocky and alluvial; growing as five girl children, mighty watery stream be our oblation acceptor.

10. पर्जन्यवाता वृषभा पृथिव्याः पुरीषाणिः जिन्वतमप्यानि।

सत्यश्रुतः कवयः यस्य गीर्भिर्जगतः स्थातर्जगदा कृणुध्वम् ।। RIK.6.49.6 ।।

पर्जन्यवाता वृषभा पृथिव्याः In the rainy bull country जिन्वतमप्यानि पुरीषाणिः most watery river (is) Pureeshaani, कवयः O the bards! यस्य गीर्मिः र्जगतः स्थातः By whose prayers world (remains) stable as जगत् world सत्यश्रुतः a true description ( of it) आकृणुष्वम् be done ( by you).

In the rainy bull country most watery river ( is) Pureeshani, Bards! By whose prayers world (remains) stable as world, a true description of it be done ( by you).

11. पावीरवी कन्या चित्रायुः सरस्वती वीरपत्नी धियं धात् । ग्नाभिरच्छिद्रं शरणं सजोषा दुराधर्षं गुणते शर्म यंसत् ।। RIK.6.49.7 ।। 47

संजोषा ग्नाभिः By the pleased Godess, धियं धात् stock holder of पावीरवी कन्या चित्रायुः सरस्वती वीरपत्नी Paaveeravee, Kanya, Chitraayu, Sarasvatee and Veerpatnee, शर्म यंसत् a virtuous penancer गृणते sprinkles (upon himself) अच्छिद्रं दुराधर्षं शरणम् impenetratable, unassailable protection. By the pleased Godess (Pureeshanni), stock holder of Paaveeravee, Kanya, Chitraayu, Sarasvatee and Veerpatnee, a virtuous penancer spinkles upon himslef impenetratable, unassailable protection

12. आ युवानः कवयो यज्ञियासो मरुतो गन्त गृणतोवरस्याम् ।

अचित्रं चिद्धि जिन्वथा वृधन्त इत्था नक्षन्तों नरो अडि्गरस्वत् ।। RIK.6.49.11 ।।

युवानः यज्ञियासः कवयः Young richualist bards आगन्तः arrive वरस्यां गृणतः मरुतः with desire of bath in Marut\* (where after) जिन्वथा moving ahead वृधन्त इत्था the Big (Marut) ends thus नक्षन्तः at termination नरः अडि्गरस्वत् Nar and Angirasvat\* (form) अचित् हि an unimaginable scene (at tri-junction of Marut\*, Angirasvat\* and Nar)

Young ritualistic bards arrive with desire of bath in the River Marut at a place (where after) moving ahead the Big (Marut) ends thus: at its termination Nar and Angirasvat\* (form) an unimaginable scene by the tri-junction of Marut\*, Angirasvat\* and Nar.

13. प्र पर्वतानामुशती उपस्थादश्वेइव विषिते हासमाने।

गावेव शुभ्रे मातरा रिहाणे विपाट्छतुद्री पयसा जवेते।। RIK.3..33.1 ।।

In (the upper reaches) विपाट् शुतुद्री पर्वतानाम् उशती Vipaat\* and Shutudree belovd of hills विषिते (keep) moving galantly प्रहासमाने happily उपस्थात् अश्वे इव like a pair of close by mares. (In plains) गावेवशुभ्रे like pair of white cows मातरा पयसा रिहाणे for being licked by mother Payas\* they go unified. [After the unification; usage of verb जु is singular suggesting that only a unified channel was moving towards Payas\*].

In upper reaches, Vipat\* and Shutudree, beloved, of hills, keep moving gallantly, happily like a pair of close by mares. In the plains, like a pair of white cows, for being licked by mother Payas\*, they go after unification.

14. इन्द्रेषिते प्रसवं भिक्षमाणे अच्छा समुद्रं रथ्येव याथः।

समाराणे उर्मिभिः पिन्वमाने अन्या वामन्यामप्येति शुभ्रे ।। RIK.3.33.2 ।।

(The pair of Payas\* and Shutudree) पिन्वमाने उर्मिभिः splashing water by waves भिक्षमाणे (are) a pair of ascetics इन्द्रेषिते directed by Indr अच्छा प्रसवं समुद्रं towards (their) source sea रथ्येव याथः move live a pair of wrestlers - (bodily bulky, moving slowly). शुभ्रे समाराणे O the white co-travelers! अन्या वां अन्यां अपि एति (then) one of you goes verily into the other.

The pair of Payas\* and Shutudree, splashing water by waves, like a pair of ascetics directed by Indr toward their source sea, move like a pair of wrestlers - bodily bulky and moving slowly. Then one of the white co-travelers goes into the other (at the confluence).

15. अच्छा सिन्धुं मातृतमामयासं विपाशमूर्विं सुभगामगन्म । वत्समिव मातरा संरिहाणे समानं योनिमन् संचरन्ती।। RIK.3.33.3 ।। अगन्म I moved in विपाशं उर्वि सुभगां Vipaash, Urvi and Subhaga अच्छा सिन्धु मातृतमामयासम् towards Sindhu, the eldest mother like river [ मात्र used dually, mother as well as river]. अनुसंचरन्ती One (river) is follwer of the other समानं योनि among same sex objects वत्समिव संरिहाणे like a well licked calf by मातरा mother. [Subhaga calf  $\rightarrow$  Uri mother, Urvi calf  $\rightarrow$  Vipaash mother, Vipaash calf -> Sindhu mother: सिन्ध: मातृतमा, विपाश मातृतरा, उर्वी मातृसमा, सुभगा वत्सा । अगन्मम in place of अगच्छन् ]. I moved in Vipaash, Urvi and Subhaga toward Sindhu, the eldest mother like river [ used dually, mother as well as river]. One (river) is follower of the other among same sex objects like a well licked calf by mother. [Subhaga calf -Urvi mother, Urvi calf -Vipaash mother; Vipaash calf – Sindhu mother ] 16. उत्त स्या श्वेतयावरी वाहिष्ठा वां नदीनाम। सिन्धर्हिरण्यवर्तनिः ।। RIK.8.26.18 ।। वाहिष्ठा स्या Revered river is सिन्ध्हिरण्यवर्तनिः due-south-moving Sindhu. वां नदीनाम् Among your rivers, रेवतयावरी उत्त Shwetayaavaree is woven ( of Shveta and Shvetaavaree or Shweta and Great Shweta). [ हिरण्यवर्तनिः Moving towards mid-day sun = south moving]. Revered River Sindhu is due south flowing. Among your rivers, Shvetaavaree is woven of Shveta (Kaneeya) and Shvetaavaree or Lesser Shveta and Great Shveta. 17. स्मदेतया सुकीर्त्याश्विना श्वेतया धिया । वहेथे शुभ्रयावाना । RIK.8.26.19 । । स्मत् एतया वहेथे सुकीत्या अश्विना श्वेतया धिया शुभ्रया वाना After that flow ( pairs of) Ashwina joined by Sukeerti, Dhiva joined by Shveta and Vaana joined by Shubhra. After that flow Ashvina joined by Sukeerti, Dhiya joined by Shveta and Vaana joined by Shubhra. 18. प्र सु व आपो महिमानमुत्तम कारुर्वोचाति सदने विवस्वतः । प्र सप्तसप्त त्रेधा हि चक्रमुः प्रसुत्वरीणामति सिन्धुरोजसा । RIK.10.75.1 ।। कारुवोंचा आतिसदने विवस्वतः Karurva (Operator) of the Movement House of Sun has collated स्वापः सिन्धः Great River Sindhu वः महिमानम उत्तमम् your majestic grandeur (as) सुत्वरीणामति biggest among flowing rivers प्रचक्रमु: moved ओजसा with water सप्त सप्त त्रेधा हि in the clusters of seven thrice. Great River Sindhu! The astronomer of Solar Movement House collated your majestic (elaborately) - biggest among flowing rivers moving with water in the grandeur clusters of seven thrice. 19. प्र तेऽरदद्वरुणो यातवे पथः सिन्धो यद्धाजां अभ्यद्रवस्त्वम् । भूम्या अधिप्रवता यासि सानूना यदेषामग्रं जगतामिरज्यसि ।। RIK.10.75.2 ।।

सिन्धो Sindhu ते अरदत् वरुणः Your sonVarun प्रयातवे पशः arrives on the path first यद्धाजां from whose waters अभ्यद्रवस्त्वम you are hardly any liqid-adding. यदग्रं Beyond this भूम्या अधिप्रवता flowing in alluvium (you) यासि सानुना move with younger sisters and एषां जगतां इरज्यसि rule the worlds. [अभि + अ + द्रवः अभ्यद्रवः]

Sindhu, your son Varun arrives on the path fist, from whose waters you hardly add any liquid. Beyond this, flowing in the alluvium you move with younger sisters and rule the worlds.

20. इमं मे गंगे यमूने सरस्वति शूतुद्रि स्तोमं सचता परुष्ण्यया।

असिक्त्या मरुद्धे वितस्तयार्जीकीये शृशुद्धा सुषोमया । RIK.10.75.5 ।

इम मे This (is) my गंगेयमुनेसरस्वतिशुतुदिस्तोम prayer of Gangas (2) – Yamunas (2) – Sarasvati – Shutudri (besides) सचता परुष्ण्य्या Sachata joined by Parushnee and असिक्त्या मरुद्धघे Marudvridas (2) through Asiktee वितस्तयार्जीकीये Aarjeekeeyas (2) through Vitasta (and) शृशुद्धा सुषोमया Shreeshuhee with Susoma. [The first set of seven rivers is Himalayan; the second set of seven rivers are all terrestrial. Four of the rivers are made of two each – Great and lesser]

# This is my prayer for Gangas, Yamunas, Sarasvati, Shutudri and Sachata joined by Parushnee besides Marudvidhas through Asiktee, Aarjeekeeyas through Vitasta and Shreeshuhee through Susoma.

21. तृष्टामया प्रथमं यातवे सजूः सुसर्त्वा रसया श्वेत्या त्या ।

त्वं सिन्धो कुभया गोमती क्रुमुं मेहत्न्वा सरथं याभिरीयसे ।। RIK. 10.75.6।।

प्रथमं Firstly यातवे सजू: (you) moved together with तृष्टामया rocky त्या river(s) सुसर्त्वा रसया रवेत्या Susartu, Rasa and Shvetee. Then त्वं सिन्धो You Sindhu याभिरीयसे सरथं ultimately flow out physically (into the sea) कुभया गोमती क्रुमुं मेहत्त्वा when joined by Gomatee through Kubha and Krumu through Mehatnu. [The description of last set of seven rivers follows the convention अदिरन्त्येन सहेता (Conclusion with first and last); त्या = त + ईम् fem. ती+विभक्ति.] Sindhu, you firstly moved together with rocky rivers Susartu, Rasa and Shvetee. Then you flow out physically into sea joined by Gomatee through Kubha and Krumu through Mehatnu.

22. अदब्धा सिन्धुरपसामपस्तमाश्वा न चित्रा वपुषीव दर्शता ।। उत्तरार्धर्चा RIK 10.75.7 ।। ऊर्णावती युवतिः सीलमावत्युताधि वस्ते सुभगाा मधुवृधम् ।। उत्तरार्धर्चा RIK 10.75.8 ।। To us, अदब्धा सिन्धु the crystal clear (pure) Sindhu, श्वा swollen अपसां अपस्तमा maximum watery among watery rivers, इव (looks) like a चित्रा beautiful वपुषी fat lady. (Contrarily), ऊर्णावती River Oornaavatee सुभगा युवतिः a majestic young lady अधिवस्ते dwells into सीलमावतीम् मधुवृधम् Seelamavatee with water aplently, (when) उत्त woven with.

To us Sindhu, most swollen among crystal clear watery rivers, looks like a beautiful fat lady. Contrarily, Oornavatee River – a majestic young lady -- joins Seelamavatee with water aplenty.

23. नि त्वा दघे वर आ पृथिव्या इलायास्पदे सुदिनत्वे अहाम् । दृषद्वत्यां मानुष आपयायां सरस्वत्यां रेवदक्ने दिदीहि।। RIK 3.23.4 ।। इलायाः पृथिव्याः On sacred Earth वरे मानुषे पदे In the great Maanush township (at the trijuction of) दृड्ढत्यां आपयायां सरस्वत्यां Drishadvatee-Aapaya-Sarasvatee रेवदग्ने rich Fire God त्वा नि आ दघे I invoke you intensely on a sacred day among days. दिदीहि Bestow upon me (grace). On sacred Earth in the great Maanush township at the tri-junction of Drishadvatee-Aapaya- Sarasvatee, I invoke the rich Fire God intensely, on a sacred day among days. Bestow wealth of your grace upon me.

Potwar Plateau and wesern Rajasthan. Sataabhishaj: Star lamda Aquarii, Saataabhishaj: month named after the star. Shatapath Brahman: A bulky Brahman-book of Yajurved. Sookt: Hymn. Sravistha: Star Beta Delphini, Varee: Great. Vyashv: A Vedic tribe of Saptasindu and adjacent Rajasthan. Yajurved: A Ved of prayers mostly for use during rituals.

#### LOCALITY INDEX (Coordinates Approximate)

Ambala (30°21':76°52'), Bakloh (32°29'N:75°57'E), Bao (32°35'N:74°45'E), Basanbir (26°55'N:77°05'E), Basoli (32°24'N:75°52'E), **Bikaner** (28°01'N:73°22'E), Bunga (29°32'N:72°04'), Cambay (22°21'N:72°35'E), Chakrata (33°44"N:77°52'), **Chor/Chhor** (25°30'N:71°46'E), **Dasapa** (25°10'N:72°15' **Dasuri** (25°17'N:73°33'E) Deoband (29°42'N:77°43E), **Dholavira** (23°53'N:70°12'E), **Dwarka** (22°15'N:69°05'E), Gandhar (21°51'N:72°38E), Hansi (29°06':76°00'E), Hardwar (29°58'N:78°13'E)

**Jaisalmer** (26°55'N:78°13'E), Jambusar (22°00'N:72°55'E), Jodhpur (26°18'N:73°04'E), **Kabul** (34°30'N:69°11'E), Kalibangan (29°25'N:74°05'E), Kankhal (=Hardwar), Kandahar (31°32'N:65°30'E), Kanod (27°08'N:71°09'E), Kuda (23°08'N:71°34'E), Limdi (23°34'N:72°00'E), Lothal (22°33'N:72°14'E), Luni (26°00'N:73°02E), Marli (25°36'N:71°37E), **Merta** (26°39'N:74°02'E), Maru (33°42'N:75°49'E), Nawabshah (26°15'N:68°25'E), Padua (32°28'N:75°40'E), Pathankot (23°17'N:75°42'E), Rasul (32°34'N:73°43'E), **Risalpur** (34°04'N:72°02'E), Saharanpur (29°58'N:77°23'E), Sargu (23°45'N:69°44'E), Sarnath (25°23'N:83°00'E), Sirsa (29°32'N:75°01'E) Surkotada (23°29'N:71°59'E), Uch (29°17'N:71°13'E), Vadodara (22°00':73°16'E), Varohi (23°48'N:71°28'E), Varanasi (25°20'N:80°0'E), Virwah (24°32'N:70°46'E).

# BOX 2 Notes on Vedic Rivers (Sl. No. in Fig. 4; River Systems in brackets)

Vedic Sanskrit has 101 words for water and 37 for rivers (Nighantu, 1.12,13) suggesting the duration through which the language has lived and also the expanse of lands where past tribes have moved and ultimately collated such an elaborate vocabulary in Veds. These words of past still continue in far and distant lands sticking to the rivers either as such or in slightly transformed state between Europe and the farthest east corner of India. For example in Danube (Europe) – Dajala (Middle East) and Indus / Dikhu Rivers (India) word Da of Mundari is for water or river even before its evolution into Udak of Sanskrit (Jagadishomrityunay, 1997). Traveling through oral communication to such far distant lands it stays till today. With a plentiful vocabulary and complex grammar in Sanskrit an approach to fix the derivation of river names in Fig.4 is possible, although it is not an exclusive derivation and one of several such options.

**1.(I): Anitabha** Anit: not perennial + Va: water  $\Rightarrow$  A seasonal stream.

A river associated with Rasa, non-existent now, possibly draining from Sohan Valley, north of Potwar Platen, into Rasa (Jhelum).

- 2.(I): Div Di + Va: water/river ⇒ A perennial stream. River relatable to locality Deoband (Dev + Van +D) and originating after Ganga and Yamuna met there. Word considered masculine, in contrast to notation feminine for sky, in view of older usage of Divo Dyaava (AST: 6.3.29) and male figure of Dyaus in Dyaus and Prithivee Pillars of Rajasthan.
- 3. (I,VI): Krumu Krin(g): sparkling (Khasi) + U: masculine suffix ⇒ A major sparkling river. It was a river of Khasis who migrated partially from Western India to Meghalaya during Vedic period (Jagadishomrityunjay, 1997). Another derivation Ka + Ru + Um + Eu is also feasible. The southernmost river of the Brihanmarut corresponds to present day Narmada. The name of the long river continued till Harappans (4.5 Ka-4 Ka) who used the river as pathway (Rao, 1982).
- 4. (I,VI):Kubba Ku: poorly + Va: watery ⇒ A poorly watery stream.
   Locality Kuda in coastal Saurashtra, close to Gulf of Kachchh may be related to the river due to same meaning of Kuda and Kubha. River Bhogava in Saurashtra was its likely main tributary.
- 5. (I): Marut Mar: land + Ud: water  $\Rightarrow$  A major stream on land.

There are three distinct channel names with somewhat confusing identity at different levels of Vedic period. Marut\* (19.III), Marut (5.I) and Marudvridha (42:VI). Marut was initially a terrestrial river related to locality Merta near Jodhpur [Mar: land + Ta: river]. This was at the level of original nomenclature. However, later the river moved much to the west near Jaisalmer. Its initial sources were rivers Div and Antariksh in Himalayas. Meerut was then possibly on its course. This trunk river of Brihanmarut System drained into Gulf of Cambay Via Marli while its most northerly stream was River Kabul in Afghanistan. Commonality of names between this river system and Sindhu is because both the channels,

irrespective of names of their tribes at different times, were a conduit of human population between equatorial India and temperate Caspian land.

# 6.(I): Pureeshinee Pureesham\*: water ⇒ A perennial stream. No evidence to tie up the name with land features. Probably it was the name of the main between Basanbir and Bolan Pass and beyond, continuing further west as Morad (PMarut). In the description, it figures along with Sarayu River that was flowing through Pachchham Island in Kachchh.

# 7. (I, VI): Rasa Ras: water $\Rightarrow$ A perennial stream .

The name appears at two horizons - Brihammrut and Brihatsindhu and connotes two different streams. During the lower or Brihammarut System the stream lies to the south of Sohan Valley. Accordingly, the name ties with the locality Rasul and the channel corresponds to Jhelum. At the higher level, it is a tributary of Sindhu and lies between Shvetee (Swat) and Susartu (Sohan River). The higher level name ties up with Risalpur. Kabul is the modern name of the channel.

# **8.** (I): Sarayu Sar: water $\Rightarrow$ A watery stream

Adjective paristhat\*, i.e., ' from far younder land' qualifies Sarayu River. Seemingly name Sarayu, is not used as a feminine word as per the current Linganushaashanam\*: Dhenu-Rajju.... If Sarayu in RIK 5.53.9 was a feminie word its adjective wouldd have been Paristhata. Vedic Sarayu is a masculine word in contrast to the later feminine Sarayu and planted Ayodhya of U.P. This river is relatable to village Sargu in Pachhham Island of Kachchh. Space imagery shows presence of a river there. The Vedic Sarayu constituted the main Indus channel diverted to the east after 32 Ka.

# 9. (I, II): Antariksham\* Composed of two rivers — Anta and Riksh.

A river common to Brihanmarut as also Brhatsaravatee Systems, the pair of component rivers corresponds to Beas and Sultej in Himalayas.

# **10. (I,IV,V,VI): Sindhu** Su/Sv:water + Indus\*/ Indhu => Affluent Indus. Su survives in Turkish for water.

An adjective Su prefixed by migrants of ~ 25 to Imd of Khasi-Munadari people ~ 42 Ka (Cf. Jagadishomrityunay, 1997, fig. 5.5), which survives till date. The river sung first by the bards of Basanbir along with Marut disappears in Sarasvatee and Pureeshaani Systems due to renaming. It is Angirasvat\* of later period till appearance of its name again during Saptasindhu Period. Possibly the initial Sindhu joined river Marut flowing along Sargodha-Delhi ridge. During the Brihatsarasvatee System, Sindhu River is named Ururaj.

There are nine channels in Sindhu River during Brihadashivina System. Most magnificent development of this waterway, however, is during Brihatsindhu System, when the number of channels described with Sindhu as conduits of wealth for Harappan traders reaches above twenty. It was the longest channel courses then, above 1500 kilometer between Kabul in Afghanistan to Cambay in India. The then Shindhu River harbored, on its banks, famous townships around 4.4 ka. It is during this time that some locality names become common between the farthest lands, like Gandhar (Gujarat) and Kandahar (Afghanistan).

- 11. (II): Aj Uch --> Oj --> Aj: water => A watery Stream.
  - A complimentary stream of Saraswatee either joining Uru before meeting Saraswatee or an independent stream close to Uru. Locality Uch, in Pakistan may be related to the stream. Uch --> Ach -->Aj transformation makes it the stream of Aj people (RIK 7.18.19). The same were called Ary or Aary during Shutudree period (Aj - Ajj - Arj -Aary transformation ). There is a stone inscription in Kachchh Museum Bhuj, belonging to 4<sup>th</sup> century AD with a mention of Dutiswami of Aary Gotr suggesting that Aary is related to a tribe named after a native land.
- 12.(II): Aapaprushee Aapap\* + Rushi joined to form the new channel: The name of stream denotes relationship with Rishikesh. The stream corresponds to Div of Marut system, made of Aapap (Yamuna) and Rushi (Ganga).
- **13.(ii): Paarthivaanee** Paarthiva:terrestrial + Enee:river => A terrestrially sourced river. Identification and tie up is difficult. Considered same as Pureeshinee of Brihanmarut System.
- 14.(II): Uru Ud --> Ur:water + u masculine termination => Major River. Hard to trace by locally name, the river appears to be same as Sindhu of Brihanmarut System.
- 15. (II,III,V): Sarasvatee In Tarasvatee Sarsvatee and Harasvatee T S H connote Ta for river, prefixed to Ras: water + Vatee suffix for river. Saraswatee means a major or important water channel. During its best development as trunk river of Brihatsarasvatee System, its headwaters ware composed of a pair of rivers Jhelum and Chenab. It was mostly a southerly flowing river. Another Saraswatee was joining Pureeshaani River as its last contributory in Gujarat. There is no mention of this river during Brihachchhutudree System. The name figures again with the trio of Aapaya–Sarasvatee—Drishadvatee during Brihadashvina System when the river is made of Beas + Sutlej. In the non Vedic reference of Manusmriti, the river corresponds to the then course of Yamuna, during transition of Brihadashvina and Brihatsindhu systems.
- **16. (III): Angirasvat\*** Angi +Ras +Vat\* = Angirasvat => A river formed by Angi (Amb) + Ras

(Jhelum) with suffix Vat\* is masculine form of Vatee.

Not existing in this form now but forming the course of Indus during Brihatpureeshaani system. It joined Marut\* at the tri-junction of Angirasvat\*, Marut and Nar. The last of these originating at the junction, moved south, veered to the east and ultimately joined Pureeshaani. This way Nar of Pureeshaani System was distinct from Nara of today which drains into Rann of Kachchh.

# **17. (III):** Chitraayu Chi = Ti: river + Trayu: trifurcated => A trifurcating river.

No tie up with locality name possible due to nature of adjective. Likely identification with Beas which has presently two main branches but had a third branch to joined in from locality Padua. This branch is now joining River Ravi. Head waters of Ravi were a part of Chitraayu.

- 18. (III): Kanya Kaneeya => Kanyya =>Kanya: Lesser => Lesser Pureeshaani River. A major branch of Pureeshani River between Kankhal (now in Hardwar township), Veekaner (Bikaner) and Kanod (near Jailalmer). This channel was first a major contributory of Sarasvatee system. During the Brihatpureeshaani System it was names as Kanya.
- **19. (III): Marut\*** Maru: desert => A stream of desert.

Unrelated to stream of same name during Brihanmarut system. Identifiable with Chenab which has a locality Marut in its headwater region.

- **20. (III):** Nar Nad => Nar: A major river See Angirasvat\* (16).
- (III): Paaveeravee Paavee: fresh (drinking) water + Tavee --> Davee --> Ravee: river => a fresh water or non-snowy stream .
   The river now represents Tawi River near Bao close to Jammu. It was joining Degh subsequently.
- 22. (III): Pureeshaani Pureesham\* : water => A watery stream.

River description as 'most watery stream' refers to its down stream part after three primary channels Nar, Pureeshaani and Kanya had joined. Sutlej formed the head water part of the main channel of Pureeshaani. Other rivers from Himalayas, like Paaveeravee and Chitraayu, joined it in the Indogangetic plains while Kanya drained into it far to the south in Rajasthan.

- **23. (III): Veerpatnee** Veed --> Veer : watery river + Patnee --> vatnee : watery river => A watery river. Probably Beji river, of Baluchistan. It flowed close to locality Virwah (River Vir) in Pakistan before joining Pureeshaani.
- 24. (IV): Payas\* Pay : water => A watery stream.

Payas\* transforms into Beas in most simple way. The river is Beas. In post Vedic works like Amarkosh (533), Vipaat\* and Vipaash are considered synonymous on the basis of grammar after rivers were renamed long ago. Vedic Index as also Avasthi (1953) followed it. Accordingly, they consider Vipaat\* and Beas as synonymous. The facts and transformation both are untenable. Vipaat\* cannot be transformed into Beas; the likely transformation is Pay (as\*) -->Pee (as\*) -->Bee (as\*) --> Beas.

25. (IV,VI): Shutudree Shutudree and Shatadru synonymy (Amarkosh : 533) suggests a hundred rivers =>A river made of numerous streams.
Identifiable with Sutlej of today, its earlier spelling Shutudree was changed to Shutudri during Brihatsindhu System. Exit point of Shutudree was from Himalayas through Markanda River course (the original Marut channel). For River Shutudri it is same as Sutlej.

**26. (IV):** Subhaga Sv (Sanskrit) or Su (Turkish): river / water + Vaga: watery stream => Major watery stream.

There is no geographic name to confirm the location of this river. In the description it is a part of a trio composed of Vipaash – Urvi – Subhaga, to the west of Beas and joining Sindhu. Vipaash is linkable to locality Basoli (Vi + Pash\* = Bas + udi) in the head water

region of Ravi. The river could be, accordingly, Paleo-Ravi. The other two channels in the trio, correspond to Chenab (Urvi) and Jhelum (Subhaga).

- 27. (IV): Vipaash Vi:Water + Pa: Drinking => Fresh water stream. See Subhaga (26).
- **28. (IV): Vipaat\*** Vi: Water + Pat \* fall : water fall. A river originating from awater fall. A major river and formed by present day channels of Yamuna + Ganga. It joined Shutudree.
- 29. (V): Urvi Urvee : river. See Subhaga (26).
- **30. (V):** Ashvina Ashvi : horse inhabited + Na : suffix for river => Main river of Horse country.

In the present, the likely position of river matches with Jhelum. On the path to Sindhu, it was accompanied by river Sukeerti, which could be river Chenab.

- 31. (V): Dhiya Di:river + Ga: river. Diga --> Dhija --> Dhiya : river : transformation of Ga
   --> Ja --> Ya. A river close to River Ashvina while it moved towards Sindhu along with its tributary Shveta. Dhiya and Shveta correspond to Degh and Ravi rivers respectively.
- **32. (V): Shubhra** Shubhra : White => White (sandy) rivers See Vaana (36).
- **33.** (V): Shveta Shvet : White => White river See Dhiya (31).
- **34. (V,VI):** Shvetaa Varee & Shveta Shvet: White => White river : Shvetaavaree Great Shveta.

In the description, Shvetayaavaree refers to two rivers: a major or Great Shveta (Shvetaavaree) joined by a (lesser) Shveta. Shvetaavaree joined Sindhu. Among the two, Shveta is river Swat and Svetaavaree is river Kabul. During Brihatsindhu System, Shveta is spelled as Shvetee and Shvetaavaree has been named as Rasa. The latter name is linkable with the township of Risalpur.

- **35.** (V): Sukeertee Su : River + Keerti fame => Famous river. See Ashvina (30).
- **36. (V): Vaana** Vanam\* : Water => Watery river .

Third and outermost pair of rivers in Ashwina System joining Sindhu includes Vaana and Shubhra. The first name seems to occupy the present course of Sutlej and continues to Pathankot and Bakloh. It has a township of Bunga in Pakistan plains. On Bunga (Van + Ga) =>Vaana synonimy, this river is treated as river Vaana. The other channel, i.e. Shubhra river seems to be the left out course of Shutudree. It joined Vaana after Beas-Sutlej had formed Sarasvatee.

- 37. (VI): Arjeekeeya Archik : Samved of Kaithumee Branch => River of Samved people. A pair of wide dry rivers, in the second cluster of Sindhu, associated with a third dry river Vitasta. With no geographic names to fix its position precisely, it is considered as the middle pair of rivers in the second trunk-channel of Sindhu.
- 38. (VI): Asiktee A : without + Siktee : watery or moist => A dry channel See Marutdvridha (42).
- 39. (VI): Ganga Gam\* : to move + ga (kha):water => Turbulent stream.A pair of fast moving channels declined as duel Gange in the description of Sindhu. It includes Jhelum and Chenab of today.
- **40. (VI):** Gomatee Matee is River suffix in Gujarati is same as nadee in Sanskrit. => A river of Go (land) originating in the plains of Gujarat.

This main river from Kutch-Saurashtra region is now submerged in Gulf of Kutch. It joined Sindhu through Kubha.

- **41. (VI) : Mehatnu** [ Meh: Urine + tanu : slightly (fide Unadi 1:7) =>A very slightly saline river. Mahi of today corresponds to this river. It is very slightly saline near Vadodara when it meets Gulf of Cambay. This probably was also the picture in past. It was joined by Krumu (Narmada) before draining into estuarine Indus when the latter drained into Arabian Sea.
- **42. (VI): Marudvridha** Mar: land + Ud: water + Vridha: great => Great dessert river. Used with a qualifier dual in declining the word. The dual channels drained in to Sindhu through Asiktee. Hard to fix the channel courses now, these have been taken as western channels in the second clusters of seven rivers of Sindhu.
- **43. (VI): Parushnee** Par: other + Vashinee: subdued => other subdued or dry channel. A mostly subdued to dry tributary of Sindhu's first cluster of seven rivers with Sachata as the main tributary. Accordingly the river included dry bed of Markanda in most part. At Kalibangan, and further south, it is now named as Ghaggar.
- **44.(V):** Sachata Sa + Chata: One like Chatak (a migratory bird, surviving on rain drops as per mythology) A tributary of Sindhu, joined by Parushnee. It continued as erstwhile dry bed of Shubra close to Indus, extending in east up to Hansi.
- **45. (VI):** Sarasvati [Derivations same as 15]. The word even though feminine has a short 'i' termination to distinguish it from Sarasvatee wich was then a name fixed to present day Yamuna. The channel and it course corresponded nearly the present day course of Beas.
- 46. (VI): Shreeshuhee Shree Shushee: Glory of dry rivers =>A major dry river with qualifier Sushomaya or rich growth of Som or grape vine on its banks. Som may also be linked to date palm. The growth of grape-vine is expected in Rajasthan country around 4.5 Ka. Hard to locate or fix its position by existing names. The river has been considered as the eastern most river in the second cluster of dry channels joining Sindhu.
- **47. (VI):** Susartu Sus churning, moving + Ritam: Water A major turbulent river. Possibly Corresponding to Sohan River [Sus\* = Suh= Soh + Um].
- **48. (VI):** Shvetee Shvet: White => White river See Shvetayaavaree (34).
- 49 (VI): Varun Var: important + Um: water (Khasi, transforming to Van in Sanskrit)
   => Important water channel. P Varun --> Balan --> Bolan transformation is possible. Its modern name is Bolan River.
- 50. (VI): Vitasta Vee: water + tasta: major river -->A major river close to Arjeekeeya where Samved people were settled. It was inhabited by Vis people.
   This is the river through which a pair of Maruts join the second cluster of seven rivers forming the tributory of Indus. No clues for fixing its name and course precisely.
  - (VI): Yamuna Yam: pair + Vana: river => A pair of watery rivers in the I cluster of Seven rivers of Sindhu

Present rivers Degh and Ravi correspond to Regvedic Yamuna. On the existing river, this name has been planted very lately.

#### EASTERN DRAINAGE

The Trading centers of Harappa and others on the banks of River Indus had metals, cotton and wool as trade items. In the search of metals, traders reached in the east up to the copper belt of Hazaribagh either through the route of Ganga or Narmada but the effective trade was through Ganga. Harappan seals from this locality suggest this fact. Ganga was a convenient channel and Alamgirpur on its banks was a point of transit in trade. In the description of Indus, River Oornaavatee figures as a long trade river comparable to Sindhu but much narrow, widening after joining Seelamaawatee.

Ornaavatee or the river of wool had its origin in Himalayas from Sankurna near Uttarkashi meaning literally a wool post. Locality Tamba-Khani of Uttarkashi was a collection center of Himalayan copper ore – 'Tamrakhany. River Oornaavati is Varanavati in Atharvaved (4.7.1) and a corresponding name of today is River Barana at Varanasi.

Initially the present day Ganga was Oorna, Varana or Rishi in Varanasi area. Originating in Himalayas beyond Varanavat Hill and passing through locality Rishikesh it reached Sarnath, which was Rishipattan or port on Rshi Rver at the time of Buddh in the sixth century B.C (Agrawala, 1984).

When Varana was named as Ganga (AD+), its original tributary Assi was renamed as Barana; and, a rivulet south of Varanasi was christened as Assi to justify the name Varanasi. Corresponding names Varana and Assi are also in Uttarkashi in the key Harappan township in Himalayas. However, after arrival of name Ganga, name Varana disappears but Varanavat hill continues, reminding the name of the once flowing Varuna or Oorna .

Present day Yamuna constituted Seelamaavatee during Harappan times. It had more water but was a less favourite river for the Harappan traders because of its longer route and long time in the transit of goods west of Varanasi.

# ABBREVIATIONS

#### Traditional Sanskrit Literature

AST	:	Ashtaadyaayi
ATH	:	Atharvaved Samhita.
СНН	:	Chhaandogy Aranyak
MAN	:	Manusmriti
RIK	:	Rigved Samhita
SPB	:	Shatapath Brahman
VMB	:	Vyaakaran Mahaabhaashy

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