SARASVATI RIVER

(circa 3000 to 1500 B.C.)

Dr. S. Kalyanaraman

October 1997

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SARASVATI: AN OVERVIEW

The mighty, sacred, Vedic Sarasvati river nourished, on her banks, an ancient, the most expansive, remarkably homogeneous, civilization of the times, circa 3000 B.C. The river is adored in the *Rigveda* as: **ambitame, naditame, devitame**. (Best of mothers, best of rivers and best of goddesses). The people of this maritime, riverine civilization (with a marked preference for alluvial plains) traversed the Himalayan rivers and the oceans across the gulf of Bahrain and the gulf of Khambat. This is evident from the over 1200 settlements located along the banks of the dried-up river bed of this great river (approx. 1600 km. long) and also trade with Mesopotamia and South India (e.g. use of alloy electrum for gold ornaments in Lothal, imported from the gold mines of Hatti or Kolar in Karnataka). The Sarasvati river joined the *sàgara* (also called Hakra or Nara or Wahind or Mihran), and flowed through the Rann of Kutch into the Indian ocean at the Gulf of Khambat. Some centuries before the river dried up (circa 1500 B.C.), it should have been possible to navigate from the Indian ocean right up to Ganga-Yamuna doab, from Dwaraka to Mathura, or from Lothal to Ganweriwala or Kalibangan, on the river Sarasvati. The rise of the ocean-bed which explains the submergence of Dwaraka also explains the rise of the Aravalli ranges which was one of the principal causes for river migrations in Northern and North-West India, the river piracy, the capture of the river source of Sarasvati by the Yamuna (Chambal), a tributary of the Ganga. The eggression and recession of the sea right upto the quaternary period, right up to Kuruk±etra, explains the Luni river system, the ocean fossils near Jaisalmer and the salt marshes of the Rann of Kutch.

The river dried up in long stretches due to sand deposition (*àndhi*) and due to river piracy (Yamuna captured Sarasvati at PaontaSaheb and carried her to Prayag, Allahabad to join the Ganga; hence the myth of the sangamam of the three rivers, Sarasvati, Yamuna and Ganga). When the river was in full flow, it had borne the Himalayan glacier waters emanating from Har-ki-dun glacier (Bandarpunch massif) and of the waters of the Sutlej emanating from Mt. Kailas; thus the river had carried the present-day waters of the Sutlej, the Tons and the Yamuna.

Due to the desiccation of the mighty river which was the life-sustence for the civilization, there was a migratory movement of people, from circa 1500 B.C., westwards towards the Haraquaiti (Kubha, Afghanistan), towards

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the Ganga-Yamuna doab (Rakhigarhi), and south through the Gulf of Khambat (cf. the ancient site of Daimabad, on the banks of Pravara, a tributary of the Godavari River).

Map 1: Course of the Vedic Sarasvati River

Map 2: Ancient Civilization Settlements on the Sarasvati River

Historical Perspective: The river and the ancient settlements

Map 1 depicts the flow of Sarasvati circa 1500 B.C. when part of the river dried up due to aandhi, river capture and river migrations; in earlier millennia, prior to 1500 B.C., the river had carried the waters of both Sutlej and Yamuna and fflowed through the Rann and Little Rann of Kutch to the Gulf of Khambat. [Map based on K.S. Valdiya, 1996].

Map 2 depicts the remarkable clustering of ancient archaeological settlements on the banks of the Sarasvati River establishing that the settlements formed the substratum of the civilization; Harappa and Mohenjodaro were only trading outposts. [Map based on Parpola, 1994].

Over 1200 of the 1600 ancient settlements of the civilization circa 3000 to 1500 B.C. are on the Sarasvati river; Ganweriwala and Rakhiharhi are as large in area as Mohenjodaro, which was also an island flanked by Sarasvati and Sindhu. The locality index is provided. (Annex 1: Locality Index: Archaeological Settlements, mostly on Sarasvati River Basin).

Radiocarbon dates (B.C.) of selected ancient sites on the Sarasvati-Sindhu Rivers

Balakot	4150-3800
Harappa	3338-3208
Kunal	3016
Ganeshwar (Jodhpura)	3018-2926
Kalibangan	2950-2650
Somnath	3055-2800
Banawali	2560-1965
Mitathal	2435-2095
Mohenjodaro	2545-2315
Lothal	2655-2185
Surkotada	2940-2540
Daimabad	1961-1420
Prabhas Patan	1406
Rojdi	1947
Shortugai	1445

Secular Sequence of desiccation of the Sarasvati River

This work proves that the Sarasvati river is not a myth; the river's ancient courses have been found from Naitwar in the Himalayas (Bandarpunch, Har-ki-dun glacier, including the earlier tributaries of Sutlej, Tons, Giri and Yamuna), through Markanda River, through Dri±advati River, to the Indian Ocean in the Gulf of Khambat (Cambay).

About 5000 years ago, a momentous geophysical event occurred. The Chambal (now called Yamuna) which was a tributary of the Ganga captured the Sarasvati River at PaontaSaheb and took the Sarasvati River to meet the Ganga River at Prayag, near Allahad. Hence, the physical basis for sangamam. About 4000 years ago another momentous geophysical event occurred. The Sutlej (Satadru) which was a tributary of the Sarasvati river (meeting at Shatrana, Punjab) migrated westwards and joined the Indus river.

These two major events in a span of a millennium, led to the drying up the mighty, sacred Sarasvati river and the migrations of people away from the banks of the Sarasvati river eastwards and southwards.

The mythical Sarasvati River is celebrated in the *Rigveda* and also in the *Mahabharata*, describing Balarama's pilgrimage, making offerings to ancestors (*pitrs*), on the river from Dwaraka to Mathura.

Niruktam gives two meanings: ***sara*** as a river and as a goddess: ***sarasvatì iti etasya nadi bad devatabehha nigama bhavanti***. (*Niruktam*, 2.29); ***sarasvatì sarah ity udaka nàma sartes tadvati*** (*Niruktam*, 9.26); In the *Rgbhà±ya*, Sàya¯a says: ***dvividhà hi sarasvatì vigrahavat devatà nadi rùpà ca*** (*Rgbhà±ya* 1,3,12). The etymon, ***sarasvati*** means `abundance of lakes (***saras***)'.

The synonym of ***sarasvatì*** (goddess of ***vàk*** = speech or language) is ***bràhmì*** which is the name given to the early scripts used in Ašoka's epigraphs of circa 300 B.C.

Tamilnadu celebrates Sarasvatì pùjà as àyudha pùjà, celebrating the arts and crafts integral to life activities. *Tiruppukazh* calls her ***caraccuti*** (Ti. 337), ***ma°aimaka³*** (Ti. 399: ***ma°ai*** = vedas).

Three points have been established by the studies made by Dr. S. Kalyanaraman and published since March 1996.

First, the Sarasvati was a mighty and perennial river circa 3000 B.C. when the so-called Harappan civilization flourished, flowing from the Har-ki-dun glacier of the Himalayas in W. Garhwal into the Gulf of Khambat near Lothal, via the Little Rann and the Nall Lake (near Ahmedabad). (Thus,

Gujarat was an island in the second millennium and it was possible to travel on the Sarasvati River from the Gulf of Khambat).

Second, as shown by the geo-physical evidence provided by hymns of the *Rigveda*, and archaeological evidence, the river sustained a maritime civilization and a metal-based economy with about 1200 ancient settlements on the river basin, which lasted for a millennium. Mohenjodaro was an island enclosed by the rivers Sindhu and the Western Nara loop (Sarasvati River in Sind). Ganweriwala (Bahawalpur province) and Rakhigarhi were sites as large as Mohenjodaro. ***Soma***, the celebrated process of the *Rigveda* has been interpreted as the processing of electrum (gold-silver quartz). The civilization was a remarkably homogeneous maritime civilization as evidenced by the artefacts unearthed from Tigris-Euphrates to the Ganga-Yamuna Doab, and showed a marked preference for establishing settlements on alluvial plains [**marutam** (Tamil)].

Third, at about 1500 B.C., the Sutlej river (originating from Mt. Kailas) which was also flowing into the Sarasvati river at Shatrana took a U-turn at Ropar and migrated westwards. Yamuna had drained the waters flowing into the Sarasvati (at PaontaSaheb or ?near ancient, Plaksha Prashravana), due perhaps to the continuing rise of the Aravalli ranges and deepening of the erstwhile Chambal (now called Yamuna) tributary of the Ganga. The phenomenon of *aandhi* (sandstorms) also submerged parts of the riverbed near Jaisalmer-Pokaran in the *Marusthali*. The settlement pattern extending over approx. 1500 years, indicates an eastern movement of people into the Ganga-Yamuna doab and southward along the coastline. The confluence of the Sarasvati at Sangam in Prayag is, therefore, not mythology, but based on ground truth. Similarly, the popular belief that the Sarasvati disappeared in the sands and went underground is also based on ground truth.

When Satadru river was joining Sarasvati river at Shatrana, Kalibangan, on the banks of Sarasvati river, a supply node from the Khetri copper mines (through Kanthali river, a tributary of Sarasvati) was accessibly over land to Harappa on the banks of Beas (Vitasta) river. Mohenjodaro was an island caught between Sindhu and Hakra and hence, was on the Right Bank of Sarasvati; so were Chanhudaro and Kotdiji settlements in Sind.

Thus, settlements on the Sarasvati River were the sustaining economic base of the civilization with Harappa and Mohenjodaro being trading outposts of the Indian Civilization.

Key Scientific studies which form the basis for and confirmation of these findings

The conclusions drawn and hypotheses for further research formulated in this work are based on a multi-disciplinary evidence-complex: the Vedas, classical texts, geological surveys, studies in glaciology, Satellite images and

analyses of semantics of the languages of the Indian sub-continent and satellite images.

In 1980, Prof. Yashpal and other scientists recognized the palaeo-channels analysed through LANDSAT imageries of North-West India; these findings have been substantially confirmed on the ground, using archaeological evidence, Geographical Information Systems (IRS-1 Satellite Remote Sensing, in particular), hydrogeology, geological surveys and other technologies.

In March 1996 (Renganathan Centre for Information Studies), and in January 1997 (World Sanskrit Conference), Dr. S. Kalyanaraman, former Sr. Executive, Asian Development Bank presented the cumulative evidence from a varied set of scientific and textual sources and established the perennial nature of the river and proved the extent of the area drained by the river, sustaining an ancient civilization on the banks of the Sarasvati River, in North West India, He also proposed the beneficial effects of the river which are present today and which can be harnessed to formulate peoples' development projects using the canal systems network, building a NW India Drainage System and using the groundwater sanctuaries and aquifers of the Sarasvati River Basin to create micro-watershed-based agro-industrial activities, supported by solar- and wind power-based electricity generation.

In May 1996, Prof. Valdiya has traced, based on hydrogeological studies, the course of the Sarasvati River from Tons River in W. Garhwal, U.P. up to the Rann of Kutch and reiterated that river piracy by Yamuna was the principal cause for the desiccation of the Sarasvati River.

In January 1997, BARC scientists have re-confirmed the existence of the Sarasvati River and of groundwater sanctuaries and aquifers, using water samples collected from deep wells in Jaisalmer region and North-eastern Rajasthan to conduct tritium (hydrogen isotope) analysis to establish the quality of water, flow and age of the water [ranging from 4000 to 8000 years Before Present (B.P.)]

In October 1997, Puri and Verma have established, through glaciological and geological studies, that the vedic Sarasvati originated in Bandarpunch (Sarasvati-Rupin glaciers confluence at Naitwar) in the Himalayas and that there was a secular sequence of desiccation of the river: (i) course through Markanda river; (ii) course through Drishadvati river; (iii) eastward migration of the river Drishadvati, linking up with Chambal and the resultant capture of the Tons (Sarasvati) River at PaontaSaheb; and (iv) signatures of palaeochannels of Satadru (which had, from Ropar, drained into Sarasvati at Shatrana) establishing the westward migration of the river with a U-turn at Ropar, ultimately joining the Sindhu river. The studies have also produced evidence of quartzite and metamorphic rocks in Paonta Doon valley and near Adh Badri in Siwalik ranges attesting to the existence of the mighty river which had brought in these rocks. In mid-eocene period (circa 35 million years ago), before the rise of the Himalayas, only three rivers originated from Mansasrovar lake (Tibet): Sindhu, Satadru and Brahmaputra.

After the rise of the Himalayas, Satadru became the anchorage river of Sarasvati, joining the latter at Shatrana. Yamuna joined Tons at PaontaSaheb and flowed into Sarasvati. Ganga emerged from Gangotri with Chambal (now Yamuna) as a tributary.

The work delineates a Sarasvati River Basin (NW India) Watershed Development Project proposal to use the alluvium and groundwater sanctuaries built over millennia by the Sarasvati river and to provide new livelihood opportunities to the people of north-western India.

Metals-lapidary-weaver craft-merchant economy

The Sarasvatì-Sindhu river valleys supported an agrarian as well as a metals-lapidary-weaver craft economy which generated surplus commodities of trade which were transported inland and also upto the Tigris-Euphrates river valley and the Caucus-Bactria (Turkmenistan) region. The people living in the Khetri copper belt supplied the copper, lead and electrum ores. Vedic people produced *soma*, after smelting and purifying the electrum ore. The metalsmiths, weavers and lapidaries living in the river valleys and mineral-belts used the metallic ores and electrum to create (and trade in, using seals and sealings) artifacts such as clothing, ropes, agricultural implements, vessels, tools, artistic mouldings, bangles, necklaces and other ornaments using gem-stones and metal. (Figures).

The civilization that flourished on the banks of this river from circa 3000 B.C. (and the heritage continues to the present day in the Indian sub-continent) has been established based on groundtruth and scientific studies. This fundamental basis of continuity of the civilization, enables a new approach to the problem of the decipherment of the script of the civilization. (The script is used in inscriptions on seals, sealings, tablets, a monumental inscription in Dholavira and other objects such as potsherds, bangles, ivory rods, metallic implements).

Kalibangan, on the banks of the Sarasvati river, in Ganganagar district of Rajasthan was discovered by B.B.Lal and B.K. Thapar after diggings for almost a decade from 1961. There is evidence that the lower levels of the desert were destroyed by an earthquake; these levels are dated to 3000-2900 B.C.

Dholavira, is a site discovered by R.S. Bisht in 1991. Dholavira, a site spread over 100 hectares is located in an island called Khadir in the taluk Bhachau, Kutch district of Gujarat. This site vividly establishes the slow and continuous emergence of the Sarasvati Civilization from phase to phase. This is the site which has yielded a monumental inscription of the civilization. The inscription has 10 signs, each 33 cm. high and 27 cm. wide made of milk-white faience or glazed steatite fixed in grooves made on a long wooden board. The archaeologist notes that the board was discovered lying flat on the ground over a debris and was

apparently hanging on the lintel of the huge doorway near the northern gateway. The site also establishes the architectural use of the 'ring stones' in many sites. At Dholavira, the round stones with holes were used in the construction of structures, particularly the pillars with capitals. Some of these stones are highly smoothened and polished. This indigenous emergence and maturity is also evidenced in the sites in Sindh such as Amri and Ghazi Shah.

Kunal was discovered by J.S. Khatri and M. Acharya of the Haryana State Dept. of Archaeology, between 1991 and 1995. Kunal (29.30N and 75.41E) is located in tehsil Ratia of Dist. Hissar, Haryana. It is about 12 kms. from the Bhuna town. The site about 3 acres in extent, is located on a now dried-up course of the Sarasvati river. Many sites of the civilization were on the alluvial plains of the Sarasvati river and the Sindhu river. The Sarasvati river and old channels of the river are called by a number of names: Rangoi, Nai, Nadi, Hakra, Ban, Sasruti. Many archaeological mounds are found on the banks of these channels. At Rangmahal, Rajasthan, the width of the Sarasvati was 10 kms. and there are evidences of shifting courses of the river as much as 10 kms. away from the present-day townships.

The range of influence of the civilization was as follows: Manda, located on the river Beas near Jammu, is the northernmost site. Bhagatrav, located on the river Tapti is the southernmost site in Maharashtra. Sutkagendor, located on the ancient shores of the Arabian sea, near the Iranian border is the westernmost site. Alamgirpur, located on the river Hindon (near Delhi), Bhorgarh near Narela in north Delhi, and Mandoli located near Nandanagiri in east Delhi are the easternmost sites.

Most of the archaeological sites of the civilization are located on the Sarasvati river basin. Some sites in Gujarat are located on rocky surfaces and on the banks of seasonal rivers, for e.g. Surkotada and Dholavira in Kutch, Lothal which is located on the banks of Bhogao river. Some sites in Sindh are found on the shores of lakes, e.g. Ghazi Shah near Manchhar lake. The sites of the Arabian coast are: Balakot, Sotka Khoh in Pakistan and Kuntasi and Nageshwar in India.

Sarasvati was a perennial river

In the days of the mature Harappan civilization, now called the Sarasvati-Sindhu civilization, circa 3000 B.C., the great river was perennial, flowing from the Har-ki-dun glacier of the Himalayas in western Garhwal and flowed into the ocean near Lothal in the Gulf of Khambat.

Sarasvati Sindhu civilization was a metals economy and was sustained on the banks of Sarasvati river

Hundreds of hymns of the *Rigveda* and later-day texts attest to the importance of the Sarasvati river to vedic people. The civilization was a maritime civilization, a metals economy with settlements on river banks and along the sea-coasts. It will be erroneous to interpret the *Rigveda* as a gazetteer of the civilization. However, the texts of the ancient texts contained in the *Rigveda* provide glimpses of the activities of the civilization. For example, there are references to traders, the pa¯is [ma¯ika, mànya, -mà¬ (Ta.), -vàn (Skt.)] engaged in sea-borne trade, to samudra (sea), to vessels on the sea (nàvah samudriyah). The lexemes of the languages of the region contain terms such as va¯ika, vaišya, vina-sanni.

Cultural continuum of the civilization in the Indian sub-continent

The cumulative archaeological evidence with over 1200 ancient settlements located on the Sarasvati river basin, points to the continuity of the civilization. The settlement patterns indicate an eastward movement of the people into the Ganga-Yamuna doab and southward movement hugging the coastline of the Indian ocean and along the rivers. The present-day Gujarat was an island circa 3000 B.C. and earlier. The submergence of Dwaraka seems to corroborate the popular tradition of the Lemuria, an island of the Indian Ocean.

Marusthali and Marutam

Marusthali and Cholistan desert (the Thar or Great Indian Desert) should have been a fertile plain, *marutam*, circa 3000 B.C. The people of the civilization had a marked preference for settling on alluvial plain.

The problem of the script of the civilization

Applying the rebus method, it is possible to interpret many pictorial motifs (including pictorially vivid signs) of the inscriptions of the civilization depicted on seals, sealings (tablets) and other objects. The interpretation using this method yields a number of sememes in Indian languages which match the pictorial motifs and yield substantive meanings for the homonyms. A corpus of the majority of the inscriptions and their 'meanings' can be built-up.

The problem of soma in the Rigveda

Like the script decipherment problem, ***soma*** in the *Rigveda* has received a variety of interpretations. In the context of the metals economy which flourished on the banks of the Sarasvati and Sindhu rivers, it is

hypothesized that ***soma***, which provided the *very raison d'etre* for the vedic chants accompanying the metallurgical, smelting process, is electrum, gold-silver quartz ore. This hypothesis is tested by a rendering of the riks related to the ***soma*** process which is the only process delineated in the *Rigveda*.

Reviving the sacred Sarasvati river

It is remarkable that hundreds of ancient settlements (cf. List of Sarasvati Sindhu Civilization sites, satellite image and other maps annexed) have been discovered along the edges of the Marusthali desert and in the Rann of Kutch. The settlements were clearly rendered possible because of the great Sarasvati river flowing in all majesty, drawing from her perennial sources, the Himalayan glaciers from Bandarpunch massif and Mt. Kailas.

While the continuing rise of the Aravalli ranges constitute a formidable impact on geological formations of North India, it is within the competence of present-day technology to revive the sacred river and make her flow again, making the desert close to her banks fertile again and overcome the problems of ongoing desertification of North India caused by inadequacies of the drainage system in North and North West India.

A research proposal has been submitted to the Ministry of Water Resources, Govt. of India by the Sarasvati Sindhu Research Centre. The proposal is simple. The groundwater resources of the desert close to the palaeo-channels of the sacred Sarasvati river will be conserved and augmented. Thanks to the undulating terrain of the dunes, the Sarasvati lakes will naturally emerge with such replenishment of groundwater. As the irrigation and drainage systems get streamlined, further improving the drainage systems of the command areas of Rajasthan canal and other canal systems, the waters will start flowing again in the ancient, now-dried, beds of the river. There are, of course, technical problems to be carefully studied through simulation and other exercises such as the problem posed by the hard pans, underground, of calcium carbonate and calcium sulphate (lime and gypsum) deposits, the problems of waterlogging and salination on the dry-beds of the river, the problems of cultivating halophytes [such as *salicornia brachiata*: bholad (Gujarati), machula (Hindi), koyyalu (Telugu), umari (Tamil/Malayalam)] to stem, or at least slow down, the northward march of the desert.

The revival or reclamation of the Sarasvati calls for a multi-disciplinary team of dedicated workers. The work has to be carried out, in a participatory approach, by the beneficiaries, i.e. people of the region themselves and has to be done in such a way as to ensure the preservation of the ancient archaeological and pilgrimage sites as national

monuments and to make them accessible as permanent exhibitions of the cherished heritage of the sub-continent.

The salient features of the proposal are:

- The groundwater resources of the Marusthali desert can be sustained and augmented, conjuctively with the development of a North India Drainage System;
- the northward march of the desert can be slowed down;
- the heritage sites can be preserved as national monuments;
- with the augmentation of groundwater storage using the desert as a natural underground reservoir, the Sarasvati lakes will naturally emerge;
- the Marusthali desert can be made fertile; and the sacred Sarasvati river will come alive and start flowing again

SARASVATI: RIVER AND GODDESS

An invocation to goddess Sarasvati in the Great Epic

Let us invoke Vyàsa the author of the classic, *Mahàbhàrata,* who seeks the blessings of two divinities: god ***Nàràya¯a*** and goddess ***Sarasvati*** before embarking upon the *magnum opus*:

> ***nàràya¯am namask°tya naram caiva narottamam***
> ***devìm sarasvatìm vyàsam tato jayam udìrayet*** (MBh 1.1.1)

Mahàbhàrata extols Sarasvatì as ***vedànàm màtaram pa±ya***: the mother of the vedas (*MBh. Šàntiparvan*: 12920).

RV 7.71.1 refers to the sun illuminated the eight quarters, the three desert regions and the seven rivers: *a±²au vyakhyat kakubhah p°thivyàs trì dhanva yojanà sapta sindhùn* (the word 'sindhu' refers to a river). Among the seven rivers, Sarasvati had attained the status of a goddess. The sapta sindhu which had entered the very consciousness of the people of the civilization may be redefined geographically as the mighty, sacred Sarasvati and her six sisters.

Rigveda adores Sarasvati as a river, as a mother, as a goddess; the adoration is expressed with such emotion and compassion, that this rik may be prescribed as the daily invocation song in every classroom, in every school in India:

ambitame nadìtame devitame sarasvati
aprašastà iva smasi prašastim amba nas k°dhi (RV 2.41.16)

O best of mothers, O best of rivers, O best of goddesses, Sarasvati, (we feel) as if given no consideration, please favour us with renown, O mother.

i³à sarasvatì mahì tisro devìr mayobhuvah
barhih sìdantv asridhah (RV 5.5.8)

Let I³à, Sarasvatì, Mahì, the three delighting goddesses, sit on kuša grass, they who do not fail.

bhàratì pavamànasya sarasvatì³à mahì
imam no yajñam à gaman tisro devìh supešasah (RV 9.5.8)

Bhàratì (is) of Pavamàna; let Sarasvatì, I³à, Mahì come to this yajña of us, the three beautifully adorned goddesses.

Sarasvati, Himalayan river:

evidence from texts and field surveys

Milindapañha refers to Sarasvatì as a Himalayan river flowing southwards through the Simla and Sirmur ranges (called Siwalik) forming a bulge. It emerges into the plains at Ädbadri in Ambala. *Bhàgavata Purà¯a* (X.34.1-18) refers to a forest called Ambikàvana on the banks of the river. *Padmapurà¯a* (S°±²ikha¯®a, Ch. 32, v. 105) refers to the Gangobhedatìrtha which is the meeting place of the river Sarasvatì with the Gangà. This is Paonta Saheb, which is a Sikh pilgrimage site, and where the river Yamuna pirated the Sarasvati river.

The Yamuna originates less than a hundred miles east of the Bhagirathi. Yamuna flows parallel to the Ganga and to the south for most of its course before merging with the Ganga at the holy city of Allahabad, also known as Triveni Sangam. It is notable that the largest tributary to the Ganga is the Ghaghara, which meets Ganga before Patna, in Bihar. It is called Ghaghara because it brings much of the Himalayan glacier melt. A parallel reason can be adduced to the naming of Sarasvati as Ghaggar by popular tradition.

`` ... we have now seen that a dry river bed can be traced, practically continuously, from Tohana in Hissar district to the Eastern Narra in Sind ... `` (R.D.Oldham, 1886).

The term ‘saagara’ has very specific lexical connotations. The term ‘saagara’ may be phonetically linked with ‘Gha-gra’ and ‘Hakra’, both are present-day names of the river Sarasvati in specific stretches. There are two ancient words in the Indian languages which connote the ocean: **sam-udra,** and **saagara**.(both words are used in the Vedic texts). The word, **sam-udra** lit. means ‘gathering together of waters’. The word, **sàgara** is used in more specific contexts such as the **sàgaràlaya**, name of Varuna, living in the ocean and **sàgaraka** name of a people, inhabitants of the sea-coast. In mythology, **sàgara**, the ocean is said to have been so named by Bhàgìratha who brought the Ganga from the Heavens and led them to the sea; the interpretation is that the name was given in commemoration of his ancestor king, Sagara of the solar race. Sagara’s sacrificial horse was traced by his many sons, after digging down towards the Pàtà³a; this digging increased the boundaries of the ocean which was therefore called Saagara. A region often associated with Pàtà³a is the Rann of Kutch and the Little Rann.

The Rann of Kutch was navigable in the third and second millennia B.C. “It is likely that the Harappans sailed down the Nara, entered the Rann, and moving along the western and southern coasts of Kutch and Kathiawar reached the Gulf of Cambay. It is suggested by some scholars that Lothal was reached through the Little Rann and the Nal Lake which were then easily navigable.... Around the head of the Gulf of

Cambay the ancient channels of the rivers, which are now silted up, act as drains for springtides, but otherwise remain a salt marsh."(S.R.Rao, 1979). During the monsoon, the lower part of the Rann of Cambay joins the Nal Lake forming a connected sheet of water which spreads over the neighbouring tracts of Bhàl and the Nalkàntha, turning the villages into islands and cutting off communication with Ahmedabad *(Imperial Gazetteer of India, Bombay Presidency*, Calcutta, 1901, II, p. 348).

Mohenjo-daro was on the banks of the Sarasvati river

Marshall's report (1931, pp.1-6) which includes a superb map, reads thus: "(Mohenjo-daro) stands on what is known locally as "The Island"-- a long, narrow strip of land between the main river bed and the Western Nara loop, its precise position being 27.19N by 68.8E, some 7 miles by road from Dokri on NW Railway, and 25 from Larkana town... Twelve centuries ago, when the Arabs first came to Sind, there were two great rivers flowing through the land: to the west, the Indus; to the east, the Great Mihran, also known as the Hakra or Wahindah. Of these two rivers the eastern one seems to have been the more important...Major Raverty, the foremost authority on the subject, concluded that at the time of the Arab invasion the main channel of the Great Mihran flowed a line roughly coincident with the existing Eastern Nara canal, which was once an important river bed (i.e. it passed close by the city of Alor...flowed...west of Umarkot, and so the Rann of Cutch (then an estuary of the sea) and by the Kori creek to the Arabian Sea. cf. Raverty, 'The Mihran of Sind and its tributaries' JASB, Vol. LXI, 1892, pp. 156-508). According to him, the terminal course of the Indus, which flows by Mohenjo-daro, was then a subsidiary branch of the Mihran, but its course was not the same as at present...the existence of two important Chalcolithic sites of Mohenjo-daro and Jhukar, the one in the near vicinity of the Indus, the other of the Western Nara loop..."

Griffin Vyse recalls observations that Alexander the Great had also sailed to the great lake and to the sea by this 'eastern branch of the Indus'..."the eastern or greater arm of the Mikran described by Rashid-ud-deen as branching off from above Mansura to the east, to the borders of Kutch, and known by the name of Sindh Sagara (Elliot, vol. i, p. 49). This ancient river is also identical with the Sankra Nala which was constituted by Nadir Shah the boundary between his dominions and those of the Emperor of Delhi."

Now it can be seen that Mohenjo-daro was also on the banks of one of the channels of Sarasvati, what is now called the Western Nara loop. With Harappa located on Ravi, accessible to Kalibangan, the locus of the civilization shifts to the banks of the Sarasvati river.

Sindhu-sàgara and the Rann of Kutch

The observations of Raverty are as follows: " Hakra... appears to be the modified form of Sagara, the letter S being pronounced H in Rajputana and Sindh... Sagar is the Sanskrit for 'ocean', 'sea' etc., and it is still known as the Sind-Sagar near the sea coast. Tod calls it 'Sankra', which is another form of the name; and it is called Sankgrah in the treaty entered into by Nadir Shah, and Muhammad Shah, Badshah of Dihli, when ceding all the territory west of it to the Persians... Hakra once did run through the so-called 'Indian Desert'... Ghag-gar, the Sursuti and the Chautang were the tributaries of Sind-Sagar or Wahindah or Hakra... Mansuriyat... this city is situated among the branches of the Mihran river, and from that place the river unites with the ocean by two channels. One is near the town of Loharanj, and the other bends round towards the east in the confines of Kaj (Kutchch) and is called the Sind Shakar (Sind-Sagarah) which means The Sea of Sind. The river Sarasat unites with the ocean to the east of Suminath. This last named river is, of course, the Sarasvati, which falls into the sea near Pattan Som-nath, not the classical river, the tributary of the Ghag-gar, described further on, the sacred river of the Brahmans... At Thatha the Sind is called Mihran..."

Sarasvati flowed into the saagara in the Gulf of Khambat

Alex Rogers was perhaps among the earliest observers of the geology of the Gulf of Khambat (earlier called Cambay, close to Lothal). He pointed out, in 1870, that from the geological formation of the country bordering on the Rann, it appeared that the drainage of the Panjàb once flowed into it. He also observed that a great river should have flowed into the Gulf of Khambat.

`` ... The rapid silting up of the Gulf of Cambay gives particular interest to an inquiry into the geological conditions which probably shaped it in remote ages ... (The head of the Gulf) comprises within itself the Great Ru¯ of Cutch ... primary or metamorphic rocks are traceable in its immediate vicinity only in a small tract on its west coast ... even the highest points of the granite peaks show signs of weathering, and probably also of the erosive action of waves ... "The alluvial soil to the north of Baroda, between the Myhee and the trap range running to the north-east from Powaghar, beyond the Champaneer beds mentioned by Mr. Blanford, is of a general character between those of the light-coloured and black varieties…. We have not to consider whence these enormous alluvial deposits can have been derived… Many considerations point to the existence in former ages of some large river flowing down from the north, and falling into the Indian ocean somewhere in the position of the present Gulf of Cambay: and it is not improbable that the river may have been the Indus (**now, we know that**

this was the Sarasvatì)… (in the country between the Lesser Runn and the Gulf of Cambay), coinciding to a great extent with the black-soil belt, there can be clearly traced a natural depression in the surface of the country for some twenty miles from the head of the Gulf, terminating in a shallow lake of brackish water called the Null. This lake, in the rainy season, is probably twenty miles long and three or four broad, and finds an outlet for its superfluous waters at that season through Bhogava, which enters the Gulf at its north-west corner. Shell of the genus Cerithiu, an estuarine form, are found lying loose in the black soil many miles from this point; and the records of the Old Revenue Survey of Goozerat state that there were formerly found in the Null large round stones with holes through them, which had evidently served as anchors for boats of some size (**now, we know that these ring stones were used for foundations for pillars as evidence by the in-situ excavations at Banawali on the banks of the Sarasvatì river**)… there is historical and well-known proof of the alteration of the level of the larger of these salt flats as the consequence of an earthquake in A.D. 1819 (resulting in the formation of the Allah Bund)… Since writing the foregoing remarks on the probability of the Indus or some large river from the north having once found its way into the Gulf of Cambay, I have seen quotations from Prof. Max Mueller's translation of the Vedas, which prove that at the time some of them were composed, the Suruswuttee, the most easterly of the Punjab rivers, which now loses itself in the desert of Rajpootana, flowed into the Indian Ocean. This confirms to some extent the theory of the cause of the alluvial deposit at the head of the Gulf of Cambay."

From Har-ki-Dun (Tons river) to the Gulf of Khambat

It would, therefore, be reasonable to conclude that the ancient, perennial, Sarasvati river, originating from Har-ki-Dun (Tons river) in the Himalayas, after traversing the edges of the Great Indian desert, had flowed through the Rann of Kutch, into the Little Rann and flowed into the Gulf of Khambat by linking up with the Nall Lake. This geological reconstruction of ancient times is reinforced by the preponderance of the ancient, homogeneous, riverine/maritime settlements of the civilization, exemplified by sites such as Lothal, Rangpur, Dholavira, Kotda, Bet Dwaraka, all of which have yielded authentic material artefacts, in general, and seals with inscriptions in particular.

In October 1997, Puri and Verma have established, through glaciological and geological studies, that the vedic Sarasvati originated in Bandarpunch as Tons River (Sarasvati-Rupin glaciers confluence at Naitwar) in the Himalayas and that there was a secular sequence of desiccation of the river: (i) course through Markanda river; (ii) course through Drishadvati river; (iii) eastward migration of the river Drishadvati, linking up with Chambal and the resultant capture of the Tons (Sarasvati) River at PaontaSaheb; and (iv) signatures of palaeochannels of Satadru (which had, from Ropar, drained into

Sarasvati at Shatrana) establishing the westward migration of the river with a U-turn at Ropar, ultimately joining the Sindhu river.

In January 1997, BARC scientists (S.M.Rao and Kulkarni) have re-confirmed the existence of the Sarasvati River and of groundwater sanctuaries and aquifers, using water samples collected from deep wells in Jaisalmer region and North-eastern Rajasthan to conduct tritium (hydrogen isotope) analysis to establish the quality of water, flow and age of the water [ranging from 4000 to 8000 years Before Present (B.P.)]

Thanks to the magnificent advances being made in maritime archaeology, it should soon be possible to establish the Himalayan fingerprints of snails and shells specific to Himalayan rivers along the ancient courses of the river Sarasvati close to the Indian Ocean.

Sarasvati: among Äprì deities in the Rigveda

In the *Rigveda* deities are personified objects belonging to the fire-sacrifice – the fuel, the sacred grass, the enclosure and so on – all regarded as different forms of agni, all used by the one who presses ***Soma***, all essential to bring wealth to the sacrificer. Hence the objects are also referred to as àprìs. It is also possible that the objects are the real àprìs from which the twelve àprì hymns receive their names. Sarasvati is an àprì (feminine noun) deity; àprì refers to the process of gaining someone's favour. The plural form of the noun àprì refers to particular invocations recited prior to the offering of oblations. The goddesses are invoked into the objects which get personified through the hymns and recitations preceding the oblations using the objects which could be parada (mercuric sulphide), milky waters (or vasatìvarì waters of the Sarasvatì) and earth from the ant-hills. The word ak±ara means 'water/rain' in RV 1.34.4; it is also the cow, sound, word in RV 3.31.6. Vaikharì vàc (laukika, the language spoken by the people) is the source of antah samudra (the madhyamà vàc or language understood by the sages). Maybe, the Sarasvatì waters are adored as the k±àra, the waters with the reducing agents to oxidize the impure metals in the electrum ore.

šam no devà višvadevà bhavantu šam sarasvatì saha dhìbhir astu
šam abhi±àcah šam u ràti±àcah šam no divyàh pàrthivàh šam no apyàh
(RV 7.35.11)

Let the gods, let all the gods exist for our happiness, let Sarasvatì by her divine thoughts be happily disposed; let the assistants and the givers of gifts be happily disposed, let all the atmospheric, earthly, and water-dwelling (beings) be for our happiness.

The three goddesses:

i³à sarasvatì mahì tisro devìr mayobhuvah
barhih sìdantv asridhah (RV 1.13.9)

Le I³à, Sarasvati, Mahì, the three delightful goddesses, sit on kuša grass, they who nevel fail.

šucir deve±v arpità hotrà marutsu bhàratì
i³à sarasvatì mahì barhih sìdantu yajñiyàh (RV 1.142.9)

Pure in the midst of the gods, fixed, sacrificing, in the midst of the Maruts, (are) Bhàrati, I³à, the great Sarasvatì; let they, worthy of sacrifice, sit on kuša grass.

sarasvatì sàdhayantì dhiyam na i³à devì bhàratì višvatùrtih
tisro devìh svadhayà arhir edam achidram pàntu šara¯am ni±adya (RV 2.3.8)

Sarasvatì, she who makes straight and subdues our highest thoughts, divine I³à and Bhàratì who are all-surpassing; may the three goddesses by their own desire (sit) on this kuša grass, let them protect this unfailing shelter for (us) to rest upon.

à bhàratì bhàratìbhih sajo±à i³à devair manu±yebhir agnih
sarasvatì sàrasvatebhir arvàk tisro devìr barhir edam sadantu (RV 3.4.8, 7.2.8)

Bhàratì (may be) in harmony with the Bhàratas (females), I³à with the gods and Agni with the humans, Sarasvatì with the descendants of Sarasvat on this side (or on the earth); let the three goddesses sit on kuša grass.

i³à sarasvatì mahì tisro devìr mayobhuvah
barhih sìdantv asridhah (RV 5.5.8)

Let I³à, Sarasvatì, Mahì, the three delighting goddesses, sit on kuša grass, they who do not fail.

bhàratì pavamànasya sarassvatì³à mahì
imam no yajñam à gaman tisro devìh supešasah (RV 9.5.8)

Bhàratì (is) of Pavamàna; let Sarasvatì, I³à, Mahì come to this yajña of us, the three beautifully adorned goddesses.

à no yajñam bhàratì tùyam etv i³à manu±vad iha cetayantì
tisro devìr barhir edam syonam sarasvatì svapasah sadantu (RV 10.110.8)

Let Bhàratì arrive at our yajña swiftly, I³à, the reasonable, (be) here as (suitable) for humans; let the three goddesses (including Sarasvatì, who are doing good work, sit on this soft kuša grass.

tvam agne aditir deva dàšu±e tvam hotrà bhàratì vardhase girà
tvam i³à šatahimàsi dak±ase tvam v°trahà vasupate sarasvatì (RV 2.1.11)

You, O divine Agni, (you are) Aditi for the worshipper, you thrive by the chant as sacrificing Bhàratì; you burn as I³à for a hundred winters, as Sarasvatì you, lord of wealth, are the killer of V°tra.

bhàratì³e sarasvati yà vah sarvà upabruve
tà naš codayata šriye (RV 1.188.8)

[From Agastya:] Bhàratì, I³à, Sarasvatì, all of whom I have invoked, let they impel us into happiness and beauty.

The goddess Sarasvati:

In RV 7.36.6 Sarasvatì is saptathì (the seventh); in RV 8.59.4 there is a reference to the dwelling place of °ta where seven sisters are found engaged in pouring out ghee.

Pàvakà nah sarasvatì vàjebhir vàjinìvatì
yajñam va±²u dhiyàvasuh (RV 1.3.10)

[From Madhuchandas Vaišvàmitra:] let the pure and bright Sarasvatì, the swift and impetuous one with rewards, let her, rich in devotion, command (our) yajña.

codayitrì sùn°tànàm cetantì sumatìnàm
yajñam dadhe sarasvatì (RV 1.3.11)

Among all the joyful ones, she is the one who animates (them), of all the good-minded (or intelligent) ones, she is the one who understands; Sarasvatì pays attention to (our) yajña.

maho ar¯ah sarasvatì pra cetayati ketunà
dhiyo višvà vi ràjati (RV 1.3.12)

Sarasvatì of the mighty-flood causes to appear striking phenomena; she brightens every pious thought.

Nadi sùkta is sung by an inhabitant of Sindhu, sindhuk±it:

imam me gaµge yamune sarasvatì šutudri stomam sacatà paru±¯y à
asikanyà marudv°dhe vitastayà àrjìkìye š°¯uhy à su±omayà (RV 10.75.5)

Oh Gaµga, Yamuna, Sarasvati, Sutudri (Sutlej) with Paru±¯ì (Iràvati, Ravi), Marudv°dha with Asikni (Chenab, Chandrabhàgà); Ärjìkìyà with Vitastà (Jhelum) and Su±omà (Sohan) hear this praise.

pra su va àpo mahimànam uttamam kàrur vocàti sadane vivasvatah
pra sapta-sapta tredhà hi cakramuh pra š´tvarì¯àm ati sindhur ojasà (RV 10.75.1)

[To the rivers from Sindhuk±it Praiyamedha:] your supreme greatness, O waters, will the poet now celebrate at the place of Vivasvat; threefold they advance in (sets of) seven, the power of the main river surpasses that of all the tributaries.

pra te aradad varu¯o yàta pathah sindho yad vàjàm abhy adravas tvam
bhùmyà adhi pravatà yàsi sànunà yad e±àm agram jagatàm irajyasi (RV 10.75.2)

O sindhu (a generic term for river), Varu¯a cuts the channels for your flow as you are running towards the booty; you speed over the slopes of the land, you rule over this (land) and all the worlds.

divi svano yatate bhùmyopary anantam šu±mam ud iyarti bhànunà
abhràd iva pra stanayanti v°±²ayah sindhur yad eti v°±abho na roruvat (RV 10.75.3)

The roar goes forth into heaven above the earth, she (the river) with shining waves animates her endless speed; as rains issue thunder from the clouds, sindhu advances bellowing like a bull.

abhi tvà sindho šišum in na màtaro vàšrà ar±anti payaseva dhenavah
ràjeva yudhvà nayasi tvam it sicau yad àsàm agram pravatàm inak±asi (RV 10.75.4)

They run toward you, sindhu, like mothers toward their children, like cows with their milk; you lead your two flanks as if a king going to battle, trying to win the elevations.

t°±²àmayà prathamam yàtave sajùh susartvà rasayà švetyà tyà
tvam sindho kubhayà gomatìm krumum mehatnvà saratham yàbhir ìyase (RV 10.75.6)

For flowing, first she unites with the T°±²àmà, with Susartu, the Rasà, with this Švetyà; you, O sindhu, with the Kubhà (Kabul) to the Gomatì (Gumal), to the Krumu (Kuram) with the Mahatnu, you go in the same chariot with them.

°jìty enì rušatì mahitvà pari jrayàmsi bharate rajàmsi
adabdhà sindhur apasàm apastamà ašvà na citrà vapu±ìva daršatà (RV 10.75.7)

Straight-flowing, white-coloured, bright-shining she moves along with her ample volumes carrying the sphere of the clouds; the inviolable sindhu is the most efficacious of the efficacious, is speckled like a mare, is like a woman to look at.

svašvà sindhuh surathà suvàsà hira¯yayì suk°tà vàjinìvatì
ùr¯àvatù yuvatih sìlamàvaty utàdhi vaste subhagà madhuv°dham (RV 10.75.8)

This impetuous sindhu (river) is rich in excellent horses, good chariots, beautiful garments, abundant gold, good deeds; she the young woman is rich in wool, rich in plants for making ropes; also she puts on lovely clothes, the fortunate one abounding in sweetness (or who increases honey).

sukham ratham yuyuje sindhur ašvinam tena vàjam sani±ad asminn àjau
mahàn hy asya mahimà panasyate adabdhasya svayašaso virapšinah (RV 10.75.9)

The easy-going horse chariot the Sindhu had harnessed, with which she may bring her booty sitting (by the sacrificial altar); whose great might is to be praised, that of the unbroken, glorious on her own, exuberant.

The Rigvedic sources which refer to Sarasvati are as follows:

pàvìravì kanyà citràyu« sarasvatì vìrapatnì dhiyam dhàt
gnàbhir achidram šara¯am sajo±à duràdhar±am g°¯ate šarma yamsat (RV 6.49.7)

May the daughter of lightning of wonderful vitality, Sarasvati, the hero's wife, give us higher thoughts; she who is in harmony with the divine females, may she grant us unfailing shelter, a hard-to-approach refuge for the invoker.

pàvìravì tanyatur ekapàd ajo divo dhartà sindhur àpa« samudriya«
višve devàsa« š°¯avan vacàmsi me sarasvatì saha dhìbhi« puramdhyà (RV 10.65.13)

The daughters of lightning, the unborn one-footed, the divine maintainer (or the maintainer of heaven), the river, the ocean waters; may all the gods hear my words; Sarasvati (is) with the higher thoughts and with Puramdhi.

àpo revatì« k±ayathà hi vasva« kratum ca bhadram bibh°thàm°tam ca
ràyaš ca stha svapatyasya patnìh sarasvatì tad g°¯ate vayo dhàt (RV 10. 30.12)

[From a hymn to the waters:] waters, opulent residences indeed, you convey riches, determination, and prosperity, and immortality and wealth, you are the masters of good offspring; Sarasvati may offer invigourating food to him who praises her.

àham sarasvatìvator indràgnyor avo v°¯e
yàbhyàm gàyatram °cyate (RV 8.38.10)

I choose the favour of Indra and Agni accompanied by Sarasvati; the two of whom this hymn in the gàyatrì meter is dedicated.

pàvamànìr yo adhyety °±ibhi« sambh°tam rasam
tasmai sarasvatì duhe k±ìram sarpir madhùdakam (RV 9.67.32)

[From Vasi±²ha:] whoever recites the Pàvamànì hymns, the essence brought together by the sages, for him Sarasvati milks condensed milk, ghee, honey, water.

sarasvatì sarayu« sindhur ùrmibhir maho mahìr avasà yantu vak±a¯ìh
devìr àpo màtara« sùdayitnvo gh°tavat payo madhuman no arcata (RV 10.64.9)

Let Sarasvati, Sarayu, and the river with waves (Sindhu), the big and invigorating ones come with their favour; let the divine waters, the mothers who keep (people) in order, their water full of ghee and honey, sing for us.

à na« pù±à pavamàna« suràtayo mitro gachantu varu¯ah sajo±asa«
b°haspatir maruto vàyur ašvinà tva±²à savità suyamà sarasvatì (RV 9.81.4)

Let Pù±an, Pavamàna, the rich in gifts, Mitra, Varu¯a come in harmony with each other; B°haspati, the Maruts, Vàyu, the Ašvins, Tva±²°, Savit°, Sarasvati, all well regulated.

tàn pùrvayà nividà hùmahe vayam bhagam mitram aditim dak±am asridham aryama¯am varu¯am somam ašvinà sarasvatì na« subhagà mayas karat (RV 1.89.3) [The legend in Aitareya Bràhma¯a refers to the purchase of ***Soma*** from the Gandharvas by Vàk: AB. I.27].

We invoke them with traditional statements: Bhaga, Mitra, Aditi, Dak±a, the unfailing ones, Aryaman, Varu¯a, ***Soma***, the Ašvins; may Sarasvati the prosperous make us happy.

àgne giro diva à p°thivyà mitram vaha varu¯am indram agnim
àryama¯am aditim vi±¯um e±àm sarasvatì maruto màdayantàm (RV 7.39.5)

[From Vasi±²ha:] O you related to Agni, (bring) heavenly words all the way to the earth, carrying Mitra, Varu¯a, Indra, Aryaman, Aditi, Vi±¯u; she
Sarasvati and the Maruts are exhilarating.

agnir indro varu¯o mitro aryamà vàyu« pù±à sarasvatì sajo±asa«
àdityà vi±¯ur maruta« svar b°hat somo rudro aditir brahma¯as pati« (RV 10.65.1)

Agni, Indra, Varu¯a, Mitra, Aryaman, Vàyu, Pù±an, Sarasvati, all in harmony with each other, the Äditya, Vi±¯u, the Maruts, the High Sun, ***Soma***, Rudra, Aditi, Brahma¯aspati.

sed ugro astu maruta« sa šu±mì yam martyam p°±adašvà avàtha
utem agni« sarasvatì junanti na tasya ràya« paryetàsti (RV 7.40.3)

[From Vasi±²ha:] let he be only formidable, O Maruts, let he be roaring (or vigorous), that mortal you promote, O you of the spotted horses (or you who have antelopes for horses); also Agni and Sarasvati join, (so that) there is nobody roaming around with his wealth.

aryama¯am b°haspatim indram dànàya codaya
vàtam vi±¯um sarasvatìm savitàram ca vàjinam (RV 10.141.5)

Assit Aryaman, B°haspati, Indra in the attainment of gifts; Vàta, Vi±¯u, Sarasvati, and impetuous Savit°.

putram iva pitàràv ašvinobhà indrà vathu« kàvyair damsanàbhi«
yat suràmam vy apiba« šacìbhi« sarasvatì tvà maghavann abhi±¯ak (RV 10.131.5)

Like the parents to the child so the two Ašvins are standing by Indra with poetic inspiration and marvellous skills; that very delightful (fluid) you drink, (and) helpfully Sarasvati protected you, Indra (or the munificent).

yà gungùr yà sinìvàlì yà ràkà yà sarasvatì
indrà¯ìm ahva ùtaye varu¯ànìm svastaye (RV 2.32.8)

Gungù, Sinìvàlì, Ràkà, Sarasvatì; Indrà¯ì I have called for their favours, and Varu¯ànì for healing (all feminine nouns).

garbham dhehi sinìvàli garbam dhehi sarasvati
garbham te ašvinau devàv à dhattàm pu±karasrajà (RV 10.184.2)

Take into the womb (conceive), O Sinìvalì, take into the womb, Sarasvati; to take into your womb (may) the two divine Ašvins, garlanded with lotuses, (help).

sarasvatìm devayanto havante sarasvatìm adhvare tàyamàne
sarasvatìm suk°to ahvayanta sarasvatì dàšu±e vàryam dàt (RV 10.17.7)

[From Devašravas or Damana Yàmàyana:] those faithful to the gods have been calling out Sarasvati, in the sacrifice Sarasvati is being reached to; the virtuous are speaking (of) Sarasvati, may Sarasvati give valuables to the worshipper.

sarasvati yà saratham yayàtha svadhàbhir devi pit°bhir madantì
àsadyàsmin barhi±I màdayasva anamìvà ì±a à dhehy asme (RV 10.17.8)

Divine Sarasvati, (she) exhilarated, has gone on the same chariot spontaneously with the forefathers; be seated on this kuša grass, be exhilarated, present to us healthy and juicy (foodstuffs).

sarasvatìm yàm pitaro havante dak±i¯à yajñam abhinak±amà¯à«
sahasràrgham i³o atra bhàgam ràyaš po±am yajamàne±u dhehi (RV 10.17.9)

The forefathers have been calling out her, Sarasvati, and she the prolific cow is coming to (our) yajña; here a portion of sacred words (or refreshments) worth a thousand, abundance of wealth (let you) present among the worshippers.

àpo asmàn màtarah šundhayantu gh°tena no gh°tapva« punantu
višvam hi ripram pravahanti devìr ud id àbhya« šucir à pùta emi (RV 10.17.10)

Let the motherly waters cleanse us, let the clarifying ghees purify us with ghee; indeed these deities wash away all impurities, from them (femalesk) I go away glowing and pure.

pàvakà nah sarasvatì vàjebhirvàjinìvatì
yajñam va±²u dhiy±vasu« (RV 1.3.10)

May Sarasvati be our purifier may she who holds food offer us food, the holder of wealth may desire yajna.

còdayitrì sùn°tànàm cetantì sumatìnàm
yajñam dadhe sarasvatì (RV 1.3.13)

The Sarasvati inspirer of good acts and good thoughts holds yajna.

maho ar¯ah sarasvatì pra cetayati ketunà
dhiyo vi±và vi ràjati (RV 1.3.12)

Sarasvati is known, by the flag (course) of great water. All prayers shine very much.

yas te stana« šašayo yo mayobhùr yena višvà pu±yasi vàryà¯i
yo ratnadhà vasuvid ya« sudatra« sarasvati tam iha dhàtave ka« (RV 1.164.49)

That ever-flowing breast of yours is causing delight, by it you nourish all valuables: this supporter of jewels and bestower of treasures is granting good gifts; O Sarasvati, (give) that here (for us) to suck.

sarasvatì tvamasmàm avi®®hi marutvatì je±i šatrùn
tyam cicchardhantam tavi±ìyamà¯amindro hanti v°±abham ša¯®ikànàm (RV 2.30.8)

Sarasvati you protect us. You who are allied with Maruts, conquer our enemies. Indra strikes that impudent leader of ša¯®ikas who is trying to show his strength.

agne yàhi dùtyam mà ri±a¯yo devàm achà brahmak°tà ga¯ena
sarasvatìm maruto ašvinàpo yak±i devàn ratnadheyàya višvàn (RV 7.9.5)

[From Vasi±²ha Maitràvaru¯i:] O Agni, go as a messenger, do not fail, to the gods on behalf of the assembled makers of crystal-clear hymns; worship Sarasvati, the Maruts, the Ašvins, the waters, all the yak±i gods so that they may grant jewels.

vidyudrathà maruta °±²imanto divo maryà °tajàta ayàsa«
sarasvatì š°¯avan yajñiyàso dhàtà rayim sahavìram turàsa« (RV 3.54.13)

[From Prajàpati, Višvàmitra or Prajàpati Vàcya:] let the Maruts with chariots made of lightning, carrying spears, the heavenly youngsters, born from °ta, tireless, and Sarasvati, all worthy of yajña, hear; give us wealth along with powerful men.

agna indra varu¯a mitra devà« šardha« pra yanta màrutota vi±¯o
ubhà nàsatyà rudro adha gnà« pù±à bhaga« sarasvatì ju±anta (RV 5.46.2)

Agni, Indra, Varu¯a, Mitra, the many gods, and the Maruts and Vi±¯u favour us; may the two Nàsatyas, Rudra, the divine females, Pù±an, Bhaga, Sarasvati be pleased.

te no rudra« sarasvatì sajo±à mì³hu±manto vi±¯ur m°³antu vàyu«
°bhuk±à vàjo daivyo vidhàtà parjanyàvàtà pipyatàm i±am na« (RV 6.50.12)

May Rudra and Sarasvati, she who is in harmony with all of them, may generous Vi±¯u and Vàyu be gracious and make us happy; may °bhuk±an, Vàja, the divine Vidhàt° (distributor), Parjanya and Vàta send us nourishment.

indro nedu±²ham avasàgami±²ha« sarasvatì sindhubhi« pinvamànà
parjanyo na o±adhìbhir mayobhur agni« sušamsa« suhava« piteva (RV 6.52.6)

Indra, come the nearest with refreshments, Sarasvati swelling with (or by) the rivers; Parjanya delighting (or refreshing) with herbs, Agni saying good things and listening willingly, like a father.

iyam adadàd rabhasam °¯acyutam divodàsa¶ vadhryašvàya dàšu±e
yà šašvamta, àcakhàdàvasam pa¯im tà te dàtrà¯I tavi±à sarasvati (RV 6.61.1)

[From Bhàradvàja:] she gave the impetuous Divodàsa, always inciting to the fulfillment of obligations, to Vadhryašva who always offers worship; she again and again dug away the residence of the pa¯i; these are your tasks and powers, O Sarasvati.

iyam šu±mebhirvisaravàyi rujatsànu giri¯àm tavi±ebhirurnibhih
pàràvata«nìmavase suv°ktibhi« sarasvatìmàr vivàsemadhìtibhih (RV 6.61.2)

We serve the Sarasvati who with her powerful tides destroyed the peaks of mountains (the fortified towns) like one who plucks lotuses with the rushing of her waters; for protection, let us dwell in Sarasvati; let me put to rest her, who strikes what is far and what is near, with good prayers and with good nets for food. [... by her force and her impetuous waves, has broken down the sides of the mountains like a digger of lotus fibres.]

sarasvati devanido ni barhaya prajà¶ višvasya b°sayasya màyina«
uta k±itibhyo vanìr avindo vi±am ebhyo asravo vàjinìvati (RV 6.61.3)

Sarasvati, strike down the god-scoffers, the cunning descendants of every B°saya; also, for the peoples you are protecting the riverine land; for them (the god-scoffers) you gushed forth poison, O you rich in horses (impetuous).

pra ¯o devì sarasvatì vàjebhir vàjinìvatì
dhìnàm avitry avatu (RV 6.61.4)

Divine Sarasvati, the rich-in-horses (impetuous) one, (may come) forth with treasures for us; you the promoter of prayers, animate (us).

yas tvà devi sarasvaty upabrùte dhane hite
indra¶ na v°tratùrye (RV 6.61.5)

Someone invokes you, divine Sarasvati, once the prize has been fixed; like Indra in the V°tra fight.

tvam devi sarasvaty avà vàje±u vàjini
radà pù±eva na« sanim (RV 6.61.6)

You, divine Sarasvati, (bestow on us) favours in the battles, you heroic one; like Pù±an, granting us a reward.

uta syà na« sarasvatì ghorà hira¯yavartani«
v°traghnì va±²ì su±²utim (RV 6.61.7)

Also, this terrific Sarasvati, this golden wheel (or river course) to us (may come); the (female) killer of V°tra is exceedingly eager.

yasyà ananto ahrutas tve±aš cari±¯ur ar¯ava«
amaš carati roruvat (RV 6.61.8)

Hers (is an) endless, non-fluctuating (or not crooked), impetuous, mobile flood; (this power) moves with a loud roaring.

sà no višvà ati dvi±a« svas°r anyà °tàvarì
atann aheva sùrya« (RV 6.61.9)

(May) she, rich in °ta, (send) to us all her other sisters (who are) beyond the enemies, like Sùrya (sends) the day.

uta na« priyà priyàsu saptasvasà suju±²à
sarasvatì stomyà bhùt (RV 6.61.10)

Also, dear to us among all the dear ones, the one out of seven sisters, she is well liked (or welcome); Sarasvatì is worthy of a hymn of praise.

pù±à vi±¯ur havanam me sarasvaty avantu sapta sindhava«
àpo vàta« parvatàso vanaspati« š°¯out p°thivì havam (RV 8.54.4)

Let Pù±an, Vi±¯u, Sarasvati, the seven rivers be pleased (with) my sacrifice; let the waters, the wind, the mountains, the forest tree, the earth hear the offering.

à yat sàkam yašaso vàvašànàh sarasvatì saptathì sindhumàtà
yà« su±vayanta sudughà« sudhàrà abhi svena payasà pìpyànà« (RV 7.36.6)

[From Vasi±²ha:] they come together honoured, roaring, and Sarasvati is the seventh one, whose mother is the ocean; they (feminine) are flowing yielding abundant (or good) milk, being beautiful streams, overflowing with their own water (or milk).

àpapru±ì pàrthivàny uru rajo antarik±am
sarasvatì nidas pàtu (RV 6.61.11)

The one who satiates all the regions of the earth, you (move in) the widest space, the region of dust (earth), and the intermediate (atmospheric) space; Sarasvatì, protect (us) from contempt.

tri±adhasthà saptadhàtu« pañca jàtà vardhayantì
vàji-vàje havyà bhùr (RV 6.61.12)

She who has a triple seat, (being endowed with) sevenfold ores, she is the promoter of the five peoples (i.e. she makes them prosper; in every battle she is invoked.

pra yà mahimnà mahinàsu cekite dyumnebhir anyà apasàm apastamà
ratha iva b°hatì vibhvane k°tà upastutyà cikitu±à sarasvatì (RV 6.61.13)

She, with majesty in the midst of all powers, may become manifest with all the splendours, she is special, the most skillful (or rapid) of the skilled ones; large as a chariot, built by Vibhavan (a heavenly artificer who carved her river bed), good to be praised. Sarasvatì is experienced (or attentive).

damùnaso apaso ye suhastà v°±¯a« patnìr nadyo vibhvata±²a«
sarasvatì b°haddivota ràkà dašasyantìr varivasyantu šubhrà« (RV 5.42.12)

The friends of the house, skillful people clever with their hands (experts in performing sacrifices), the wives of mighty men, the perfectly carved rivers cut out by a skillful artificer (Vibhavan, one of the three °bhus), Sarasvati, goddess of the lofty sky °àkà, they offer service; let they, the shining ones increase our prosperity.

sarasvaty abhi no ne±ì vasyo màpa spharì« payasà mà na à dhak
ju±asva na« sakhyà vešyà ca mà tvat k±etrà¯y ara¯àni ganma (RV 6.61.14)

O Sarasvatì, bring near us larger wealth, do not kick us away (as a cow during milking), do not consume us with milk (or water); be pleased with our friendship and with our living in an adjacent and dependent territory, do not let us go away from you into foreign lands.

ni tvà dadhe vara à p°thivyà i³àyàspade sudinatve ahnàm
d°±advatyàm mànu±a àpayàyàm sarasvatyàm revad agne didìhi (RV 3.23.4)

Agni, you were placed on the earth on an auspicious day (at the time of fine weather) on the best of the places on the earth, in the dwelling of I³à. Blaze (shine opulently, O Agni) with wealth among the descendants of manu (on the banks of) D°±advati, Äpayà and Sarasvati.

ambitame naditame (RV. 2.41.16)

best of mothers ... best of rivers ... Ascertaining the wishes of the great sages the best of rivers (the Sarasvati) incorporated Aru¯à with her own body; formerly the flow (of the Aru¯à) was hidden. Afterwards (the Sarasvati) inundated the divine Aru¯à wih its own waters.

ambitame nadìtame devitame sarasvati
aprašastà iva smasi prašastim amba nas k°dhi (2.41.16)

O best of mothers, O best of rivers, O best of gods, Sarasvati, (we feel) as if given no consideration, please favour us with renown, O mother.

tve višvà sarasvati šritàyùm±ì devyàm
šunahtotre±u matsva prajàm devi didi®®hi na« (RV 2.41.17)

In you, Sarasvati, are all life powers, rejoice in the Šunahotras, allot our descendants their share, O goddess.

imà brahma sarasvati ju±asva vàjinìvati
yà te manma g°tsamadà °tàvari priyà deve±u juhvati (RV 2.41.18)

Rejoice in this sacred hymns, O rich in horses (impetuous) Sarasvati, O you rich °ta, we the G°tsamada poets have thought of you; (it is) you the dear (whom people) worship among the gods.

à no divo b°hata« parvatàd à sarasvatì yajatà gantu yajñam
havam devì juju±à¯à gh°tàcì šagmàm no vàcam ušatì š°¯out (RV 5.43.11)

From high heaven, from the mountain, let the worthy of worship Sarasvati come to our yajña; let the goddess pleased with the oblation, filled with ghee, willingly hear our word.

b°had u gàyi±e vaco asuryà nadìnàm
sarasvatìm in mahayà suv°ktibhi stomair vasi±²ha rodasì (RV 7.96.1)

[From Vasi±²ha:] I wish (and endeavour) to chant a great word, (she is) the incorporeal (or divine) among all rivers; gladden (or invigorate)

Sarasvati, (who is in) heaven and earth, with much power, with excellent hymns of praise, with chants, O Vasi±²ha.

ubhe yat te mahinà šubhre andhasì adhik±iyanti pùrva«
sà no bodhy avitrì marutsakhà coda ràdho maghonàm (RV 7.96.2)

O beautiful one, by your power the Pùrus are settled (near) both juices (***Soma*** and milk); she the protector attend to us, she the friend of the Maruts incite the kindness of the munificent ones.

bhadram id bhadrà k°¯avat sarasvaty akavàrì cetati vàjinìvatì
g°¯ànà jamadagnivat stuvànà ca vasi±²havat (RV 7.96.3)

May the gracious one (female) indeed effect prosperity, O Sarasvati, the unselfish one (female) is attentive, the one (female) rich in horses (impetuous); she has been praised by the likes of Jamadagni, now may she be celebrated in hymns by the likes of Vasi±²ha.

janìyanto nv agrava« putrìyanta« sudànava«
sarasvanta¶ havàmahe (RV 7.96.4)

Indeed, the unmarried ones wish for wives, the munificent ones yearn for children; let us offer oblations to Sarasvat (male).

ye te sarasva ùrmayo madhumanto gh°tašcutah
tebhir no avità bhava (RV 7.96.5)

Those waves of yours, O Sarasvat, are rich in honey and distilling ghee; with them be our protector.

pìpivà¶sa¶ sarasvata stana¶ yo višvadaršata«
bhak±ìmahi prajàm i±am (RV 7.96.6)

The swelling breast of Sarasvat is visible to all; we should eat, seeking progeny.

a yat šàkam yašay vàvašnàh sarasvati saptathì sindhumàtà
yàh su±vayanta sudugha« sudhàrà abhi svena payasà pìpyana« (RV 7.36.6)

May the seventh (stream), Sarasvati, the mother of the Sindhu and those rivers that flow copious and fertilizing, bestowing abundance of food, and nourishing (the people) by their waters, come at once together.

prak±odasà dhàyasà sas° e±à sarasvatì dharù¯amàyasì pù«
prabàbadhana ratthyeva yàti višvà apo mahina sindhuranyà (RV 7.95.1)

[From Vasi±²ha]This Sarasvati, firm as a city made of Ayas (copper) flows rapidly with all sustaining water, sweeping away in its might all other waters, as a charioteer (clears the road). Alternative: àyasì« pù« : (Sarasvati is) like a great fortified town. [With her fertilizing stream the Sarasvati comes forth. (She is to us) a stronghold, an iron gate. Moving along, as on a chariot, this river surpasses in greatness all other waters.]

ekàchetat sarasvatì nadìnàm šuchìryati giribhya à samudràt
ràyašchetantì bhuanasya bhurer gh°tam payo dudue nàhu±àya (RV 7.95.2)

Sarasvati, chief and purest of rivers, flowing from the mountains to the ocean, understood the request of Nahu±a and distributing riches among the many existing things, milked for him butter and water. [Alone among all rivers Sarasvati listened, she who goes pure from the mountains as far as the sea. She who knows of the manifold wealth of the world, she has poured out her fat milk for her neighbour (or kinsman).]

sa vàv°dhe naryo yo±a¯àsu v°±à ±i±ur v°±abho yajñiyàsu
sa vàjinam maghavadbhyo dadhàti vi sataye tanvam màm°jiìta (RV. 7.95.3)

He (Sarasvat), a strong hero, has thrived in the midst of young women, a young bull in the midst of those who are worthy of yajña; he appointed a horse for the promoters of yajña, he cleansed (their) body for success.

uta syà na« sarasvatì ju±à¯à upa šravat subhagà yaj¯e asmin
mitajñubhir namasyair iyànà ràyà yujà cid uttarà sakhibhya« (RV. 7.95.4)

Also may she, Sarasvati, hear us with delight at our yajña, she the prosperous (or charming) one; approached repeatedly by being offered homages on strong knees, equipped with wealth, she the excellent one is mindful of her friends.

imà juhvànà yu±mad à namobhi« prati stoma¶ sarasvati ju±asva
tava šarman priyatame dadhànà upa stheyàma šara¯am na v°k±am (RV. 7.95.5)

Offering these oblations all the way to you (venerable plural) with homages, take delight, Sarasvati, in this praise (hymn), granting (us) your refuge, O most dear one, as if a shelter tree, may we stand near (you).

ayam u te sarasvati vasi±²ho dvàràv °tasya subhage vy àva«
vardha šubhre stuvate ràsi vàjàn yùyam pàta svastibhi« sadà na« (RV 7.95.6)

And this Vasi±²ha for you, O prosperous Sarasvati, has uncovered the two doors of °ta; increase, O beautiful one, to whom is praising (you) give all the energies (or the booties), may you (venerable plural) protect us always with blessings.

indro và ghed iyan magham sarasvatì và subhagà dadir vasu
tvam và citra dàšu±e (RV 8.21.17)

Either Indra gave this gift, or Sarasvati the prosperous one has given this wealth, or you, Citra; we honour you.

citra id ràjà id anyake yake sarasvatìm anu
parjanya iva tatanad dhi v°±²yà sahasram ayutà dadat (RV 8.21.18)

Citra is indeed a king, petty princes are indeed others who live along the Sarasvati; like Parjanya with the rain, so gave he one hundred, ten thousand.

{This is reminisced in the Mahàbhàrata:

šùdra àbhìra ga¯àš caiva ye ca àšritya sarasvatìm
vartayanti ca ye matsyair ye ca parvata vàsinah (MBh 2.29.9)

[Nakula conquered] all the hosts of Šùdras and Äbhìras who dwell by the Sarasvati, and those who live on fish, and those who dwell in the mountains.}

SARASVATI: ECONOMY AND POLITY

Sarasvati Sindhu civilization, a metals economy, was sustained on the banks of Sarasvati river

The vedic people had used ships to cross oceans: ***anàrambha¯e tadavìrayèthà manàsthàne agrabha¯e samudre yadašvinà ùhathurbhujyumastam šatàriträm nàvamàtasthivàmsam (***RV. I.116.5; cf. VS. 21.7) referring to ašvins who rescued Bhujyu, sinking in mid-ocean using a ship with a hundred oars (***nàvam-aritrapara¯ìm***).

> Ye wrought that hero exploit in the ocean which giveth no support or hold or station. What tim ye carried Bhujyu to his dwelling, borne in a ship with hundred oars, O Ašvins.

Vedic culture was composed of a cooperating society among the yajñikas and others, both endeavouring to generate wealth:

samàne ùrve adhi saµgatàsah sa¶ jànate na yatante mitha-s-te te devànàm na minanti vratànyamardhanto vasubhir-yàdamànàh (RV. vii.76.5)

> Being united with common people they become of one mind; they strive together as it were, nor do they injure the rituals of the gods, non-injuring each other they move with wealth. (Šàya¯a explains samàne ***ùrve*** as cattle -- common property of all: ***sarve±àm sàdhàra¯e go-samùhe***).

The civilization worked with metals. Sarasvati was a bestower of wealth. A number of professions are indicated, particularly those of smithy:

> *vedà yo vìnàm padamantarik±è¯a patatàm*
> *veda nàvah samudriyah (RV. I.25.7)*
>
> He knows the path of birds that fly through heaven, and, Sovran of the sea (Varu¯a), He knows the ships that are thereon.
>
> *nànànam và u no dhiyo vivratàni janànàm*
> *tak±à ri±²am rutam bhi±agbrahmà sunvantamicchatìndràyendo risrava (RV. IX.112.1)*
>
> We all have various thoughts and plans, and diverse are the ways (professions) of men. The Brahman seeks the worshipper (a professional), wright seeks the cracked, and doctor the maimed. Flow, Indu, flow for Indra's sake.
>
> *brahma¯aspatiretà sam karmàrivàdhamat*
> *devànàm pùrvye yugesatah sadajàyata (RV.X.72.2)*

These Brahmanaspati produced with blast and smelting, like a smith, Existence, in an earlier age of Gods, from Non-existence sprang.

tigmam cidema mahi vapro asya bhasadašvo na yamasàna àsà
vijehamànah parašurna jihvàm dravirna dràvayati dàru dhak±at
(RV.VI.3.4)

Fierce is his gai and vast his wondrous body: he champeth like a horse with bi and bridle, And, darting forth his tongue, as 'twere a hachet, burning the woods, smelteth them like a smelter.

tara¯iri sim±àsati vàjam purandhyà yujà
à va indram puruhùtam name girà nemi ta±²eva sudvam
(RV.VII.32.20)

With plenty for his true ally the active man will gain the spoil, Your Indra, Much-invoked, I bend with song, as bends a wright his wheel of solid wood.

Dràpi is explained by Sàya¯a as 'kavaca, i.e., coat of mail), perhaps it was a gold-embroidered vest (vibhrad-dràpim hira¯mayam) (RV.I.25.3;IX.86.14; AV.V.7.10)

Five Peoples of the Sarasvati river

A vedic hymn refers to the endowment of metallic ores proximate to the river.

tri±adhasthà saptadhàtu« pañca jàtà vardhayantì
vàji-vàje havyà bhùr (RV 6.61.12)

She who has a triple seat, (being endowed with) sevenfold ores, she is the promoter of the five peoples (i.e. she makes them prosper; in every battle she is invoked.

One of the five peoples referred to included the Pùrus. The word is as an epithet of a folk in RV. vii.18.13 ***je±ma pùrum vidathe m°dhra vàcam***; vi.46.8 ***yad và t°k±au druhyau yat pùrau***, i.108.3 ***yadushu turvašè±u druhyu±u pùru±u***. The people associated are Yadus, Turvašas and Druhyus.

ubhe yat te mahinà šubhre andhasì adhik±iyanti pùrva«
sà no bodhy avitrì marutsakhà coda ràdho maghonàm (RV 7.96.2)

Beautiful one, by your power the Pùrus are settled (near) both juices (***Soma*** and milk); she the protector attend to us, she the friend of the Maruts incite the kindness of the munificent ones.

citra id ràjà id anyake yake sarasvatìm anu
parjanya iva tatanad dhi v°±²yà sahasram ayutà dadat (RV 8.21.18)

Citra is indeed a king, petty princes are indeed others who live along the Sarasvati; like Parjanya with the rain, so gave he one hundred, ten thousand.

This historical reference is reminisced in the great epic, referring to the peoples living by the Sarasvati:

šùdra àbhìra ga¯àš caiva ye ca àšritya sarasvatìm
vartayanti ca ye matsyair ye ca parvata vàsinah (MBh 2.29.9)

[Nakula conquered] all the hosts of ***Šùdras[2] and Äbhìras*** who dwell by the Sarasvati, and those who live on fish, and those who dwell in the mountains.

In the historical periods, ***Šùdras and Äbhìras*** (cowherds) are located as belonging to the downstream settlements of the Sarasvati river.

Metals economy of the civilization

The trace impurity pattern of copper from the Khetri copper mines (nickel and arsenic content) compare with the Harappan artifacts. Ganeshwar copper mines ascribed to the third millennium B.C. (Sikar district, Rajasthan) are located in the Drishadvati (Ghaggar-Hakra-Wahinda) system. R.C. Agrawala made a remarkable discovery in 1977: an examination of the 60 flat copper celts (20 to 25 cms. Long) from a 'hoard' in Neem-ka-thana in Sikar district of Rajasthan were associated with the Indus Valley complex. Ganeshwar is about 15 kms. from Neem-ka-thana; at this place, copper axes had been made more than four thousand years ago. This site is 250 kms. from Kalibangan and 160 kms. from Bhadra. Both Kalibangan and Bhadra are in Ganganagar district of Rajasthan. By 1979, after further diggings, 1000 copper objects (arrow heads, rings, bangles, spear heads, chisels, balls, celts) had been found in Ganeshwar. Arrowheads, thin blades and fishhooks and other characteristic Indus civilization metal artifacts were also found. Rich copper ores are also said to exist in Afghanistan, at Tezin, east of Kabul, Musai in the Shadkani Pass and the Silwatu Pass (Forbes, 1972, p. 13).

[2] 'Sudra' is a term derived from 'k±udraka'; in Kautilya's *Arthasàstra,* 1.13.13,26; 2.13.37,40 the term connotes a commoner engaged in minor work (in gold, such as bead-making). Abhiras are concordant with aayar in Tamil, herdsmen or cowherds. Thus the pancajaata cited in *Rigveda* should connote people engaged in five trades or professions.

The Early Harappans seem to have been involved in the minerals and metals economy. It is notable that sixteen furnaces were discovered on Mound F of Harappa. The civilization is most significantly a metals economy: excavations have produced 2000 metal artifacts at Mohenjodaro and over 1000 at Harappa. The metals were: copper-bronze, gold, silver, lead and more rarely electrum. Some necklaces or belts contain hundreds of metal beads. Metal tool types were: points, knives, chisels, needles. Tin-bronze alloying was used for knives, axes and chisels. Metal additives were not used for tools such as points, razors and fishhooks.

"Metals known to the Harappans. Gold has been used extensively for making ornaments, etc., by the Harappans. The forms encountered generally are beads, armlets, pendants, needles, conical caps, brooches, etc. The gold used is rather pale in colour and it has been suggested that quite often it was used as electrum (mixture of gold and silver). A significant use of gold appears for the first time only with the Harappans. Silver, in protohistory, seems to have been confined only to the Harappans--- it neither appears before them nor after them. The only exception is the Gunjeria hoard of thin silver plates. Rao (1973) erroneously holds the view that silver 'was used sparingly' by the Harappans. Silver has been extensively used by the Harappans for making vessels, beads, buckles and ornamental devices. It is certainly more prolific than gold. Electrum was quite commonly used by the Harappans… Lead (1-2%) was used mainly to increase the fusibility of copper while casting… Copper, of course, was the most extensively used metal by the Harappans… The discovery of large quantities of copper oxide ore from a brick-lined pit from the DK area of Mohenjo-daro may indicate its probable use for extracting copper… Ores and mines. Non-cuprous ores: In the whole range of prehistory, the Harappans alone used silver most extensively, not only for ornaments but also for large vessels. The source of silver is anybody's guess. Rao suggests both the Kolar (Karnataka) and the Jawar mines (Udaipur)… A lead ore (TF-Cu-5) from Mohenjo-daro was analyzed by us but showed only antimony and lead. Though lead ores occur at several places in India, the Jawar mines (Udaipur) seem to be a more likely source… '…Documents show that in the twentieth century B.C. seafarers were bringing to Ur gold, silver, much copper, lumps of lapis lazuli, stone-beads, ivory combs and ornaments and inlays, eye-paint, wood and perhaps pearls' (Wheeler, R.E.M., 1968, *The Indus Civilization,* Third edition, Cambridge)."(Agrawal, D.P., 1984). Lead might have been used mainly as a smelting flux. This is evident because of the discovery of copper ore together with a small piece of lead in a bricklined pit in a house at Mohenjodaro "Varying ratios of copper to other metals in the manufacture of bronze objects may not reflect technological limitations, but rather a detailed knowledge of how to produce a functional utilitarian object with the greatest economy of materials… Fentress states that the highest frequency of metal objects was in the habitation area at Mohenjodaro—not in the high

mound with all of its public or monumental architectural units. Similarly, at Harappa, Fentress states that metal artifacts are relatively evenly distributed throughout the site, rather than being concentrated in any particular area… To sum up, it appears that except for obvious items of jewelry, metal artifacts were manufactured for use in daily activities and were available to a broad segment of Harappan society, urban or rural… there is little difference between Allahdino and the large urban centers of the Mature Harappan culture such as Mohenjodaro. All the essential characteristics of the urban center are duplicated at this smaller site, including literacy." (Shaffer, Jim G., 1982). A similar theme is echoed by Rafique Mughal: "Thus, before the rise of large cities of the Indus Civilization, a wide-spread cultural phenomenon had already set a permanent and uniform pattern of essential elements." (Mughal, M.R., 1973).

"The copper objects recovered from the excavations at Kalibangan, in the district of Ganganagar in Rajasthan, have an important bearing on ancient Indian copper technology… the pre-Harappan levels of Kalibangan have yielded a rich variety of 56 copper objects which included antimony-rods, rings, wire pieces, lumps, bangles, pins, arrow-heads, beads, rods, celts, etc… at such an early stage (2700-2500 B.C. MASCA corrected dates)… About 200 kms. south of Kalibangan are located the well-known copper deposits of Khetri. One of its various ranges runs also in the adjoining Sikar district of Rajasthan… Ganeshwar, as a site, is ideally situated on the source of one of the streams of the river Kantli… the river Kantli seems to have been a major river during the pre-Harappan period. Flowing east of Jhunjhunu town, it now dries up near Rajgarh in the Churu district, whereas, in the past, it joined the Drishadvati river somewhere between Nohar and Bhadra in the north, from where there was no difficulty in moving towards Kalibangan which is hardly 50 kms… The Kantli river is, at some places, 2 to 3 kms. in width and it must have made possible, movement from Ganeshwar to Kalibangan and other Indus centres of the west. A number of Kalibangan sites along the Drishadvati river, such as Siswal, Sherpura and Sothi are well known… Interpretation of landsat imagery seems to suggest two streams of the river Kantli from Rajgarh, one flowing towards Nohar-Bhadra and the other towards Hissar. Both these routes are now marked by railway tracks. Our explorations and excavations at Ganeshwar and its vicinity in 1979 yielded a rich collection of copper objects, about a thousand in number. These include 60 flat celts, more than 400 arrow-heads, 50 fish-hooks, dozens of blades, spear-heads, nails, bangles, chisels, etc., all of which belong to the Indus context; and not a single specimen is of the Copper Hoard type of the Ganga-Yamuna doab… It is likely that the Kurada celts with four marks were prepared in the Ganeshwar region… It is to be noted that Kurada was situated on a trade route which runs west via Ganeshwar, Kurada-Pokaran-Phalodi-Jaisalmer-Kot Diji, etc." (Agrawala, R.C., 1984).

Khetri-Singhana in Jhunjhunu district of Rajasthan is an ancient source of copper; Siddhuwala Ther located near Derawar contains numerous kilns and Sir Aurel Stein found a copper ingot at this site.

Kalibangan is 250 kms. from Ganeshwar and was linked via the Kantli river which has its source near Ganeshwar. "This (Kantli) river once joined the Drishadvati somewhere near Nohar-Sothi-Bhadra in Ganganagar district of Rajasthan. Thus, the copper objects from Kalibangan, 1200 in number, seem to have been manufactured and supplied by the people of the Ganeshwar-Khetri region. The Khetri copper mines are hardly 60 kms. from Ganeshwar." (Agrawala, R.C. and Vijay Kumar, 1982). Kalibangan excavations have revealed seven 'fire-altars'. These altars were clay-lined pits, each measuring about 75X55 cms. "Within each pit were noted ash, charcoal and the remains of a clay stele as well as of what are known as terracotta cakes. Of the last-named item, complete examples were found in some of the 'fire-altars' in the residential houses of the lower town. The clay stele, as seen from the relatively more intact examples in the lower town, stood vertically up, was either cylindrical or slightly faceted, and measured about 30-40 cms. In height and 10-15 cms. in diameter. It would even appear that it occupied the focal position in the complex… The row of these altars ran north-south and immediately behind it was a burnt-brick wall… To the west of the row, but within easy reach of the 'worshipper', was the lower half of a jar, partly embedded in the ground and full of ash and charcoal. Perhaps in it was kept some ready fire to be used for the ritual… on this very platform, a short distance away from these altars, were a well and the remains of a few bath-pavements with attached drains… For the construction of the well, bath-pavements and drains, kiln-burnt bricks were used… on the top of another such platform within the southern rhomb. On it were noted not only a well and a 'fire-altar', but something more: it was a rectangular pit, measuring 1.25 X 1 m. and lined with kiln-burnt bricks. Within it lay bovine bones and antlers, evidently representing some kind of a sacrifice." (Lal, B.B., 1984).

"Banawali stands on the northern bank of the shallow and wide depression of the storm-water drain, known in the locality variously as the Hakra Ban, Rangoi, Nadi or Nali, but famous as Sarasvati during the Vedic period. The mound is over 400 m. square and rises to a height of about 10 m. from ground-level (Bisht, R.S., Banawali: a New Harappan Site in Haryana, *Man & Environment*, Vol. II, 86-88)… the Sothians lived at Banawali for a longer duration than at Kalibangan… The Harappans followed them closely without any perceptible break… The location, size and rigid planning of the town on one hand and the presence in large numbers of antiquities like seals, weights, beads of gold and lapis lazuli and items of marine shells, semi-precious stones, etc. on the other are definite pointers towards the strategic importance of the site… A few contiguous rooms have several hearths, ovens and fire-pits… Pieces of copper and copper slags have been collected from here.

Probably, we have encountered here a workshop-cum-residence of a metalsmith(s). The brick, both fired and sun-dried, is the principal building material… One square fireplace contains the Kalibangan earthen cone in the centre… there is a house near the 'drain-gate'… A prominent merchant might have been the owner of this house since it has given a rich harvest of seals, weights, beads, including those of gold, lapis and etched cornelian, besides the de luxe pottery of the age." (Bisht, R.S., 1984).

"…the limits of the ecological zones adopted by the Harappans in the Indus basin were already to a great extent known to their pre-Harappan predecessors. This is evidenced by the occurrence of pre-Harappan sites upto Gumla, Sarai Khola and Rahman Dheri in the Indus basin and a chain of pre-Harappan sites including Sandhanawala, Chabbuwala Ther, Kudwala, Kalepar and Derawar along the ancient course of the Hakra. Then there are Kalibangan, Banawali, Dhalewan, Lakhmirwala, Gurnikalan and Balu in the Sarasvati valley, and Siswal and Mitathal in the Drishadvati." Fairservis, W.A. (1975) has observed that knowledge about Mature Harappan urban centres has been collected at the expense of knowledge about the equally important rural aspects of this culture. For example, Allahdino is a very small, perhaps rural site which was integrated in the internal trading network of the civilization. Allahdino excavations discovered (196 pieces of copper or bronze) metal objects including gold and silver and semi-precious stones, most of which seem to have been manufactured not at Allahdino but other sites.

Triangular terracotta are typical Harappan artifacts. They are present in the hearths at Kalibangan (Thapar, B.K., 1973). The triangular cakes are called mushtis which also means 'hilts or handles'. These were apparently used as handles to lift the molten metals from the hearths and as packing material in kilns to fire pottery and other terracotta objects, as shown by Rafique Mughal (1997).

Minerals: references in the Rigveda

In the following riks, **àkara** may also mean a mine or quarry.

> *eko dve vasumatì samìcì inda à paprau p°thivìmuta dyàm*
> *utàntarik±àdabhi nah samìka i±o rathìh sayujah šùra vàjàn*
> *(RV.III.30.11)*
> Indra alone filled full the earth and heaven, the Pair who meet together, rich in treasures. Yea, bring thou near us from the air's mid-region strength, on thy car, and wholesome food, O Hero (Indra).
>
> *àkare vasorjarità panasyatenehasah stubha indro duvasyati*
> *vivasvetah sadana àhi pipriye satràsàhasamabhimàtihanam stuhi*
> *(RV.III.51.3)*

Where battle's spoil is piled the singer winneth praise, for Indra taketh care of matchless worshippers. He in Vivasvàn's dwelling findeth his delight: praise thou the ever-conquerin slayer of the foe.

abhik±anto abhi ye tamàanašurnidhi pa¯ìnàm paramam guhà hitam
te vidvàmsah praticak±yàn°tà punaryata u àyana tadud°yuràvišam
(RV. II.24.6)

They who with much endeavour searching round obtained the Pani's noblest treasure hidden in the cave,-- Those sages, having marked the falsehoods, turned them back whence they had come, and sought again to enter in.

b°haspate yà paramàparàvadat à ta °tasp°šo ni peduh
tubhyam khàtà avatà àdridugdhà madhvah šcotantyabhito virapšam (RV IV.50.3)

Brhaspati, from they remotest distance have they sat down who love the law eternal. For thee were dug wells springing from the mountain, which murmuring round about pour streams of sweetness.

mì³uhu±matìva p°ithivì paràhatà madantyetyasmadà
°k±o na rvo marutah šimìvàm amo dudhro gairiva bhìmayu
(RV. V.56.3)

Therefore we praise you that your cars may travel far in front of ours-- You who accept the eulogy of Ràtahavya with his hymns.

acchà mahì v°hatì šantamàgìrdùto na gantvašvinà huvadhyai
mayobhuvà sarathà yàtamarvàggantam nidhim dhuramà¯irnanàbhim
(RV. V.43.8)

Hither, as herald to invite the Ašvins, come the great lofty song, most sweet and pleasant.

yasyavadhìta pitaram yasya màtaram yasya šakro bhràtaram nàta ì±ate
vetìdvasya prayatà yatankaro na kilvi±àdì±ate vasba àkarah (RV.V. 34.4)

The Strong God doth not flee away from him whose sire, whose mother or whose brother he hath done to death. He, the Avenger, seeketh this man's offered gifts: this God, the source of riches, doth no flee from sin.

dhiyam vo apsu dadhi±e svar±à yayàtarana daša màso navagvàh
ayà dhiyà syàma devagopà ayà dhiyà tuturyàmàtyahah
(RV.V.45.11)

I lay upon the Floods your hymn, light-winning, wherewith Navagvas their ten months completed. Through this our hymn may we have Gods to guard us: through this our hymn pass safe beyond affliction.

abhyavasthàh pra jàyante pra vavrervavrinciketa upasthe màturvi ca±²e (RV.V.19.1)

One state begets another state: husk is made visible from husk: Within his Mother's side he speaks.

yùyam hi ±²hà sudànava indrajye±²hà amidyavah
kartà no adhvannà sugam gopà amà (RV. VI. 51.15)

Ye, O most bountiful, are they who, led by Indra, seek the sky. Give us good paths for travel: guard us well at home.

yathà gauro apà k°tam t°±yannetyaveri¯am
àpitve nah prapitve tùyamà gahi ka¯ve±u su sacà piba
(RV.VIII.4.3)

Even as the wild-bull (*Bos Gaurus*, a kind of buffalo), when he thirsts, goes to the desert's watery pool, Come hither quickly both at morning and at eve, and with the Ka¯vas drink thy fill.

yenà dašagvamadhrigum vepayantam svar¯aram
yenà samudràmàvithà tamìmahe (RV.VIII. 12.2)

Wherewith thou helpest Adhrigu, the great Dašagva, and the God Who stirs the sunlight, and the sea, for that we long.

yah su±avyah sudak±i¯a ino yah sukraturg°¯e
ya àkarah sahasrà yah šatàmagha indr yah pùrbhidàritah
(RV.VIII.33.5)

He who is praised as strong of hand both right and left, most wise and bold: Indra, who, rich in hundreds, gathers thousands up, honoured as breaker-down of forts.

°tasya gopà na dabhàya sukratustrì ±a pavitrà h°dyarantarà dadhe
vidvàntasa višvà bhuvanàbhi pašyatyavàju±²àn vidhyati karte avratàna (RV.IX. 73.8)

Guardian of Law, most wise, he may not be deceived: three Purifiers hath he set within his heart. With wisdom he beholds all creatures that exist: he drives into the pit the hated riteless ones.

pràvepà mà b°hato màdayanti pravàtejà iri¯e vav°tànàh
somasyeva maujavatasya bhak±o vibhìdako jàg°virmahyamacchàn
(RV. X.34.1)

Sprung from tall trees on windy heights, these rollers transport me as they turn upon the table. Dearer to me the die that never slumbers than the deep draught of Mùjavàn's (said to be a mountain on which the finest ***Soma*** grew) own ***Soma.***

supar¯à vàcamakratopa dyavyàkhare k°±¯à i±irà anarti±uh
nyašµginayantyuparasya ni±°tam purù reto dadhire sùryašvitah
(RV. X.94.5)

The Eagles have sent forth their cry: aloft in heaven; in the sky's vault the dark impetuous ones have danced. Then downward to the nether stone's fixt place they sink, and, splendid as the Sun, effuse their copious stream.

yathà ha tyadvasavo gaurya citpadi pitàmamuncatà yajatràh
evo ±vašsmanmuncatà vyamhah pra tàryagne prataram na àyuh (RV.X. 126.8)

As in this place, O Holy Ones, ye Vasus freed even the Gauri when her feet were fettered. So free us now from trouble and affliction: and let our life be lengthened still, O Agni.

Glimpses of life in the vedic period (Sarasvati-Sindhu civilization)

The best source for the description of life in the vedic period is the Veda itself, *Rigveda*, in particular.

It was a cooperating society among the yajñikas and others, both endeavouring to generate wealth:

samàne ùrve adhi saµgatàsah sa¶ jànate na yatante mitha-s-te
te devànàm na minanti vratànyamardhanto vasubhir-yàdamànàh
(RV. vii.76.5)

Being united with common people they become of one mind; they strive together as it were, nor do they injure the rituals of the gods, non-injuring each other they move with wealth. (Šàya¯a explains samàne ùrve as cattle -- common property of all: sarve±àm sàdhàra¯e go-samùhe).

The vedic period was a nascent material culture: the period had weavers; the words sirì and vayitrì denote a female weaver. (RV. x.71.9; PB, I.8.9); tasara is referred to which is a shuttle (RV. xiv.2.51). Reference to women weaving is provided: tantum tatam sa¶vayanti (RV. ii.3.6).

Gold (hira¯yapi¯®àn, hira¯yayu«) was highly valued (cf. RV. vi.47.23, vii.78.9).

Divodàsa gave golden treasures to the °±I Gàrga. *Rigveda* refers to ni±kagrìva (RV v.19.3) which is a golden ornament on the neck and necklaces of gold reaching down to the chest. Hira¯ya (pl.) means gold ornaments (RV. 1.122.2). Gold was smelted from the ores (*PB*, xviii.6.4, *JB* I,10) which evoke the Indian alchemical tradition enshrined in the ***Soma*** rasa, later elaborated as the science of alchemy: rasa-vàda. In Tamil ***Soma***-ma¯al means, sand containing silver ore. In Tamil, còma-ma¯al means 'sand containing silver ore.' Vèda iyal refers to alchemy. Äcàri (Skt. àcàrya) is a goldsmith. In Gypsy, *somnakay* means gold. In Egyptian, assem means electrum; in Gypsy, so¶nakay means gold. Gold was won from the river-beds: Sindhu is called the hira¯mayì (RV. x.75.8); Sarasvatì is called hira¯yavartanì (AV. vi.61.7). [cf. the reference to vasatìvari waters in vedic hymns related to ***Soma***, an apparent reference to panned-gold from the Sarasvatì river-bed.] It is notable that in 1992, Rafiq Mughal (Pakistan archaeological department) has discovered a site, Ganweriwala, an industrial site on the dried-up river bed of the Sarasvati across the Rajasthan border). This site is reportedly as large as Mohenjo-daro. The vedic people had used ships to cross oceans: *anarambha¯e... agrabha¯e samudre... šatàritram nàvam... (*RV. I.116.5; cf. VS. 21.7) referring to ašvins who rescued bhujyu, sinking in mid-ocean using a ship with a hundred oars (*nàvam-aritrapara¯ìm*). There is overwhelming evidence of maritime trade by the archaeological discoveries of the so-called Harappan civilization, which can now be re-christened: Sarasvati-Sindhu civilization. Some beads were reported to have been exported to Egypt from this valley (*Early Indus Civilization*, p. 149); Sumerians had acted as intermediaries for this trade (L. Wooley, *The Sumerians*, pp. 46-47; cf. *Ur Excavations*, vol. II, pp. 390-396).which extended to Anatolia and the Mediterranean. W.F. Leemans opines that 'magan or makkan' and 'meluhha', inscribed on clay-tablets, found at Ur, are the same as Makran coast and the coast of Western India including Sind and Saurà±²ra respectively. (*Journal of the Economic and social History of the Orient*, Vol. III, 1960, pp. 20-37). Bahrain island, known as Telmur was the trading entrepot between Indian and Mesopotamian civilizations. Ur was in contact with Makkan and Telmun. RV describes the saving of Bhujyu from mid-ocean and of a shipwreck. [So ye, with birds, out of the sea and waters bore Bhujyu, son of Tugra, through the regions, Speeding with winged steeds through dustless spaces, out of the bosom of the flood they bore him. (RV.VI.52.6)].

Rajatajàtarùpe (silver and gold) is referred to in Là²yà. Šr.S. (1,6,24) and Šàµkh.Šr.S. (iii.19.9)

Hira¯ya meaning gold is a frequent reference in the *Rigveda* and later texs. (RV. I.43.5; iv.10.6; AV. I.9-2; ii.36.7; V.28.6). In an apparent

reference to gold won from the rivers, Sindhu is referred to as hira¯mayì (RV. X.75.8); Sarasvati is referred to as hira¯yavartanì (AV. VI.61.7). Zend refers to gold as zaranya. In the plural, hira¯ya connotes ornaments of gold (RV. I.122.2). Divodàsa gives to a priest ten lumps of gold: daša hira¯ya pi¯®àn (RV.VI.47.23). Kàtyàyana Šrauta Sùtra specifies that the priest, the sacriicer and his wife should wear golden chains before the extraction of ***Soma*** at Vàjapeya. Gold was kept safely in pots, buried underground (*hira¯yasyeva kalašam nikhàtam*: RV.I.117.12). *ni±ka, šatamàna, suvar¯a, pàda* are apparently linked with gold as coins and found in Vedic texts in the context of gift-giving. The term *jàtarùpebhyah parimà¯e* indicates the yield of gold as an exchange value standard (RV.VI.2.55).

The VS refers to a jeweller as *ma¯ikàra*. *Ma¯i* refers to a jewel, an amulet to protect from evil (RV.I.33.8). The compound *ma¯igrìva* shows that the jewel could be strung on a thread and worn round the neck. (RV.I.122.14). Sàya¯a's explaination samudram na sañcara¯e samsyavah (RV.I.56.2) indicates that merchants, desirous of wealh, took to sea voyages.[To im the guidance-following songs of praise flow full, as those who seek gain go in company to the flood. To him the Lord of power, the holy synod's might, as to a hill, with speed, ascend the loving ones.]

Gods are depicted as smelting like ore, the human generations (....*ayo na deva janimà dhamantah*)(RV.IV.2.17) Agni's flame and smoke sent forth reach the heaven as a smelter fans and sharpens fire (RV.V.9.5; cf. RV.IX.112.2). By the side of a lake in the Kuruk±etra, called Šarya¯àvan, ***Soma*** is smelted [Let the Vritra-slaying Indra drink ***Soma*** by Šarya¯àvan's side... (RV.IX.113.1)]

The Sarasvati-Sindhu rivers supported the cultivation of wheat and barley, as evidenced by the archaeological finds. (John Marshall, *Mohenjo-daro and the Indus Civilization,* vol. 1, p.27) Sunam nah phàla vi k°santu bhùmim... šunàšìrà šunam-asmàsu dhattam: the ploughshare ploughing makes the food that feeds us and with the feet cuts through the path it follows (RV. iv.57.5-7).

Many vedic people were herdsmen, pastoralists: *jàto-yad-agne bhuvanà vyakhyah pašun na gopà:* agni looks upon the people of the world as a herdsman watches his cattle. (RV. x.19.3-5).

By the 15th cent. B.C., many references in Vedic texts had been deified: H.G.Rawlinson refers to the trade-relations between the Sapta Sindhu valleys and the Euphrates; an early record in cuneiform inscriptions of the Hittite kings of Mitanni in Kappadokia, belonging to 14th or 15th century B.C., discovered by Prof. H. Winckler at Boghozkai in 1907 refers to the Hittite kings worshipping gods: Indra, Mitra,

Varu¯a and Nàsatya. (Rawlinson, *Intercourse between India and the Western World,* Rai Book Service, Delhi, 1977, p. 2f.). The equation of the word *sindhu* with muslin in ancient Babylonian list of clothes is significant.

By referring to *paràvata sindhu* (RV 10.137.2) [para, paràvat as distinct from avaram arvàvat, 'on this side or proximate'] the hymn is referring to 'other side, distant' apparently speaking of Sindhu in geographic relation to Sarasvati. RV 3.54.6, 8 refers to two sisters who hold the two worlds from °tasya-yoni (the womb or source of °ta). This is perhaps a reference to the two rivers: Sarasvati (avara, near) and Sindhu (para, distant).

Sapta-sindhavah (the land of the seven rivers) is the area of sapta-sindhu (seven rivers): the Sarasvatì, the Sindhu plus the five rivers: Šatadru (Sutlej), Vipàsà (Beas), Iràvatì (Ravi), Candrabhàgà (Asiknì or Chenab), Vitastà (Jhelum). In RV 3.33.2, the two rivers Vipàšà and the Šatadru are said to run towards the ocean like two cart-driving horses. In RV 6.61.10 saptasvasà is interpreted as the one out of seven sisters treating the term as a bahuvrìhi compound. Saya¯a explains it as: *gàyatryàdìni sapta chandàmsi svasàro yasyàs tàd°šì, nadìrùpàyàs tu gaµgàdyàh sapta nadyah svasàrah*). This is consistent with RV 1.34.8 which refers to the seven rivers as 'seven mothers' and with RV 10.104.8 which refers to seven divine rivers with which the ocean (sindhu) is being filled by Indra, plus ninety nine other rivers. In RV 1.80.8 and 1.121.13 there is a reference to navatim nàvyà (ninety navigable rivers). In RV 8.98.8 yavya perhaps refers to an irrigation canal (to irrigate yava, barley crops).

"…the upper course of the Sarasvati, right from Adi Badri in the Siwaliks, traditionally held as its sources, to Bahar, running past Kapalmochan, Bhagwanpura, Thanesar-Kurukshetra and Pehoa (ancient P°thùdaka), is still seasonally alive. [Kalàpagràma is near the Himalayan source of Sarasvatì which is a tributary of Alaknanda, in Badrinath in Garhwal (*Asia. Res.,* vol. XI, p. 524).]At Bahar it has lately been taken by the Ghaggar. Its old course, which now runs parallel to that of the Ghaggar, is still traceable and forms the Sottar Valley now famous for yielding bumper crops and potable subsoil water. This valley, which is two to four kilometers wide, and even more at places, runs through the districts of Jind, Hissar and Sirsa in Haryana until it meets the modern Ghaggar near the Rajasthan border… It is still publicly known variously as the Rangoi, Nai, Nadi, or Hakra Ban. A series of mounds runs along both its banks. The mound of Banawali is one of those on the northern flank." From Banawali, Kalibangan is 120 kilometres west by south, Ropar (Roopnagar) is 180 kilometres northeast, Mitathal is 110 kilometres southeast and Rakhigarhi is 80 kilometres northeast. "Pre-Indus or Kalibangan Culture: … a partially uncovered house complex with several hearths, ovens and fire pits in the room. Excessive fire activity

in this area has reddened house floors there. Surely, it should be a workshop, plausibly that of a metalsmith. One more interesting feature is the presence of precisely circular pits, both large and small, neatly cut deep into the house floors. In one case, a pit rim was lined with mud bricks and its walls were thickly plastered. Most of these pits yield fine bluish ash, occasionally mixed with charred grains; although the pits themselves show no sign of firing. These might be the storage silos or bins…. Mature Indus Culture: … A house was generally provided with a room containing a square fireplace, with or without brick lining, but with a longish cone of clay placed in the center. This was also noticed at Kalibangan… clay object that gradually tapers upwards from the square base and ultimately turns towards a side terminating into two short horn-like prongs. It is usually found placed in the center of the hearth… At times, the lower body of a vessel or a roughly straight-sided pottery stand is found to have been placed in a fire pit… seals were generally recovered from houses which on the basis of their contents… have been tentatively attributed to a trader or a jeweler. It is also important to note that the site is very rich in lapis lazuli and gold. Gold plated terracotta beads were also found." (Bisht, R.S., Excavations at Banawali, 1974-77, in: Possehl, Gregory, L., *Harappan Civilization*, Delhi, Oxford and IBH, pp. 113-124).

Trade in this vast domain included lapis lazuli, metals, beads with etchings, seals and carved chlorite vessels (found in Tepe Yahya). The agricultural settlements (e.g. Kalibangan) on the Sarasvati river valley had existed prior to the emergence of the Mature Harappan sites.

The Early Harappan sites of the Ghaggar/Hakra (Sarasvati) are on the now extinct waterways of the region, close to the mountains of Rajasthan. Bagor, Jodhpura and Ganeshwar in the Khetri copper-mine belt are third millennium settlements which hold the key to an understanding of the importance of minerals in the material culture of this civilization. (Misra, V.N., 1973, and Agrawala, R.C. and Vijay Kumar, 1982). The Early Harappans seem to have been involved in the minerals and metals economy. It is notable that sixteen furnaces were discovered on Mound F of Harappa. "(Trade) routes move up the Ravi from Multan to Harappa, and thence some 60 kms. southeast to Pakpattan. This has been the traditional ferry point on the Sutlej for centuries, and is an important stage on routes connecting the Punjab with the Sarasvati Valley. Alternately, a winter caravan route has traditionally moved *from Dera Ismail Khan to Jhang, Kamalia, Harappa, Pakpattan and thence to Delhi (Gazetteer of Montgomery District 1884*: 147-48, pp. 184-85)… deodar wood from the Himalayan temperate forests… copper and steatite from the Zhob valley, placer gold from the upper reaches of the Chenab… "(Ratnagar, Shereen, The location of Harappa, in: Possehl, Gregory L., *Harappan Civilization*, Delhi, Oxford and IBH, 1982, pp. 261-264). "(Gold)… the richer sources lie in Soviet Central Asia. South of the Caucasus, in Armenia, the famous metal workers, the Chalybes,

are credited with rich mines. This probably means the deposits near the Taldjen River, close to Artwin… Gold is washed in many places in the Karakorum and in the beds of a number of rivers of Central Asia. The Muruntau mountains in the Kyzyl Kum desert has the largest deposit of gold (Forbes, R.J., Studies in Ancient Technology, Vol. VIII, Leiden, E.J.Brill, 1971:166; Kalesnik, S.V. and Pavlenko, V.F. eds., *Soviet Union: A geography*, 1976:202)… the discovery of the famous Fullol Hoard in the Hindu Khush of northern Afghanistan contained a number of gold objects with Mesopotamian and South Turkmenian motifs. (Tosi, M. and R. Waradak, 1972, The Fullol Hoard: a new find from bronze-age Afghanistan, *East and West*, 22 (1-2): 9-17)… Silver and Lead. silver was used for making vases and ornaments, such as bracelets, bangles and beads… small quantities of silver are frequently found in conjunction with lead at a few places in India. Lead is plentiful at Mohenjodaro and it is to be noted that traces of lead have been found in a sample of silver from the site (Marshall, John, 1931, *Mohenjodaro and the Indus Civilization, 3 vols.*, London, Arthur Probsthain, p. 524). This makes it probable that it was extracted from lead ores. Rajasthan, Bihar and Orissa contain several silver-bearing lead deposits… Ajmer and Jawar mines in Rajasthan are likely sources for these metals as far as the Harappans are concerned… Another silver source… is in Afthanistan and Iran. Lead mines, which could have been such a source for silver as well, are situated in Faranjal in the Ghorband Valley of Afghanistan and are common in southern Afthanistan, especially at Hazara Jat. Well-known silver mines are also known to have existed near the head of the Panjsher valley in the southeastern Hindu Kush and in the vicinity of Heart… Lead might have been used mainly as a smelting flux. This is evident because of the discovery of copper ore together with a small piece of lead in a bricklined pit in a house at Mohenjodaro (Mackay, E.J.H., *Further Excavations at Mohenjodaro, 2 vols.*, Delhi, Government of India, p. 48). Asthana, Shashi, Harappan trade in metals and minerals, in: Possehl, Gregory L., *Harappan Civilization*, Delhi, Oxford and IBH, 1982, pp. 271-285).

Ganweriwala is located midway between Mohenjo-daro and Harappa and is within a cluster of 174 contemporary sites. The evolution of the pre-Harappan to mature Harappan seems to have occurred on the Sarasvati basin. The late Harappan culture seems to have continued till the Painted Grey Ware culture as evidenced by the surface collections in Bahawalpur region. (Mughal, M.R., 1975). Excavations at Bhagawanpura and Dadheri have yielded stratigraphic evidence of overlap between the late Harappan and the PGW culture, thus establishing the continuity between the Harappan and post-Harappan traditions. (Joshi, J.P. and Madhubala, 1982). The coastal sites in Gujarat are late Harappan, while the settlements of Surkotada and Desalpur in Kutch indicate a direct entry of Harappan peoples from Sind. Audumvara is Kutch; its ancient capital was ko²ešvara or Kutchešvara (*MBh. Sabhà P.*, ch. 52 and *Cunningham's Arch. S. Rep.*, v, p.155); this is the country of odomboerae of Ptolemy. Dholavira

(Kotda) could have been ko²ešvara. “The availability of twenty one sites in an area of approximately 50 kms. X 25 kms. (i.e. 1250 sq. kms.) in Mansa taluk of district Bhatinda shows that this area was a very important zone in the Harappan culture area. The pre- or early Harappans and Harappans preferred the Ghaggar and its tributaries… The Sirhind, a tributary of the Ghaggar, was one of the most important lines of communication between Punjab and Rajasthan; vitally important for getting raw material like timber, especially deodar used in house-building activities… three types of settlements: (1) Cities, of about 1500 X 1500 m. area such as Dhalewan, Gurnikalan, Baglian Da Theh, Lakhmirwala and Hasanpur. (2) In between there appear to be six towns also ranging in area between 900 X 900 m. and 500 X 500 m. at Karampura, Dallewala I, Sahnewali, Hirke, Dallewala II and Baran II. It has been observed that all the cities and towns were situated on the eastern side of the river where denudation by floods was less, while (3) a series of villages, numbering 14, covering approximately an area of 200 X 200 m. to 400 X 400 m. sites like Danewala I, Danewala II, Chhoti Mansa, Lallianwali, Lal Bhikhi, Gurni Kalan II, Nebriwala, Naiwala I to V are situated on the western side which was subjected to occasional floods… In all, there are about 200 sites of Harappan and late Harappan cultures in Gujarat. While Lothal, Surkotada and Desalpur have already shown a glimpse of matured phase of Harappa Culture, generally sites show a long survival of Harappan settlements and traditions. The sites in Kutch and northern Saurashtra show the route of movement… The Harappans who reached Daimabad had the typical late Harappan pottery, Indus script, cakes, burials etc. and at present it is the southern-most limit of the culture… Hydrological changes affecting adversely the availability of water in the middle and lower course of the perennial river systems like the one we observe in the Ghaggar-Sarasvati, made the Harappans leave their settlements and break their urban fabric forever.” (Joshi, J.P, Madhu Bala and Jassu Ram, 1984).

The penetration of the peoples to the east of the Sutlej seems to have followed the emergence of the Mature Harappan. “Even today we find many an element that is surprisingly reminiscent of the Indus Civilization. Would one believe that the gauge of the bullock-cart in the lower Indus valley is exactly the same as it was in the Indus days; or the present-day grid pattern of ploughing the field, so as to sow black gram in one set of rows and mustard in another, goes back to pre-Harappan times? Do not the innumerable bangles put on by Marwari ladies today remind one of the supple arms of the dancing girl from Mohenjo-daro? Detailed work has, therefore, to be done on the legacy of the Indus Civilization.” (Lal, B.B., Introduction in: Lal, B.B. and Gupta, S.P., eds., *Frontiers of the Indus Civilization*, Delhi, Indian Archaeological Society, 1984, pp. viii-xiv). This perception is echoed in emphatic terms by Allchin: “Our personal view would be that the search for some area outside from which to derive the Mature Harappan ready-made, to

supersede the Early Indus style, is a chimera. At base, the Mature style must have evolved out of the Early in the Indus Valley itself, implying continuity of population and technical skills, and probably recognizable more particularly by the introduction of such important innovations as writing and all the implicit concomitants of political, administrative and social organization… This (local) evolution is everywhere apparent in the basic aspects of the culture, pattern of settlements, crops and agricultural life, and in the basic crafts involved" (Allchin, F.R., 1984). "The oldest weights and measures discovered in archaeological excavations anywhere in the world belonged to the Indus Civilization (Berriman, A.E., 1963, *Historical Metrology*, London, J.M.Dent & Sons)… Several of the marks found on the punch-marked coins are identical with those on the seals of Mohenjo-daro and Harappa and, therefore, appear to show a derivation from the Indus Civilization and close similarity with the Mohenjo-daro and Harappa pictographs. Prem Nath was the first scholar to note this striking similarity between the symbols found on the Mohenjo-daro and Harappa seals and those on punch-marked coins (*Indian Historical Quarterly*, 1931-32, Vol. VII and Vol. VIII)… The discovery by Rao Bahadur K.N. Dikshit of the conformity in shape and weight system of the punch-marked coins and the metal pieces recovered during the excavations at Mohenjo-daro is another important support in favour of their similarity. Fabri's theory is more conclusive. The humped Indian bull, the elephant, the tiger and the crocodile, etc. on the punch-marked coins and the Harappan seals meant to him that not only were the objects similar, but that there were similarities in such small details that one must necessarily suppose that they were not due to mere chance. (The punch-marked coins, a survival of the Indus Civilization, JRAS, 1935, 308)." (Mainkar, V.B., 1984).

"Metals known to the Harappans. Gold has been used extensively for making ornaments, etc., by the Harappans. The forms encountered generally are beads, armlets, pendants, needles, conical caps, brooches, etc. The gold used is rather pale in colour and it has been suggested that quite often it was used as electrum (mixture of gold and silver). A significant use of gold appears for the first time only with the Harappans. Silver, in protohistory, seems to have been confined only to the Harappans--- it neither appears before them nor after them. The only exception is the Gunjeria hoard of thin silver plates. Rao (1973) erroneously holds the view that silver 'was used sparingly' by the Harappans. Silver has been extensively used by the Harappans for making vessels, beads, buckles and ornamental devices. It is certainly more prolific than gold. Electrum was quite commonly used by the Harappans… Lead (1-2%) was used mainly to increase the fusibility of copper while casting… Copper, of course, was the most extensively used metal by the Harappans… The discovery of large quantities of copper oxide ore from a brick-lined pit from the DK area of Mohenjo-daro may indicate its probable use for extracting copper… Ores and mines. Non-cuprous ores: In the whole range of prehistory, the Harappans alone

used silver most extensively, not only for ornaments but also for large vessels. The source of silver is anybody's guess. Rao suggests both the Kolar (Karnataka) and the Jawar mines (Udaipur)… A lead ore (TF-Cu-5) from Mohenjo-daro was analyzed by us but showed only antimony and lead. Though lead ores occur at several places in India, the Jawar mines (Udaipur) seem to be a more likely source… '…Documents show that in the twentieth century B.C. seafarers were bringing to Ur gold, silver, much copper, lumps of lapis lazuli, stone-beads, ivory combs and ornaments and inlays, eye-paint, wood and perhaps pearls' (Wheeler, R.E.M., 1968, *The Indus Civilization*, Third edition, Cambridge)." (Agrawal, D.P.).

There are no archaeological sites of the Sarasvati-Sindhu civilization in the Punjab to the west of Harappa which is on high ground (bar) on the banks of the Ravi river. Kalibangan is to the southeast of Harappa on the southern bank of Sarasvati river in Ganganagar district of Rajasthan. The land around Kalibangan is flat, with low sand-dunes nearby. Laying of a wide canal through the ancient, now-dried up river bed has resulted in the slow recession of the sand-dunes. This points to the possibility that during the second millennium B.C. when the Sarasvati was a full-flowing river, Kalibangan should have been a settlement with lush agricultural fields. Sumerian economic texts record considerable volumes of shipments of tons of copper from Meluhha (an apparent reference to the Sarasvati-Sindhu civilization area). Harappa is close to the resources from the mountains of the Sulaiman range through the Hindu Kush. Mohenjodaro is close to the resources of Baluchistan and Rajasthan. Ganweriwala is close to the Ganeshwar copper mines of Rajasthan. Larkana flood plain and the Sarasvati river valleys would have been fertile enough to support the surrounding village settlements, surrounding the three large sites: Harappa, Ganweriwala and Mohenjodaro. Lothal is a small-sized trading town on a frontier providing access to the Persian gulf, to the Deccan and to the mineral resources of Rajasthan. Aurel Stein surveyed the ancient sites along the dry bed of the Hakra (Ghaggar or the lost Sarasvati) between Hanumangarh and the deltaic portion below Derawar (Stein, Sir Aurel, 1942). The survey yielded the following clues: (a) the Hakra branch canal is an ancient winding bed of the Sutlej which joined the Hakra between Walar and Binjor; (b) the Desert branch canal followed an ancient bed of the Sutlej which joined the Hakra between Kudwala and Lurewala; [c] the dry-bed of Hakra widens beyond Walar; (d) hundreds of ancient sites are located between Walar and Lurewala; (e) mounds indicating ancient sites occur near Fort Abbas and continue down the Hakra. This survey of Stein was followed up by Rafique Mughal's survey in 1974-77 of 480 kms. long stretch along the Hakra river between Fort Abbas and Yar Khan. Mughal found the largest concentration of sites between Lurewala and Duhienwala Qila. This substantiates the palaeochannels gleaned through landsat images which are the Hakra and Desert branch channels of the Sutlej which had joined the Hakra between Walar and Binjor and

between Kudwala and Lurewala. Pre-Harappan and Harappan sites are located in the valleys of various seasonal streamlets (chois) on the Hakra (Ghaggar) like Sirhind Nadi, Markanda, Patialvi, including Chautang (Drishadvati).

Selected vedic hymns related to Sarasvati matching the archaeological and geophysical evidence

It is known that the Sarasvati Sindhu civilization was a trading civilization, producing and trading in metal products and producing handicrafts using beads and terracotta or faience material.

Rigveda attests to the Sarasvati:

> "associated with the Maruts:" (vii.3.8)
>
> "associated with a desert" (vii.71.1)
>
> "associated with the ocean" (vii.36.6)
>
> "associated with d°±advati and apayà rivers" (iii.23.4)

Only one river matches these geophysical references: the Markanda-Ghaggar-Hakra-Nara (Mihran) river system in North West India.

The reference is apparently not to any of the other three Sarasvati rivers drawn on the National Atlas maps: (i) Haraquaiti (Zend Avestan version of Sarasvati) river which joins the river Kubha, a tributary of the Sindhu in Afghanistan; (ii) River Sarasvati joining the Little Rann of Kutch; and (iii) River Sarasvati originating from Pushkar, near Ajmer and joining the Luni River. These three rivers do not match the descriptions provided in the *Rigveda* and no major archaeological sites have been discovered on these three rivers. Naming of many rivers as Sarasvati may be a recollection of the memories of the lives of ancestors, as people migrated westward, eastward and southward.

The Vedas refer to fortified towns and metallic forts:

prak±odasà dhàyasà sas° e±à sarasvatì dharù¯amàyasì pù«
prabàbadhana ratthyeva yàti višvà apo mahina sindhuranyà (RV 7.95.1)

[From Vasi±²ha]This Sarasvati, firm as a city made of Ayas (copper) flows rapidly with all sustaining water, sweeping away in its might all other waters, as a charioteer (clears the road). Alternative: àyasì« pù« : (Sarasvati is) like a great fortified town. [With her fertilizing stream the Sarasvati comes forth. (She is to us) a stronghold, an iron gate. Moving along, as on a chariot, this river surpasses in greatness all other waters.]

In RV 7.95.1 Sarasvati is called ***pur*** (feminine noun) because she protects the àryas by delimiting a safe place for them. The heroic dweller of ***pur*** is ***puru±a***. In RV 4.30.20*: šatam ašman-mayìnàm puràm…*

divodàsàya, ‘of one hundred cities made of stone… for the benefit of Divodàsa’. In RV 10.101.8, pura is made of metal:

vrajam k°¯udhvam sa hi vo n°pà¯o varma sìvyadhvam bahulà p°thùni
purah k°¯udhvam àyasìr adh°±²à mà vah susroc camaso d°mhatà tam (RV 10.101.8)

[An extraordinary process of metal creation is explained *in Šatapatha Bràhma¯a* (VI.1.3.1-5): In the beginning, Prajàpati was alone; so he had a desire to reproduce himself. He practised penance and waters were produced. Waters asked him about the use of waters. He said, ‘you should be heated’; the waters were heated and foam was produced. Foam was heated and clay was produced. Clay was heated, sand was produced. From sand, pebble resulted, from pebble, the stone. From stone, metal ore came and in the last process, gold was produced. This is the eight-step k±ara¯a-vyàpàra of Prajàpati and each of his vyàpàras or k±ara¯as implies one ak±ara or syllable obtained by Gàyatrì and hence the eight-syllabled Gàyatrì.]

Construct a cowpen, for that is the drinking place of your leaders, fabricate armour manifold and ample; make fortresses of metal that are invincible, let not your ladle leak, make it strong and unbreakable.

[cf. Max Mueller, *Sacred Books of the East*, xxxii.60: ‘Here we see samudra used clearly in the sense of sea, the Indian sea, and we have at the same time a new indication of the distance which separates the Vedic age from the late Sanskrit literature. Though it may not be possible to determine, by geological evidence, the time of the changes which modified the southern areas of the Punjab and caused the Sarasvati to disappear in the desert, still the fact remains that the loss of the Sarasvati is later than the Vedic age, and that, at that time, the waters of the Sarasvati reached the sea.’] cf. RV 10.64.9 *Baudhàyana's Dharmasùtra* (I,1,2,9) describes Madhyadeša as lying to the east of the region where sarasvatì river disappears, to the west of the black forest: kàlakavan, to the north of the pàripàtra mountain and to the south of the Himalayas.

Mahàbhàrata refers to a descendant of Pùru:

matinàrah khalu sarasvatyàm
dvàdaša-vàr±ikam satram àjahàra
niv°tte ca satre sarasvaty abhigamya tam bhartàram
varayàm àsa tasyàm putram ajanaya tamsum nàma
atrànuvamšo bhavati
tamsum sarasvatì putram matinàràd ajìjanat
ilinam janayàm àsa kàlindyàm tamsur àtmajam (MBh 1.90.25-28)

Matinàra (a descendant of Pùru) performed a twelve-year sacrifice on the bank of the Sarasvati river. When the sacrifice was finished Sarasvati herself approached him and selected him as her husband. He then begot in her a son named Tamsu. The lineage which descends from this noble couple is: Sarasvatì gave birth to a son named Tamsu by Matinàra, and Tamsu begot in Kàlindì a son named Ilina.

There are references to the ***pa¯i***, a merchant and the flow of the river affecting his residence and also to movements of people away from the river:

iyam adadàd rabhasam °¯acyutam divodàsa¶ vadhryašvàya dàšu±e
yà šašvamta, àcakhàdàvasam pa¯im tà te dàtrà¯i tavi±à sarasvati
(RV 6.61.1)

[From Bhàradvàja:] she gave the impetuous Divodàsa, always inciting to the fulfillment of obligations, to Vadhryašva who always offers worship; she again and again dug away the residence of the ***pa¯i***; these are your tasks and powers, O Sarasvati.

sarasvaty abhi no ne±i vasyo màpa spharì« payasà mà na à dhak
ju±asva na« sakhyà vešyà ca mà tvat k±etrà¯y ara¯àni ganma
(RV 6.61.14)

Sarasvatì, bring near us larger wealth, do not kick us away (as a cow during milking), do not consume us with milk (or water); be pleased with our friendship and with our living in an adjacent and dependent territory, do not let us go away from you into foreign lands.

Sarasvati of the vedic civilization was the river close to the rivers D°±advati, Äpayà.

ni tvà dadhe vara à p°thivyà i³àyàspade sudinatve ahnàm
d°±advatyàm mànu±a àpayàyàm sarasvatyàm revad agne didìhi
(RV 3.23.4)

Agni, you were placed on the earth on an auspicious day (at the time of fine weather) on the best of the places on the earth, in the dwelling of I³à. Blaze (shine opulently, O Agni) with wealth among the descendants of Manu (on the banks of) D°±advati, Äpayà and Sarasvati.

Sarasvati was the river which had flowed into the ocean.

ekàchetat sarasvatì nadìnàm šuchìryati giribhya à samudràt
ràyašchetantì bhuanasya bhurer gh°tam payo dudue nàhu±àya
(RV 7.95.2)

Sarasvati, chief and purest of rivers, flowing from the mountains to the ocean, understood the request of Nahu±a (neighbour, man) and distributing riches among the many existing things, milked for him butter and water. [Alone among all rivers Sarasvati listened, she who goes pure from the mountains as far as the sea. She who knows of the manifold wealth of the world, she has poured out her fat milk for her neighbour (or kinsman).]

à yat sàkam yašaso vàvašànàh sarasvatì saptathì sindhumàtà
yà« su±vayanta sudughà« sudhàrà abhi svena payasà pìpyànà«
(RV 7.36.6)

[From Vasi±²ha:] they come together honoured, roaring, and Sarasvati is the seventh one, whose mother is the ocean; they (feminine) are flowing yielding abundant (or good) milk, being beautiful streams, overflowing with their own water (or milk).

The same ocean-going Sarasvati is referred to in the Great epic, which describes Balarama's pilgrimage along the river from Dwaraka to Mathura:

tìrtha yàtràm yayau ràjan kurù¯àm vaišase tadà
sarasvatìm pratisrotah samudràd abhijagmivàn (MBh 9.34.15-18)

The procession moved swiftly to the pilgrimage sites at the time of the war of the Kurus; going upstream along the Sarasvatì, from the ocean onwards.

Vàmana Purà¯a says that it is Sarasvatì alone, which, irrespective of seasons, never ceases to flow (*var±àkàlabahàh sarvàvarjayitvà sarasvatì* : *Vàm. P.* XXXIV.8). It is *sàgaragàminì* (flowing to the ocean) according to *Padma Purà¯a* (V.27.119).

Sarasvati was allied with the Maruts. It would appear that Maruts were apri deities, the wind gods of the desert-storms. The aandhi phenomenon, the sandstorms in Marusthalì is well-known.

sarasvatì tvamasmàm avi®®hi marutvatì je±i šatrùn
tyam cicchardhantam tavi±ìyamà¯amindro hanti v°±abham ša¯®ikànàm (RV 2.30.8)

Sarasvati you protect us. You who are allied with Maruts, conquer our enemies. Indra strikes that impudent leader of ša¯®ikas who is trying to show his strength. [cf. also RV. 7.96.2: When in the fulness of their strength the Pùrus dwell, Beauteous One, on thy two grassy banks, Favour us thou who hast the Maruts for thy friends: stir up the bounty of our chiefs.]

Reference to seals occurs in the *Mahàbhàrata* in a region close to the Hakra joining the ocean (Rann of Kutch):

tasmims tìrthe mahà bhàga padma lak±a¯a lak±itàh
adyàpi mudrà d°šyante tad adbhutam arimdama
trišùlàk±àni padmàni d°šyante kuru nandana
mahà devasya sàmnidhyam tatraiva bharata °±abha (MBh 83-84)

[In this pilgrimage site of Dvàravatì] signs with lotuses are observed; even nowadays seals are seen; this is a marvellous home of faithfulness. Lotuses marked with tridents are seen there, in the presence of the great god (i.e. where K°±¯a lives).

According to *Aitareya Brà«ma¯a* (ii.19) the country at some distance from the river was even then desert, for the ri±is, at a sacrifice on the banks of the Sarasvatì, took Kavasha Ailùsha into the wilderness, saying, 'let thirst destroy him here.'… (Oldham, C.F., 1893, The Sarasvatì and the lost river of the Indian desert, in: *JRAS*, pp. 48-76). Vinašana lay on top of the maru desert (marup°±²e : *MBh, Vana.* 80.118).

tato vinašana gacchen niyato niyata ašanah
gacchaty antar hità yatra maru p°±²he sarasvatì
camase ca šivobhede nàgobhede ca d°šyate (MBh 3.80.118)

Then one should go to Vinašana, where the Sarasvati disappears in the desert and reappears at Camasobheda, Šivobheda, and Nàgobheda.

SARASVATI: GEOGRAPHY AND ARCHAEOLOGY

Sarasvatì civilization

The cumulative achievement of archaeological and geological, remote-sensing LANDSAT satellite imagery work allows us to redefine the Harappan civilization as Sarasvatì Civilization, confirming the Vedic evidence.

Harappa was an archaeological `city' site discovered in the 1920's on the Ravi river which flowed into the Sindhu; Harappa had given the name to the civilization. The state of archaeological knowledge has grown enormously during 75 years since this discovery. It is now known that the banks of Sarasvati river had nurtured hundreds of `village' sites; this was the river adored in the Vedic texts.

Maps 1 and 2 depict

- the ancient course of the Sarasvatì river from the Himalayas to the Gulf of Khambat,
- site-clusters of the civilization along the Sarasvatì river and
- major discovery sites in the Sarasvatì and Sindhu river valleys.

Major findings of the Study

The major findings of the study are based on an analysis and synthesis of the following evidence:

- documented in ancient texts (for e.g., the Vedas, the epics, saµgam and bràhma¯a literature);
- proved by discoveries and cultural material finds of hundreds of archaeological sites along the banks of this river (for e.g., Ropar, Kalibangan, Banawali, Ganweriwala, Mohenjodaro, Dholavira, Surkotada, Zekdi, Lothal) with cultural artifacts coterminous with those found on the archaeological sites on the Sindhu river (for e.g., Allahdino, Amri, Mohenjo-daro, Kotdiji, Chanhujo-daro, Harappa);
- substantiated by the remote sensing imageries of palaeo-water-channels produced from the LANDSAT satellites; and
- supplemented by geographical maps drawn based on the information gathered from geological and hydrological field-surveys.

Impact of the Study

The implications of this study for further evaluation and action are as follows:

(1) It is possible to make the Thar desert bloom using the ground-water resources built-up by the Sarasvatì river over millennia and by stopping the north-ward march of the desert.

(2) Cultural-linguistic legacy of the civilization is present in all areas of the Indian sub-continent, thus re-inforcing the essential unity of the peoples of the land and of the languages of the sub-continent. ***Marutam***, is a fertile plain in Tamil; ***maru*** is Marwar, ***marusthalì*** in Sanskrit is the Thar desert (which had once bloomed, thanks to the Sarasvatì river which flowed in all majesty and splendour, as wide as 10 miles in stretches, along the edges of the desert), ***marut*** is the wind-god (cf. the sand-storms of the region, *àndhi*), the regent of the north-west quarter in the classical tradition; ***maru*** is ***bharu***-Kutch***a***, marshy ocean, ***varu¯a*** of the vedic lore.

Further research work needs to be done to conduct detailed geological, sedimentary and hydrological studies and to further evaluate the semantic patterns and structures of the linguistic heritage of the sub-continent.

Methodology of the Study

This is a multi-disciplinary study based on the

- use of computer and remote sensing technologies;
- analyses based on archaeological findings;
- geological/hydrological survey results; and
- studies of spoken and written languages of the region covered by the Sarasvatì-Sindhu civilization.

Information systems for the Sarasvatì-Marutam Project

The delineation of the ancient courses of the Sarasvatì river has been rendered possible by the synthesis of information collated from diverse sources such as: geomorphological studies, LANDSAT satellite imageries, archaeological reports, and ancient texts (*Rigveda, Mahàbhàrata).* A list of principal information sources of maps, images and list of ancient archaeological sites is provided in Annex 1. An overview of the use of LANDSAT satellite images to delineate the course of the palaeo-channels of the Sarasvatì river is provided in Annex 2.

The consistent message drawn from these information sources is that the river flowed from the Siwalik ranges through the Ra¯¯ of Kutch into the Gulf of Khambat supporting the ancient settlements; and that the river dried up due to the march of the desert for over a millennium and the capture of river source by Yamuna river and the migration of Sutlej river.

The Thar desert (Marusthalì) can be made to bloom again if the Sarasvatì river can be made to flow again, as a perennial river, drawing its source from near the Markanda river-channel. The Sarasvatì-Marutam Project will be designed to stop the deposition of sands from the desert onto the river-bed, by, for example, diverting in excess water from the Western Yamuna Canal into Markanda river-channel which is one of the feeder-channels of the Sarasvatì and by using the research studies of cultivation in arid zones. Feasibility studies have to be drawn up after extensive aerial and field surveys; evaluation of the quantum of water presently available in the water-tables along the course of the river and the conservation/exploitation of monsoon waters; and analysis of the impact of the Rajasthan canal project.

An information campaign has to be launched to sustain an awareness of the importance of the project among the donor and beneficiary communities, as a fundamental measure of life-sustenance for over 10 million people living in the desert areas of Rajasthan (India: Marusthalì) and Bahawalpur (Pakistan: Cholistàn).

The Sarasvatì-Marutam Project will be a major international project requiring the cooperation among all the peoples of the sub-continent and the donor agencies from the developed nations who can provide the technological support to manage and execute the engineering components of the project.

The course of the river

Rigvedic seers are ecstatic about the great river Sarasvatì. The vedic civilization flourished on her river-banks. Archaeology of the last 75 years has produced conclusive evidence of thousands of ancient sites of the civilization which had been sustained on the Sarasvatì and Sindhu river valleys for over a millennium since circa 3000 B.C.

The Sindhu river has the large site of Harappa. The Sarasvati-Sindhu doab in Sind has the large site of Mohenjodaro. The Sarasvatì river has the large industrial site of Ganweriwala (as large as Mohenjodaro, with about 300 sites around the city) and also the sites of Rakhigarhi, Kalibangan, Banawali, Dholavira and Lothal.

Many hundreds of sites on the Sarasvatì river bank and on the Sindhu had been deserted by around 1500 B.C., the century during which the Sarasvatì river had finally dried-up beyond Anupgarh (Rajasthan); this desertion led to migrations eastward to the Ganga-Yamuna doab and southward, along the Arabian coast and south-eastward, down the Godavari river (cf. the Late Harappan site of Daimabad on the banks of Pravara an estuary of the Godavari river).

The evidence of ancient texts is that the river merged into the ***sàgara***. This is the river which extends as Hakra-river (***sàgara***) which flows into the Rann of Kutch. The Rann was composed of islands with sites such as Dholavira and Surkotada. The flow of the Sarasvatì had extended from the Rann of Kutch into the Gulf of Khambat, close to which is the site of Lothal. Hundreds of archaeological sites have been identified on the Rann and in Gujerat near Lothal. It is notable that no ancient sites have been found on the banks of the river Luni which runs from Rajasthan into the Rann of Kutch in Gujerat.

<u>Islands in Rigvedic references</u>

amyak sà ta indra °±²irasme sanemyathvam maruto junanti
agniščiddhi ±màtase šušukvànàpo na dvìpam dadhati prayàmsi
(RV.I.169.3)

That spear of thine sat firm for us, O Indra: the Maruts set their whole dread power in motion. E'en Agni shines resplendent in the brushwood: the viands hold him as floods hold an island.

yàh pravato nivata udvata udanvatìranudakàšca yàh
tà asmabhyam payasà pinvamànàh šivà devìrašipadà bhavantu
sarvà nadyo ašimidà bhavantu (RV.VII.50.4)

The steep declivities, the valleys, and the heights, the channels full of water, and the waterless-- May those who swell with water, gracious Goddesses, never afflict us with the šipada disease, may all the rivers keep us free from Šimidà.

vi dvìpàni pàpatan ti±²had ducchuno bhe yujanta rodasì
pra dhanvànyairata šubhrakhàdayo yadejatha svabhànavah
(RV.VIII.20.4)

Islands (higher unsubmerged grounds) are bursting forth and misery is stayed: the heaven and earth are joined in one. Decked with bright rings, ye spread the broad expanses out, when ye, Self-luminous, stirred yourselves. (Saya¯a: The islands fall asunder, the firmest (trees) experience distress; they (the winds) distress heaven and earth; the waters hurry onward, O bright weaponed, self-shining ones, when you agitate them.')

yat stho dìrghaprasadmani yad vàdo rocane divah
yad và samudre adhyàk°te g°he ta à yàtamašvinà (RV.VIII.10.1)

Whether ye travel far away or dwell in yonder light of heaven, Or in a mansion that is built above the sea, come thence, ye Ašvins, hitherward.

yad và šakra paràvati samudre adhi mandase

asmàkamit sute ra¯à samindubhih (RV.VIII.12.17)

Or, Šakra, if thou gladden thee afar or in the sea of air, Rejoice thee in this juice of ours, in flowing drops. (Saya¯a: 'Indra the benefactor of his friend (the worshipper), has enlaarged himself to drink the ***Soma***, in like manner as the pious praise dilates and proclaims the measure of his merits.')

apàmidam nyayanam samudrasya nivešanam
anyam k°¯u±vetah panthàm tena yàhi vašàm anu (RV.X.142.7)

This is the water's reservoir, the great abode of gathered streams, Take thou another path than this, and thou listest walk thereon.

àyane te paràya¯e dùrvà rohantu pu±pi¯ìh
hradàšca pu¯®arìkà¯i samudraya g°hà ime
(RV. X.142.8)

On thy way hitherward and hence let flowery Dùrvà grass springs up Let there be lakes with lotus blooms. These are the mansions of the flood.

Settlement clusters on Sarasvatì and Sindhu river valleys

Vàmana Purà¯a says that it is Sarasvatì alone, which, irrespective of seasons, never ceases to flow (*var±àkàlabahàh sarvàvarjayitvà sarasvatì* : *Vàm. P.* XXXIV.8). It is *sàgaragàminì* (flowing to the ocean) according to *Padma Purà¯a* (V.27.119).

Almost all the sites of the Sarasvati-Sindhu civilization have been on sea-coast or river-bank. It is possible that there was an expanse of sea where there is now dry land in the areas south of Amri upto Karachi. It has also been suggested that some at least of the prehistoric beaches are the result of recent coastal uplift, possibly accompanied by earthquake shocks. (Raikes, Robert L., 1979).

The Harappan occupation at Kalibangan continued up to the thirteenth century B.C. The pre-Harappan dates to circa 2900-2700 B.C.; while the Harappan was circa 2200-1700 B.C. (Lal, B.B.,, 1979). Based on this evidence, based on Carbon-14 dating, it would appear that the drying-up of the Sarasvati, on this segment, occurred between the 17th and 13th centuries B.C. Most sites in the Kutch and Saurà±²ra area and some in the doab indicate movements of the people from the Sarasvati-Sindhu valleys, apparently mainly forced by the drying-up of the Sarasvati.

``Evidence from many sources, including that of archaeological remains associated with old river courses, indicates that a major river, stemming mainly from the same sources as the present Sutlej, flowed through

Northern Rajasthan, Bahawalpur and Sind-- to the southeast of the present course of the Sutlej and the Indus -- in the third to second millennium BC. This river, known as the Sarasvati in its upper course, at different times either joined the lower course of the Indus in Sind, or found its way independently into the Arabian Sea via Rann of Kutch." (Allchin, B., Goudie, A., and Hegde, K., 1978).

Prof. Ahmad Hasan Dani writes (Ed. *Indus Civilization -- New Perspectives*, Quaid-i-Azam University, Islamabad, 1981, pp.3- 12): `To him (John Marshall) goes the credit of coining the term The Indus Civilization. But his geographic horizon no longer holds good and the term deriving therefrom is open to question... The wide-spread nature of the Indus Civilization throughout Panjab and Sind had already expanded the meaning of the original term. Still later in the post-1947 period the Indus Civilization sites have been discovered in large number outside the present Indus region right up to the very borders of Yamuna in the north-east (Alamgirpur on the Hindon, a tributary of the Yamuna about 30 miles north of Delhi), along the dried-up bed of the river Ghaggar in northern part of Rajasthan, and in Gujrat right upto the mouths of Narbada and Tapti rivers'.

Ghaggar which reached the Hakra branch in Bahawalpur, is traditionally identified with the Sarasvati river. [cf. Sir Aurel Stein's explorations in the valley: *Ancient India*, no.5, 1949, pp. 12-30; A. Ghosh discovered 25 Harappan sites (*Indian Archaeology--a Review*, 1962-63) in the ``region beginning right from the Pakistan border (eastwards) up to midway between Hanumàngarh (Bha²ner or bha²²inagara) and Sùratgarh in the Sarasvati valley and about 25 kms. east of Bhadra in the D°i±advati valley"; Dr. Mughal discovered more than 400 sites in the Bahawalpur area)].

The geographic triangle of the expansive civilization was formed by the edges of the Thar desert (between the Sarasvati and Sindhu rivers), Tigris-Euphrates, and (across Turkemenistan to) Bactria: stretching from Lothal to Tepe Gawra to Shortugai. Harappa is a site on the west bank of Ravi; Kalibangan is a site on the right bank of Sutlej (?Sarasvati); Amri is a site on the west bank of Indus (close to the Arabian sea); Banawali is located 15 km northwest of Fatehbad, near the Sarasvati river and about 120 km east of Kalibangan; Lothal and Rangpur are sites below the Ra¯ of Kutch. It also extended south to Daimabad, located on the left bank of the Pravara river, a tributary of Godavari, 18 kms. southeast of Shrirampur (in Dhond-Manmad stretch of the Central Railway). [*MBh. Vana*, 118 refers to the Godàvarì as the northern boundary of dràvi®a]. The Daimabad site was discovered in 1958 by B.P. Bopardikar (IAR 1958-59:15) and excavated by M.N. Deshpande in 1958-59 and by S.A. Sali between 1975-79. Typical artifacts of the Harappans of Daimabad are: a circular hearth, 50 cms. Diameter and 10

cms. deep, containing ash and charred animal bone fragments; a terracotta button-shaped seal bearing the famous sign (the 'jar or the pitcher with a rim'), a bead of gold leaf, a piece of slag indicating metal-smelting, fragmentary celt, a pinhead and broken knife made of copper and beads of shell, faience. (Sali. S.A., The Harappans of Daimabad, in: Possehl, Gregory L., *Harappan Civilization*, Delhi, Oxford and IBH, 1982, pp. 175-183).

Cholistan or Rohi Desert: continuation of the Thar (Marusthali), the Great Indian desert

Pakistan's Department of Archaeology and Museums has announced a major and spectacular discovery of 414 protohistoric settlement sites of a civilization dated to a continuous sequence from circa fourth millennium B.C. to the first millennium B.C., after an extensive survey of 300 miles of the dry bed of the Hakra (Ghaggar) river, within an approximately 10 to 15-mile-wide strip (Mughal, M.R., 1980). The survey was conducted over four seasons between 1974 and 1977. The civilization sites were found concentrated around Fort Derawar and to its southwest in the Cholistan desert of former Bahawalpur state in river valley of Hakra (Ghaggar). Mughal classifies the 414 sites as follows (Some sites have more than one cultural phase).:

Fourth millennium B.C.: Hakra wares (Jalilpur related): 99 sites

> Animal figurines, shell and terracotta bangles, grinding-stone fragments, bits of copper and a great number of other implements.

Early third millennium B.C.: Early Harappan (Kot Diji related): 40 sites

> 35 percent of the sites combine residential functions with specialized/industrial activities; Gamanwala spreads over an area of 27.3 hectares (half the size of Harappa 65 hectares or 160.6 acres; Jalwali spreads over 22.5 hectares.

Mid and late third millennium B.C.: Mature Harappan (Mohenjodaro and Harappan related): 174 sites

> Sites shift from the northeast to the southwest, around and beyond Derawar fort; Ganweriwala is 81.5 hectares in area (comparable to Mohenjodaro: ca. 83 hectares and larger than Harappa: ca. 65 hectares); about 45.4 percent of the sites are industrial sites clearly separated from habitation areas: firing of pottery, bricks, small terracotta objects, glazed faience objects and melting of copper. Ganweriwala has an elevated 'citadel' close to a larger lower town (residential). This place, midway between Mohenjodaro and Harappa would appear to have drawn on the mineral resources of Rajasthan (perhaps, the Ganeshwar copper mines).

Khetri-Singhana in Jhunjhunu district of Rajasthan is an ancient source of copper; Siddhuwala Ther located near Derawar contains numerous kilns and Sir Aurel Stein found a copper ingot at this site.

There is evidence of large-scale production of standardized objects and inter-settlement trade.

The later spread is apparent to Baluch hills and along the Arabian coast, corresponding to the long-distance sea trade of the civilization.

Early second millennium B.C. and later: Late Harappan (Cemetery H related): 50 sites

These sites are concentrated in the same area as the Mature Harappan sites. Industrial sites account for only 18 percent of the total sites.

End second and early first millennium B.C. (Post or non-Harappan, painted grey and black-and-red wares related):14 sites.

All sites (with the exception of Satwali covering 13.7 hectares) are located on the former Hakra river bed. The painted grey ware, claimed to be a continuum from the Harappan tradition, is reported from 320 sites in India located in northern Rajasthan, Haryana , the Punjab and western Uttar Pradesh (Tripathi, Vibha, 1975, *The Painted Grey Ware: An Iron Age culture of northern India*, Delhi, Concept Publishers).

Mughal concludes: "On the Pakistan side, archaeological evidence now available overwhelmingly affirms that the Hakra was a perennial river through all its course in Bahawalpur during the fourth millennium B.C. (Hakra period) and the early third millennium B.C. (Early Harappan period). About the middle of the third millennium B.C., the water supply in the northeastern portion of Hakra, roughly between Fort Abbas and Yazman (near Kudwala) was considerably diminished or cut-off. But, abundant water in the lower (southwestern part) of this stream was still available, apparently through a channel from the Sutlej; this is attested by the heavy clustering of sites in that area during the late third and early second millennium B.C. (Mature and Late Harappan periods respectively). About the end of the second, or not later than the beginning of the first millennium B.C., the entire course of the Hakra seems to have dried up and a physical environment similar to that of present day in Cholistan set in. This forced the people to abandon most of the Hakra flood plain. A few Painted Grey Ware settlements, most of them smaller than four hectares in size, are located along the upper part of the Hakra river. These were sustained by a meager water supply reaching there with seasonal regularity from the Ghaggar… the presence of Hakra Ware sites on top of old, reddish-brown sand, as observed on the south and southwest of Derawar, would seem to indicate that the

Cholistan part of the Thar desert had already advanced close to Derawar prior to the fourth millennium B.C." (Mughal, M. Rafique, 1982).

This area was not explored earlier during the surveys conducted by Aurel Stein in 1941 (Stein, Aurel, 1942). The desert contiguous to the Cholistan desert is called the Rajputana desert which was surveyed by A. Ghosh (1952). The area near Anupgarh and Nohar on the Ghaggar river was noted by Katy F. (1980).

Bahawalpur's alluvial grounds are cluttered with a number of depressions and palaeochannels of dried-up river beds of the Hakra system. These channels had apparently linked up the Ghaggar-Hakra-Nara-Wahinda rivers which flow parallel to and south of the Sutlej-Indus rivers, skirting the Great Indian desert. A channel from the snow-fed Sutlej river at the Sulemanki Weir meets the Hakra (Ghaggar) just above Fort Abbas. This explains the increased width of the dried-up river bed west of Fort Abbas and for the occurrence of the Ganweriwala and other 413 sites in a crescent all along the river banks of the erstwhile Sarasvati river.

Ropar is on the left bank of the Sutlej in the foothills of the Siwalik mountains. A number of pre-Harappan and Harappan sites are located nearby in chols and nais such as: Sirhind nadi, Markanda and Patialvi which are part off the Hakra (Ghaggar) river system, which is principally fed by monsoons in the Siwaliks and lower Himalayas. [? link between chols and cò´a in Tamil land]

Nara ran parallel to the Sindhu and joined the Rann of Kutch, before the earthquake of 1833. "The Gulf of Kutch was an inlet of the Arabian sea and has now been silted up by the detritus poured into it by rivers flowing from east to northeast. This is why in winter (November to March) during the regime of the north-eastern monsoon, the Rann presents a salt-encrusted desolate mud-flat, enlivened only occasionally by a passing camel caravan or wild asses, but during the other half of the year, is flooded with water that is held back mainly by the ebbing sea, due to monsoon gales… Fairservis went to the extent of… taking Desalpur as a seaport contemporary with Lothal A and indicative of the sustenance of the sea-connections between Sind and Gujarat." (Soundararajan, 1984).

Banas, Sarasvati and Rupen are rivers in Gujarat which fall into the Little Rann. The entire Rann of Kutch is marked by tidal flats and saline marshes, known as kharbands. Ranns are level expanses of salt and sand. Kutch is a peninsula with the sea on all sides excepting the east. The stretches of sand are leveled like asphalt by salty efflorescence and brine. Near the Kori Creek in the northwest, a channel from Indus can be traced upto the Allah Bund. The bund was apparently caused by an earthquake and the bund had cut off the flow of Indus into Kutch. Kotada Dholavira (in Khadir) and Surkotada are Harappan sites in Kutch. Surkotada is a military outpost with a fortified settlement.

Dholavira was a settlement of about 2 ½ sq. kms. between Sind and Gujarat. Pabumath is 20 kms. from Dholavira and yielded a typical Indus seal. "… hydrology, archaeology and geology suggest that the Ranns were indeed under a permanent sheet of water at a time when the Harappan Culture was flourishing in Kutch. Based on hydrological studies, S.K. Gupta maintans that 'even as late as 2000 years ago Little Rann was about 4 m. deep' (Gupta, S.K., 1977)… Based on the location of Dholavira in Khadir to the north, and Lothal in the south, it can be concluded that these settlements were engaged in sea trade between Sind, Kutch and Saurashtra. Lothal was also trading with the Persian Gulf." (Chitalwala, Y.M., 1982). Khadir was an island: Robert Siverights cites Alexander Burnes "that vessels had been known to be wrecked on Pacham and that they came for shelter in heavy weather to the island of Khadir" (Silverights, R.,1907).

The National Atlas of India (Hindi), Calcutta, 1957, Govt. of India publication; *Bhàrat-Bhùracanà* map depicts a short trace of Sarasvati-Ghaggar in Haryana, in dotted lines apparently to denote dried-up river beds. Rivers named Sarasvatì also appear (i) flowing westward into the Rann of Kutch in Gujerat, (ii) as a tributary of Luni river near Pushkar (Ajmer, Rajasthan), and (iii) as Haraqaiti in Afghanistan joining the Kurram and then on to the Sindhu.

Panhwar (Panhwar, M.H., 1964*, Groundwater in Hyderabad and Khairpur Divisions,* Direcorate of Agriculture, Hyderabad Region) has shown how the early courses of the (Indus) river were related to reserves of fresh groundwater. It is possible to identify reserves of fresh groundwater in the entire region earlier inundated by the Sarasvatì in the Great Indian Desert.

The original source of the Sarasvatì from the Himalayas is now feeding the subterranean flow beneath the dried-beds of the river Ghaggar-Hakra. (Prasher, R.N., 1988). The perfectly carved rivers cut out by a skillful artificer (Vibhavan, one of the three Rbhus) (RV 5.42.12); (Sarasvati has been) built by Vibhavan (a heavenly artificer who carved her river bed) (RV 6.61.13). The western Yamuna canal was re-excavated in 1356; this is the present-day D°±advati. (Bharadwaj, 1991). "… it is necessary to look for another possible cause to explain regular and abundant supply of water to the series of archaeological sites found in the plain. For the Chautang region at least, the only possible explanation is that extensive irrigation once existed in the area (ibid)… (through soil analysis, it is found that) from top to bottom of this upper sequence the gradual increase of the quartz sand grain content is the consequence of an endless reworking of the same materials and results in a lessening of fertility of the soils developed over the last five thousand years… We shall take care not to forget that the use in Bactria of long canals measuring about twenty kilometers and constructed thanks to the remarkable knowledge of hydraulic techniques, as has been demonstrated

in the Ai Khanoum plain and at Shortugai, has been ascribed to a small social unit having close ties with the Indus valley civilizations. The question about the origin of these irrigation techniques has not yet been answered." (Gentelle, P., 1986). Geomorphological analyses and hydrological field surveys of dried-river-bed sites should help differentiate man-made canals from natural palaeo-channels.

The course of the Sarasvati to the west of Jaisalmer has an estimated reserve of about 3000 mcm. of water awaiting a judicious exploitation. Thar desert in Rajasthan had a population of 13.48 million (National Census for 1981) an increase of 37% over the figure in 1971, accounting for a density of 84 persons per square kilometre, making the Thar perhaps the most densely populated desert in the world. Livestock density was 120 per sq. km. with about 25 million livestock in 1987-88. The desert constitutes about 61 percent of the total area of Rajasthan state. The buried stream segments are potential ground water aquifers. (Venkateswarlu J., et. al., 1990).

Royal Meteorological Society, London published in 1966 a study of the world climate from 8000 to 0 B.C. conducted by Lamb, Lewis and Woodroffe. Ramaswamy focusses on the monsoon patterns in western India and Pakistan between 2,000 and 500 B.C. and concludes: "During the south-west monsoon seasons around 2000-500 B.C. deep troughs in the upper westerlies must have extended into west Pakistan far more frequently than they do now, inducing monsoon activity and also causing any monsoon depressions from the Bay of Bengal moving towards longitude 78E (central India) to curve to the north or north-east. These developments would have caused frequent active monsoon conditions over the entire Indus valley, which is basically a fertile region. Thick vegetation and marsh jungles inhabited by fauna as described by archaeologists and intermittent floods in the Indus and its tributaries would, therefore, have characterized the period of the Harappan civilization. These conclusions are further supported by the recent discovery of considerable reserves of ground water in the arid region of extreme west Rajasthan close to the Indus valley. Carbon-14 tests carried out by staff of the Tata Institute of Fundamental Research in Bombay at a place called Palana, 14 miles south of Bikaner, indicate that the ground water there is about 5,000 years old, this being the upper limit of the true age of water." (Ramaswamy, C., 1968).

"The Sarasvati, taking its rise in the submontane regions of the Ambala district, at present pursuing its feeble course past Kurukshetra, Thaneswar and Pehoa (P°thùdaka), all of them ancient towns in Punjab, is met by a few other channels and joins the Ghaggar, a more northerly stream, at a place near Shatrana in Pepsu… In Bikaner… the channel is met by another one from a north-eastern direction now known as Naiwala and identified as an old bed of the Sutlej, which, in ancient times, formed

part of the Sarasvati system. (Ghosh, A., 1952). According to Vàmana P. (ch. 58), P°thùdaka is situated on the Oghavatì. Pehoa (P°thùdaka) is marked near the junction of the Markanda and the Sarasvatì (*Punjab Gazetteer*, Ambala District, 1884, p.5). Perhaps Oghavatì is Markanda. This memory of the river continues in the South Indian tradition where a river near Madurai is named *vaikai* and a river near Kanchipuram is called *vegavati*.

The protohistoric settlements are extraordinarily dense on the Sarasvati river, only a few sites are located on the Sindhu river. There are Harappan sites on the Sutlej only in the upper course near the Siwaliks. "It is evident that a major geographic population shift accompanied this second millennium B.C. localization process. This shift by Harappan and, perhaps, other Indus valley cultural mosaic groups is the only archaeologically documented west-to-east movement of human populations in South Asia before the first half of the first millennium. The reasons for this population movement remain unknown. Certainly the changing Ghaggar-Hakra river drainage pattern played a significant role for regions directly affected by it. Limited palaeonvironmental studies in Rajasthan and elsewhere suggest an overall increase in aridity as another factor… Certainly this complex situation has multiple explanations. However, an understanding of what happened is unlikely to be achieved without a major paradigm change in South Asian archaeology." (Shaffer, Jim G. and Diane A. Lichtenstein, 1995). Sarasvati was a mighty stream in the *Rigvedic* times and had dried up after the mid-second millennium B.C. in the *Mahàbhàrata* times.

Field investigations substantiate the ancient river courses presented by landsat imagery: "Remote sensing data interpretation of the area (Thar desert) besides the study of geological, physiographical, meteorological, mythological and archaeological findings have been carried out to explore the possibility of the existence of a river system in the past in this area. Interpretation of Landsat TM and IRS images on 1:250,000 scale using visual techniques and aerial photo-interpretation of selected tracts was followed by verification of interpreted signatures… Geo-electrical sounding and groundwater drilling at aerial photo-interpreted palaeo-courses with ground truth (sic) have been exercised southeast of Rajgarh in order to establish applicability of palaeo-courses in Thar desert as a source of groundwater… Groundwater-level in Kantli (a tributary of Sarasvati) area varies from 30 to 40 meters below ground level. Field investigation shows that area possesses low salinity compared to its immediate vicinity." (Tiwari, O.N., 1992). "The few wells along the (desert) tract provide additional evidence in support of the earlier course of the Sarasvati. At Dharmi Khu, Ghantial, Ghotaru and to the west of Shargarh the wells have sweet water at 30 to 40 m. depth… and there is no report of the well drying up even during severe droughts… suggesting a continuous supply of water from the upstream side. In

contrast, the wells away from the old courses of the Sarasvati river have insufficient water and are mostly brackish or saline… Hence it may be suggested that the present subsurface hydrology of the region is mainly controlled by precipitation in the catchment of the Sarasvati in the Himalaya… We suggest that the alluvium in the extreme western part of the desert was contributed by the Sarasvati river, and that the surface water in the western part of this desert is mainly derived from precipitation in the Himalaya flowing subterraneously through the former courses of the Sarasvati." (Ghose, Bimal, et. al 1979).

" It was almost impossible to imagine a mighty river running through the arid plains and dunes of the Thar desert. Yet both here in Muslim Cholistan, and across the border in India's Rajasthan, tribal bards tell tales of just such a river which flowed here before the desert existed. The stories are matched in the *Rigveda*… Additional confirmation came from Sir Auriel Stein (1940), British archaeologist, explorer, and ancient civilization-hunter extraordinary. He studied the Veda and noticed that one river was given greater prominence than either the Indus or the Ganges. That river was the Sarasvati, referred to in the texts as 'the holiest of rivers, flowing down from the mountains and into the sea'… Stein knew a good story when he heard one. And like any geographer worth his salt, he recognized that legends often contain the key to events of the remote past. The Veda gave little geographical information about the actual location of the Sarasvati, but numerous local legends brought the octogenarian Stein to the Thar desert… He had observed that an ancient river bed could sometimes be located by a continuos ridge of sand-dunes, a ridge created when drifting sand piled up over a core of vegetation such as might be found on a river bank. It wasn't long before Stein had discovered such a ridge at Hanumangarh in Bikaner state and he tracked it south-west for 250 miles into Cholistan. On the way, he came across numerous mounds smothered in shards of terracotta. These, Stein guessed, were all that remained of the towns and villages which had once stood on the river, abandoned millennia ago to the drifting desert sands. (Asher, Michael, 1990).

Vaši±²ha threw himself into the Sutlej and the river broke up into a hundred channels, says the Mahàbhàrata. There is a Vaši±²ha Ashram in (P°thùdaka, which also has some of the oldest bathing-ghats in the country visited by thousands of pilgrims), where Sarasvati makes a u-bend around the Ashram and becomes pràcìvàhinì (east-flowing). Šatadru means: running as a hundred. It is notable that many riks related to Sarasvati are attributed to Vaši±²ha.

The ancient course of the Sutlej (after linking up with Sarasvati at Shatrana) did not join the Sindhu in the third millennium B.C. but had flowed directly through the Nara into the Rann of Kutch (as seen from a palaeo-channel on the landsat imagery). There is a palaeo-channel

southeast of river Markanda; Chautang joins the Ghaggar near Suratgarh; Ghaggar bifurcates near Anupgarh and both palaeo-channels end abruptly. We find many channels of dried-up river beds in the satellite images of north-west India. There was an eastward shift of the channels of the Yamuna; and a westward shift of the channels of the Sutlej. All these channels were in the third millennium B.C. flowing into the Sarasvati. Many dry river beds are found between Yamuna and Sutlej; these are beds which moved eastward disconnecting from Sarasvati. (Dikshit, K.N., 1977). The eastern arm of the Hakra is formed by four rivers: the Chautang or Drshadvati, the Sarasvati, the Ghaggar and the Wah or Sonamwal. The western arm of Hakra is formed by three rivers known as Naiwal. Oldham's view is that the Sutlej flowed into Hakra through each of these present-day dried river beds, shifting its course westwards. This is substantiated by the landsat imagery. Wilhelmy opined that the Yamuna flowed into the Sarasvati in the pre-Mahàbhàrata times. (Wilhemly, 1969). This view is countered by Kar and Ghose who suggest that some of the tributaries of the Drshadvati had been captured by the Yamuna. (Kar, Amal and Bimal Ghose, 1984).

Many inspired insights have been provided in N. Mahàlingam's article in Tamil which appeared in *Amuda Surabhi*, Dìpàva³i issue, 1995: *carittiraµga³ai uruvàkkiya sarasvati nadi* (sarasvati river which created histories), citing the work done by Swàmi Šàkyànanda of advaita ã±ram, Trichur affirming that north-western region nurtured by the Sarasvati river is the ancient civilization which is the heritage of South Asia. Šakyànanda is at the Vivekananda Vijnana Bhavanam, Punkunnam, a branch of the Ramakrishna Ashram in Trissur. His views have been presented in: *Glimpses from our glorious past*, 1984, Madras, International Society for the investigation of ancient civilizations. His views may be summarised as follows: " Tradition says that Maharshi Vaivasvata Manu, the first king of humanity, had his seat on the banks of Sarasvati… Sarasvati and Drishadvati along with the system of five streams joining Sindhu, used to flow separately into the sea (Sindhu) which then extended far into the interior like the present Gulf of Cambay at the mouth of Narmada, or the Persian Gulf in the West. The mouth of this Gulf of Sindhu, or Sindhu-Sagar as it was called, was then known as Kutcha. There were some islands at this mouth and in the middle of this Gulf. They were known under puranic name of Santimati, Dwaraka, Panchajanyam (present Mandvi-kutch) and Ramanakam (Sind-Hyderabad in Pakistan)… the vast plains round about Mathura and Kuruk±etra were then known as Vraja-bhumi meaning pastureland… The coastal area on either side of Sindhu-sagar were very low and hence those regions come to be known as Pàtà³abhùmi, or Netherlands… this was the condition before 3100 B.C., i.e., beginning of Kaliyuga… The people who inhabited this region and the coastal areas on either-side of Sindhu-sagar and the islands during this remote period were known as somàrya pañcajanàs, meaning thereby the five different races of people descended from the

five sons of Yayati. The sons are known under the puranic name of Yadu, Turvasu, Druhyu, Anu-Druhyu and Puru. Their descendants, the pañcajanas, are often referred to in the puranas as ***Soma***ryas or asuras, i.e., the original or major stock of àrya-k±atriyas (pùrvadevah) devoted to Asura-mahadeva, the great God… The beginning of Kaliyuga… The first stage in the process of destruction was the Mahabharata war of B.C. 3067… the second stage by cataclysms following the departure of Sri Krishna in B.C. 3031. Seismic upheavals brought about the rising of the level of Vrajabhumi and the sea-bed by a few feet. The flow of water through Sarasvati southwards was thereby arrested and the rivers became dry thereafter… (puranas) give us valuable information about the disappearance of Sarasvati at the northern part of 'vinašanam' (place of destruction). Sand storms buried the ancient cities underground… the present site of Mohenjodaro originally belonged to the Saindhavas, a sub-clan of Anus; it was called 'sauvira' in olden days. [This perhaps refers to ophir of Bible, I Kings, 9, 10. Cunningham identifies Edar in the province of Gujarat with Badarì which in the Pauranic period was Sauvìra: *Anc. Geo.,* p. 494]. Nandolal Dey adds that according to the B°hat-jyoti±ar¯ava, Edar is a corruption of Ilvadurga, situated on a river called Hira¯yanadì. The city of Harappa (Harayupia) was built by Salvas, who are remembered to be a subclan of Bharatas, Anus and Srinjayas fused together… Puranas tell us of a severe drought and famine that lasted for twelve years during the reign of Aswamedhaja, the fifth ruler in the line of Parìk±it, sometime about 2900 B.C… The people, leaving their villages and cities, migrated to different parts of Madhyadesh, to South India, to East India, to Kashmir and Himalayas. In some of these places, we find now-a-days, a set of people called 'sarasvatas' and 'gouda sarasvats'. Local tradition is that they are descendants of the ancient ***Soma***ryan settlers on the banks of river Sarasvati, who were forced to leave the place during the days of drought and famine of Kaliyugadi… Pañcajanas, the heroic people descended from Yayati, the sixth king in the line of Manu. They are known to us by their puranic names of Haihayas, Yadavas, Saindhavas, Sauviras, Salvas, Turvasus, Anus, Druhyus etc. They were a mixed race speaking different dialects of Paisaci language, the prakrit form of vedic sanskrit… Paisaci was the language of the people not only of western India, but also of the whole of India and West Asia. All later Prakrit dialects like Pali, Magadhi, Maharashtri, Suraseni, Gandhari, Pahlavi etc., have developed from the different forms of Paisaci… The waters of the Himalayan rivers pouring down into the plains and minor streams flowing from the eastern and western hill ranges, all getting collected in the gulley [in the middle part of the plain between Pàriyàtra (Aravalli) hill ranges and Pratyanta (Sulaiman) ranges], a fresh-water lake was formed there in the middle of the southern half of the plains. Its waters joined the ocean at Kutchha. In this position it looked like a gulf, an extension of the ocean, that is Sindhu… The Himalayan rivers were joining this Sindhu-sagar at its northern end. Rig Veda mentions twenty one of them by name in the

famous ‘nadi sukta’ (X.75.5.6, VII.95.1.2, II.33.1)… the pañcajanas branched off into two major groups, the saraswata and saindhava… The artificial water courses made by the pañcajanas of yore are called ‘apagas’ or ‘apayas’ in Sanskrit to distinguish them from natural rivers, which were called ‘nadis’…” (pp. 26-73).

Bharatas appear as a variant for the kuru-pàñcàlas in a passage of the *vàjasneyi samhità* (XI.3.3). *Mahàbhàrata* addresses Arjuna as bhàrata and also as kurunandana, an apparent confirmation that kurus and bharatas were the same people inhabiting kuruk±etra. *Šatapatha Bràhma¯a* describes kuru-pàñcàlas and kuru-mahàv°±as as the peculiar home of pure speech. (*Šatapatha Bràhma¯a Kà¯vìya rescension*, eds. Caland and Raghu Vira, repr. Delhi, 1983, IV.2.3.10: *udìcì pathyayà svastyà vàmvai pathyà svastih tasmàdatrauttarà hai vàgvadatìyàhu kurupañcàle±u kurumahàv°±e±vityetàm hi tayà dišam pràjànanne±à hi tasyà dik prajñàtà*). “The territory of mahàv°±as lay about vinašana and was roughly bounded by the Kurus on the east and extended in the west into Rajasthan areas which were later associated with ni±àdas, sùdras and àbhiras. They occupied the country lying in the belt known for its valuable breed of Zebu cattle which gave them their totemic name… According to a legend in the *Chàndogya Upani±ad* sage Raikva was rewarded with the gift of a cluster of villages called after him as Raikvapar¯a by king jànašruti pautràya¯a of the mahàv°±as. These villages still exist in tehsil Nauhar of district Ganganagar and are mainly inhabited by the Raika clan of Rajputs who are evidently the descendants of sage Raikva.” (Bharadwaj, O.P, 1991).

Aitareya Bràhma¯a refers to the bartering by the gods with the gandharvas of Sarasvatì for the ***Soma***. (*Ait.Br.* 1.27). The gandharvas had pilgrimages (tìrthas) on her banks. (*MBh* xxxvii.v.11).

Hieun Tsang's reference to `five indies' is amplified by Cunningham to define northern India to comprise the Punjab proper including Kashmir and the adjoining hill states, eastern Afghanistan beyond Indus and the Sutlej states to the west of the Sarasvatì river. The Avesta also mentions the Hapta-hindu and the beautiful Haraquaiti. In the Iranian tradition, haoma is reportedly obtained from Haraqaiti (which is cognate with sarasvati).

Geographically, the sarasvatì basin can be traced to the currently known: ghaggar-nà³ì-hak®à-rainì-nàrà-wàhindà-mihràn-purà¯ channels. Ghaggar might have been a stream that rose in the Siwaliks and that joined the sarasvatì. This network runs parallel to the Indus across Sind. The river flowed from the Himalayas to the Ra¯¯ of Kutch. [cf. Oldham, C.F.,1893; Sir A. Burnes, 1834]. It will be seen that the river flowed further into the Gulf of Khambat through the Nal lakes of Saurashtra in Gujarat, as evidenced by the massive alluvium accumulated at the mouth of the Gulf.

Highway from Sind to Delhi along the Sarasvatì river-bed

The dried-up bed -- wadi -- of sarasvatì might have constituted the great road between hastinàpur and dvàràvatì (Dwàraka). Part of this road would have constituted the road from Sind to Delhi via Bahawalpur, Maro², Anupgarh, Suratgarh, Dabli, Kàlibaggà¯, Bha²ner (Hanumgarh), Tibi and Sìrsa suggested by Major F. Mackeson in 1844 to the British government (Report on the Route from Sìrsa to Bahawulpore, *JAS, Beng*., XLII, Pt.I, 1844, No. 145 to 153)]. A synonym of sìrsa is sarsuti < sarasvatì; at this place, about 100 miles below Rassauli, a fortress was built.

The following extracts, principally from earth sciences' and landsat (Land Satellite) literature establish the existence of Sarasvati river contiguous to the Indus river valley and the area of Rann of Kutch and the Gulf of Khambat (Cambay) in Gujarat. This region is studded with many Harappan culture sites.

Landsat images analyzed

Bimal Ghose et al (1979) use images taken in 1972. Plate V traces the wide valley of the Sarasvati running from Suratgarh through Anupgarh to Fort Abbas and Ahmadpur East. From Anupgarh another wide belt of discontinuous patches of dark grey tone runs southwestward upto Sakhi. From Sakhi, the remnant of a former valley can be traced towards the west ... the imagery reveals the presence of a narrow zone of saline/alkaline fields, partly obliterated by the overlying sand dunes, extending upto Khangarh. To the south of Khangarh, a narrow strip of green vegetation, producing a slightly darker tone than the surroundings, can be identified. It runs from Islamgarh, through Dharmi Khu, Ghantial, Shahgarh, Babuwali and Rajar to Mihal Mungra. This was the course of the Sarasvati from the Himalaya to the Ra¯ of Kutch after the river severed relations with Luni. South of Mihal Mungra, the course could be traced up to the present Hakra channel and there are indications of its having even crossed the Hakra channel (Plate VI). This signifies that the course of the old Sarasvati might have been somewhere to the west of the present Hakra ... The other major courses of the Sarasvati could be identified further to the west, through Mithra and Sandh, the remnants of which are now known as the Raini and the Wahinda rivers. Here also the river shifted its course several times, and, at one time, flowed to the east of the Wahinda river, through Mundo. Finally, the river ceased to flow southward and met the Sutlej to the west of Ahmadpur East.

"The ancient fortress of Sasruti or Sarasvatì (now Sirsa) was a place of importance upto the time of the early Mohammedan invasions. Its site is

marked by immense mounds rising some sixty feet above the plain… Some seven or eight miles to the eastward of Sirsa is another old bed of Sarasvatì. This is partially obliterated, but it apparently joined the channel just referred to, not far from Sirsa. It may, however, have once been continuous with the old river-bed, called in our maps Chitrang. The exact position of Vinàsana is unknown, but it was probably not far from Sirsa. We may now consider how the Sarasvatì came to lose itself in the sands. The view held by several writers on the subject appears to be that it was owing to a shrinking of the stream caused by diminished rainfall… According to Aitareya Brà«ma¯a (ii.19) the country at some distance from the river was even then desert, for the ri±is, at a sacrifice on the banks of the Sarasvatì, took Kavasha Ailùsha into the wilderness, saying, 'let thirst destroy him here.'… Its ancient course, however, is continuous with the dry bed of a great river, which, as local legends assert, once flowed through the desert to the sea. In confirmation of these traditions, the channel referred to, which is called Hakra or Sotra, can be traced through the Bikanir and Bhawulpur states into Sind, and thence onwards to the Rann of Kutch… Throughout this tract are scattered mounds, marking the sites of cities and towns. And there are strongholds still remaining, in a very decayed state… the country must have been fertile for a long period, and that it became desert in comparatively recent times. Freshwater shells, exactly similar to those now seen in the Panjàb rivers, are to be found in this old river-bed and upon its banks… It is not beyond the bounds of possibility that the Yamuna may at some very remote period have taken a westerly instead of an easterly course and joined the Hakra… the waters of the Sutlej flowed in the Hakra to the sea, and to the south of the Mer country, at a place called Kàk (Kutch), spread out into a great lake… which was the embouchure of three important rivers, the Indus, Sutlej and Luni, of which the two first and greatest have long abandoned it. In a paper read before the Geological Society, Mr. A. Rogers, of the Bombay Civil Service, pointed out that from the geological formation of the country bordering the Rann, it appeared that the drainage of the Panjàb once flowed into *it (Journal of Geological Society*, February, 1870). The tradition of all the tribes bordering upon it agree that this expanse of salt and sand was once an estuary. And, as noticed by Burnes and others, places still exist upon its shores which once were ports." (Oldham, C.F., 1893). The word ira¯a means a salt land (Amara-koša) (Rann); the same as Eirinon of the Periplus of the Erythraean Sea.

Ramasamy, Bakliwal and Verma (1991) show satellite photographs mosaiced, planimetrically controlled ... Figure 1 shows the last tongue of the Sarasvati river ... The study of remotely-sensed data in the desert tract of Rajasthan shows that there are plenty of palaeochannels with well sprung-up tentacles throughout the desert (figure 3). On the northern edge of the Thar-Great Indian desert at the Ganganagar-Anupgarh plains a well-developed set of palaeochannels are clearly discernible in

satellite photographs (figures 1 and 4). Bakliwal et al (1988) have explained that these well sprung-up palaeochannels are traces of the mighty Sarasvati river which once ruled the desert. Yashpal et al (1980) have argued that the palaeochannels observed in the Anupgarh plains are the arm of the Sarasvati river, which has been displaced by the present day Ghaggar river ... that the Sarasvati river once flowed close to the Aravalli hill ranges and met the Arabian Sea in the Ra¯ of Kutch, that it has migrated towards the west, the north-west and the north and has ultimately got lost in the Anupgarh plains ... Yash Pal et al (1980) present in Figure 3 a synoptic view provided by the Landsat of the northwestern Indian subcontinent showing 6-8 km wide palaeochannel of the Sarasvati ...; Figure 4 shows the old bed of the Sarasvati river ... Figure 7 shows a synoptic view of the Indus valley showing possible course of the Sarasvati beyond Maro² through the Nara into the Ra¯ of Kutch ...

Raverty, H.G (1893): `` ... to notice some of the numerous fluctuations in the courses of the Sindhu, Ab-i-Sind, or Indus, and of the rivers of the Panj-ab. The changes in the courses of two of these rivers, together with the drying up of the Hakra, Wahindah, or Bahindah were so considerable that they reduced a vast extent of once fruitful country to a howling wilderness, and thus several flourishing cities and towns became ruined or deserted by their inhabitants... the old course of the Biah, or `Bias' previous to its junction with the Sutlej, when both rivers lost their names and became Hariari , Nili or Gharah ... why the army of Islam marched along the bases of the mountains, for the route was long, and the way by Sasruti and Marut was nearer? He (Mangu Khan) was answered that the numerous fissures on the banks of the river rendered the way impossible for the army ... Sarasti is the ancient name of Sirsa: Sursuti is the name of a river, the ancient Sarasvati... Sutlej was a tributary of the Hakra or Wahindah... Hakra ... appears to be the modified form of Sagara, the letter S being pronounced H in Rajputana and Sindh... Sagar is the Sanskrit for `ocean', `sea' etc., and it is still known as the Sind-Sagar near the sea coast. Tod calls it the `Sankra', which is another form of the name; and it is called Sankrah in the treaty entered into by Nadir Shah, and Muhammad Shah, Badshah of Dihli, when ceding all the territory west of it to the Persians... Hakra did once run through the so-called `Indian Desert'... Ghag-gar, the Sursuti and the Chautang were also the tributaries of Sind-Sagar or Wahindah or Hakra... Mansuriyat ... this city is situated among the branches of the Mihran river, and from that place the river unites with the ocean by two channels. One is near the town of Loharanj, and the other bends round towards the east in the confines of Kaj (Kutchch) and is called the Sind Shakar (Sind-Sagarah) which means the The Sea of Sind. The river Sarasat unites with the ocean to the east of Suminath. This last named river is, of course, the Sarasvati, which falls into he sea near Pattan Som-nath, not the classical river, the tributary of

the Ghag-ghar, described farther on, the sacred river of the Brahmans... At Thatha the Sind is called Mihran ..."

The tail-end of the Hakra is used presently as the perennial canal of the Sukkur barrage project. The heights above sea-level along the Sarasvati-Hakra course are as follows: Bahawalpur 559 feet, Rawanwala 449 feet, Kudwala 385 feet, Badalwala 375 feet, Bhagla 347 feet, Sukkar (SW of Amarkot) 190 feet, Mohenjo daro (180 feet). The Sarasvatì flowed down along 69E and into the Rann of Kutch at 24.2N 69.1E

Leshnik, Lawrence S., 1968: `` ... The Volkerwanderung that brought the Harappans to Lothal (2450 BC) is conceived of as a sea passage from the Indus ... This dating is, however, questionable and exploration of the Kutch area has brought to light a number of Harappan sites there (Joshi, J.P. 1966), so the arrival- by-sea theory will have to be reconsidered ... In Mohenjo-daro there is a linear representation of a man using the shaduf, so that its presence is documented for the Harappan civilization as well ... Marshall describes the Mohenjo-daro ringstones as having slots that were used to fasten stones to something that passed through the central aperture. This could have been the arm of a shaduf, to which the stone weights were lashed by rope or leather thongs. The shaduf is still employed near Lothal, although the stones are no longer pierced, but simply secured with rope. Pierced stones continue however to be used in this way in Eastern India... A note on the Lothal tank as an irrigation reservoir... "

River migrations in Western India

Ramasamy, SM, et. al.: ``The art of remote sensing has opened up many vistas in the study of river migration as satellite photographs, both in their normal and digitally enhanced modes, vividly show the rivers and their migratory signatures. The rivers migrate for various reasons amongst which tectonic movement is one of the main causes ... The study has shown that Western India sow considerable signs of Quaternary tectonics ... `` ... (Landsat photographs, on a 1:1 000 000 scale) ... the palaeochannels were interpreted, as exhibiting linear, curvilinear and loop-like features with typical black ribbon-like stripes ... The Landsat imagery studies show that the Indus river has a very wide flood plain on either side of its course up to a maximum width of 100-120 km in the east and south-east. To have such a wide flood plain on only one side shows that the Indus river has preferentially migrated towards the north-west in the northern parts and towards the west in the central and southern parts. The study of remotely sensed data in the desert tract of Rajasthan shows that there are plenty of palaeochannels with well sprung-up tentacles throughout the desert. On the northern edge of the Thar-Great Indian desert at the Ganganagar-Anupgarh plains a well-developed set of palaeochannels are clearly discernible in satellite photographs.

(Bakliwal PC, et. al., 1983) have explained that these well sprung-up palaeochannels are traces of the mighty Sarasvati river which once ruled the desert... (these and) the present study show clearly that the Sarasvati river once flowed close to the Aravalli hill ranges and met the Arabian sea in the Rann of Kutch, that it has migrated towards the west, the north-west and the north and has ultimately got lost in the Anupgarh plains ...

``...When the Aravalli hills are traced back to the foothills of the Himalayas the water divide of the Yamuna and Sarasvati rivers becomes apparent. Hence, it follows that the drifting of the Sarasvati river from its easterly flow towards the Great Indian Desert would have been initiated by such a rise in the Aravalli mountains and that due to the subsequent Luni-Sukri cymatogenic arching, the Sarasvati migration towards the north-west would have been accelerated ...

``...it seems that climatic changes have also played a subordinate role in shifting the (Sarasvati) river towards the north. When the Sarasvati flowed in a southwesterly direction it was flowing against the northeasterly moving sand advance in the Thar desert. It can be concluded, therefore, that the Sarasvati river could not overcome such a sand advance and hence that it started drifting towards the north with a rotational migration in a clockwise direction until ultimately it was buried in the Anupgarh plains ..."

P.C. Bakliwal and A.K. Grover, 1988: ``... Remote sensing study of the Great Indian Desert reveals numerous signatures of palaeochannels in the form of curvilinear and meandering courses with feeble to contrasting tonal variations. The Sarasvati river, which is believed to be lost in the desert, could be traced through these palaeochannels as a migratory river. Its initial course flowed close to the Aravalli ranges and successive six stages took west and northwesterly shifts till it coincides with the dry bed of Ghaggar river. The groundwater, archaeological and pedological data with selected ground truths also corroborate these findings. The migration of river Sarasvati seems to be caused by tectonic disturbances in Hardwar-Delhi ridge zone, Luni-Surki lineament, Cambay Graben and Kutch fault facilitated by contrasting climatic variations. The stream piracy by Yamuna river at later stage is responsible for the ultimate loss of water and drying up of the Sarasvati river ...``

Eastward shift of Yamuna after capturing a source of Sarasvatì

R.L. Raikes (a hydrologist) and R.K. Karanth (a geologist) found at Kalibangan (in 1967) through a drilling program, that at a depth of 11 m. below the present flood-plain level, a coarse, greyish sand very similar in mineral content to that found in the bed of the present-day Yamuna. It extended over a width at least four times that of the bed

of the present-day Yamuna and down to a depth, at one point at least, of 30 m. ..the material in short is typical flood-plain deposit of the kind being laid down today at a rate of about 2 m. per thousand years. That the Yamuna was flowing in the Ghaggar channel is surmised on geomorphic and sedimentological evidence. The meandering channel of the Yamuna across the 10-15 kms. width of the plain, its sloping on the west towards the Indus are the geomorphic evidence. Above the 11 metres depth, only clays and silts typical of the present-day flood-plain deposits are found. The western Yamuna canal was diverted westward to Indus c. 2500-1750 coinciding with Harappan occupation. (Raikes, R.L., 1968). "The eastward shift of the Yamuna must have taken place through the channels which have recently been traced by Suraj Bhan (Suraj Bhan, 1972a). One of these starts from near Indri, 20 kms. north of Karnal and is traceable for a distance of 180 kms. upto Tigrana near Tosan in the south-west. This channel runs along the course of the West Yamuna Canal upto Mundak and then along the Jind branch of the same canal up to Safidom… Suraj Bhan has located two more channels further east with late Harappan and P.G.W. sites on them, thus providing further evidence for the eastward shift of the Yamuna. This eastward diversion of the Yamuna to its present channel and the westward diversion of the Sutlej into the western arm of the Hakra, sometime in the Late Harappan times, must have left the channel of the Ghaggar (Sarasvati) dry over a long distance (up to Wallur where the western arm of the Hakra joined it). This must have created the myth that Sarasvati went underground to join the Yamuna" (Misra, V.N., 1984).

Secrets of the Thar desert

Singhvi AK and Kar, Amal 1992: `` ... In the south it (Thar desert) has a sharp natural boundary with the world's largest saline waste - the Great Ra¯ of Kutch, while in the north the riparian sub-Himalayan plains define its boundary ... Quaternary continental sediments in the Thar desert of Rajasthan comprise a succession of fluvial, fluvio-lacusrine and aeolian deposits... The neogene tectonic movements ... are considered as responsible for controlling the origin, configuration and development of basins of deposition... Occurrence of aligned earthquake epicentres of different dates from 1879 to 1976 AD along it (Luni-Sukri lineament from the Rann to the Sambhar lake) in the Kutch area suggests its neotectonic potentiality... The dry bed of the Ghaggar is conspicuous on the satellite imagery of north Rajasthan and adjoining parts of Pakistan as a continuous wide belt running through Suratgarh and Anupgarh in India to Fort Abbas and Ahmadpur East (in Pakistan) (Ghose et al., 1979; Balkiwal, PC and Grover, AK, 1988). Some south-flowing earlier courses of this stream were detected through the western part of Jaisalmer district and in the Bikaner-Sardarshahr tract further east. Buried courses of another Himalayan stream, R. Drishadvati (which was also a tributary to the Sarasvati) were found in the Churu-Nagaur tract.

The rivers had several tributaries joining them from the Aravallis and other rocky areas within the desert. Recent SEM analysis of the Quaternary sediments of the northeastern part of the desert indicate considerable glacial, as well as fluvial, transport of some of the sediments (Raghav, KS, 1991). The survival of the Sarasvati-Drishadvati courses depended to a large extent on the perennial supply of water from the mightier Sutlej (the Satadru of Vedic literature) which shifted its course several times in the sub-Himalayan plains due to neotectonism, change of grade etc. (Valdiya, KS, 1989). A detailed account of former streams in the region is provided by Kar (Kar, A., 1992). Some of the buried stream segments are potential ground water aquifers.. The course of the Sarasvati to the west of Jaisalmer has an estimated reserve of about 3000 mcm water awaiting a judicious exploitation ...

`` ... Mughal M.R. (1982) has located a large number of settlements of the Hakra Ware culture, dating to the fourth millennium BC., and of the Harappan culture, dated to the third millennium BC, on this (Ghaggar-Hakra) river in Pakistan. Nearly two hundred settlements of the Harappan culture have been located by Indian archaeologists on the Ghaggar river and is tributaries in Punjab, Haryana and northern Rajasthan [Ghosh, A., 1952; Bhan, S., 1973] ... Kalibangan was abandoned at the beginning of the second millennium BC., probably due to the drying up of the river and shifting of the Sutlaj away from it (Lal. B.B., 1979).

Bhan, Suraj., 1973: `` ... The Kalibangan I culture (c. 2300 - 2100 BC) ... The Siswal A ware was recovered from 16 sites in the south-western part of Haryana adjoining northern Rajasthan. It extended to Jind and Paoli in the north-east. The comparative preponderance of the ware in the Drsadvati valley suggests the preference of the pre-Harappan folk for smaller river valleys as in north Rajasthan ... But the absence of the Late Harappan ware from north Rajasthan and the adjoining regions of Haryana (south of Banawali near Fatehabad in the Sarasvati valley and Alipur Kharar near Hansi in the D°±advati valley) suggests the survival of the Harappa culture in our region (as also in the north-eastern Panjab and western UP), after the lower and mid zones of the Sarasvati basin had been deserted. The desertion of the semi-arid zone of north Rajasthan and Bahawalpur by the Harappans or the Harappa-influenced kindred folks, and their subsequent expansion further north-east seems to have been forced by the growing desiccation of the Sarasvati basin consequent upon the changes in the courses of the Sarasvati, Drshadvati and the Yamuna rivers. It was this second phase of the Harappan expansion which was largely responsible for the colonization of the ancient Madhya Desa which ensued with the settlements of Daulatpur I, Alamgirpur I etc ... With more than 90 OCP or Late (degenerate) Harappan sites reported from the doab it would be difficult to agree

with Agrawal (1967-68) that the doab was first colonized by the iron-using PGW people."

Yash Pal, et. al., 1980:``... delineation of the palaeochannels of the Sutlej, the Yamuna and the Ghaggar to trace the `lost' Sarasvati. Study of Landsat imagery shows that the Sutlej once flowed into the Ghaggar; it is also probable the Yamuna too was flowing into the Ghaggar river at the same time. The bed of this river is traceable upto Maro², from where it is likely to have extended through Hakra/Nara bed to the Ra¯ of Kutch. The present dried bed of the Ghaggar was thus part of a major river, anciently known as Sarasvati. Analysis of satellite imagery supports the above hypothesis regarding the course of the `lost' Sarasvati ...

`` ... Sutlej and Yamuna are perennial rivers ... the rivers Ghaggar, Sarasvati, Markanda and Chautang all rise from the Siwalik Hills and are non-perennial. They flow mainly during the monsoon. At present none of them reaches the sea or joins any major river as a tributary... The sharp westward right-angled bend in the course of Sutlej is suggestive of its diversion in the past, as at the point of river capture or stream diversion similar elbows develop...

"... There is a sudden widening of the Ghaggar Valley about 25 km. south of Patiala ... can be explained only if a major tributary was joining Ghaggar at this place. The satellite imagery does show a major palaeochannel joining the Ghaggar here ... Our observations are supported by the field data of Singh (Gurdev Singh, 1952, *The Geographer*, 5,27) who mentions a channel starting near Ropar and leading towards Tohana (29.35N, 75.55E). The area along this old course of the Sutlej is called `dhaia' meaning an upland or high bank ... It might have required only a little tectonic movement to disturb its previous course and force it into its present channel... Our studies show that the Sutlej was the main tributary of the Ghaggar and that subsequently the tectonic movements may have forced the Sutlej westward and the Ghaggar dried. Wilhelmy (H., 1969, *Z. Geomorphol. Suppl*., 8, 76) considered ... the second alternative, i.e., river capture. The Satudri (Sutlej) might have been a tributary of the Vipasa (Beas) and through headward erosion captured the waters of the river coming down the Himalayas near Ropar. Tectonic movements may have aided the river capture ...

`` ... the Landsat imagery of the Indus system and it appears that the confluence of the Sutlej with the Indus may not be an ancient feature. The palaeochannel of the river Beas, which is quite conspicuous in Landsat imagery, joined the Indus independent of the Sutlej. There is a distinct palaeochannel which seems to suggest that the Sutlej flowed through the Nara directly into the Ra¯ of Kutch ...

`` ... The ancient bed of the Ghaggar has a constant width of about 6 to 8 km. from Shatrana in Punjab to Marot in Pakistan. The bed stands out very clearly having a dark tone in the black-and-white imagery and reddish one in false colour composites. There is a clear palaeochannel southeast of the river Markanda which joins the ancient bed of the Ghaggar near Shatrana ... Another channel which corresponds to the present Chautang (D°±advati) seems to join the Ghaggar near Suratgarh. Near Anupgarh the ancient Ghaggar bed bifurcates and both the palaeochannels come to an abrupt end; the upper one terminates near Maro² and the lower one near Beriwala. These two terminal channels of the Ghaggar seem to disappear in a depression which is suggested by salt encrustation and the physiography of the area ...

`` ... Palaeo-Yamuna was alive during the Painted Grey Ware (PGW) period (c. 800-400 BC) as indicated by the distribution of the PGW sites on its banks (Gupta SP etal., 1977, *Ecology and archaeology of Western India* eds. DP Agrawal and BM Pande, New Delhi, Concept Pub., p. 79). Both the Chautang and the Ghaggar beds have archaeological mounds on their banks (Pande BM, ibid, p.55). The Ghaggar continued to be a live river during the pre-Harappan (c. 2500-2200 BC) and the Harappan times (c. 2200-1700 BC). Even during the PGW times, there is some indication of habitation along the palaeochannel, though the PGW mounds follow a very narrow river bed, perhaps indicating a dwindling water supply. The archaeological evidence for dating the Chautang is not very definite yet, though the late Harappan mounds along it appear to be a clear indication that it was a living river during at least the late Harappan time (c. 1700-1000 BC) ...

`` ... For miles and miles around Maro² one finds numerous place names with a suffix toba, which in the local language means a playa (or ra¯) ... It is obviously improbable for such a mighty river to vanish into a shallow depression (or khadins in the local languages) in its heyday. There is, therefore, a good possibility that the Ghaggar flowed into the Nara and further into the Ra¯ of Kutch without joining the Indus ... `` ... If the bore-hole samples from these areas are analyzed, one is sure to come across mineralogical compositions reflecting the signatures of the ancient Sutlej and the Palaeo-Yamuna when they flowed through the Sarasvati bed ... A multi-disciplinary approach employing archaeological, mineralogical, chemical and thermoluminescence, combined with remote sensing techniques can provide a clear and consistent history of these changes in the palaeochannels of northwestern sub-continent in an absolute time-frame."

LANDSAT evidence

Landsat imagery used by Yash Pal et al. comprises multispectral scanner (MSS) data in four spectral bands (0.5-0.6, 0.6-0.7, 0.7-0.8 and 0.8-

1.11um). The imagery was interpreted using techniques such as enlargements, colour additive viewer, density slicing, grey scale conversion, contrast stretching, band ratioing. The negatives and diapositives in 70-mm and 23-cm format were enlarged to 1: 250,000 scale topographical maps supplied by the Survey of India. The palaeo-channels, in most of the cases, stand out clearly because of the vegetation patterns on their beds. "Our studies thus show that the Sutlej was the main tributary of the Ghaggar and that subsequently the tectonic movements may have forced the Sutlej westward and the Ghaggar dried… it appears that the confluence of the Sutlej with the Indus may not be an ancient feature. The palaeo-channel of the river Beas, which is quite conspicuous in Landsat imagery, joined the Indus independent of the Sutlej. There is a distinct palaeo-channel which seems to suggest that the Sutlej flowed through the Nara directly into the Rann of Kutch… The ancient bed of the Ghaggar has a constant width of about 6 to 8 kms. from Shatrana in Punjab to Marot in Pakistan. The bed stands out very clearly having a dark tone in the black-and-white imagery and reddish one in false colour composites. There is a clear palaeo-channel southeast of the river Markanda which joins the ancient bed of the Ghaggar near Shatrana Channel Y1 (1 and 2). The present Sarasvati mostly flows through this channel. Another channel, Y2, which corresponds to the present Chautang seems to join the Ghaggar near Suratgarh. Near Anupgarh the ancient Ghaggar bed bifurcates and both the palaeo-channels come to an abrupt end, the upper one terminates near Marot and the lower one near Beriwala. These two terminal channels of the Ghaggar seem to disappear in a depression which is suggested by salt encrustation and the physiography of the area… For miles and miles around Marot one finds numerous place-names with a suffix toba, which in the local language means a playa. This area may have been turned into a large lake in the first instance but desiccation led to the formation of playas… there is a possibility that the Ghaggar flowed into the Nara and further into the Rann of Kutch without joining the Indus. The chain of tectonic events which diverted the Sutlej westward and the Palaeo-Yamuna southeastward was perhaps also responsible for the subsidence near Marot and Beriwala into which the Ghaggar seems to have vanished." (Yash Pal, Baldev Sahai, R.K. Sood and D.P. Agrawal, Remote sensing of the 'lost' Sarasvati river in: Lal, B.B. and Gupta, S.P., *Frontiers of the Indus Civilization,* Delhi, Indian Archaeological Society, pp. 217-226).

Climate change

Gurdip Singh, 1971: suggests that `...the significant increase in rainfall at the beginning of the third millennium BC, attested by palaeoecological evidence, played an important part in the sudden expansion of the Neolithic-Chalcolithic cultures in north-west India, ultimately leading to the prosperity of the Indus culture ... The present evidence would suggest that the onset of aridity in the region around 1800 BC probably resulted

in the weakening of the Harappan culture in the arid and semi-arid parts of north-west India..'

Amal Kar and Bimal Ghose, 1984: ``... there are indications that the river formerly flowed southwards, through the desert, and was supplied from streams originating in the Aravallis, thus explaining the distribution of alluvium in the region ...D°±advati ... means a stream with a pebbly bed ... The interfluve between the Sarasvati and the D°±advati used to be known as Bra«mavarta and was sacred ... Sir Alexander Cunningham (1871) first identified the D°±advati with the modern Rak±i ...``

Aurel Stein, 1942: '... the sketch-map based on the latest survey shows how great is the contrast between the very scanty volume of water brought down by the Ghaggar and the width of its dry bed within Bikaner territory; over more than 100 miles it is nowhere less than 2 miles and in places 4 miles or more. This bed is lined on both sides by dunes varying in height ... the Ghaggar bed above Hanumangarh, one notes that the number of mounds marking ancient sites long abandoned is here distinctly smaller than farther down the old river bed... (mounds) known as ther or their... Archaeological facts prove cultivation, and with it settled occupation, to have been abandoned much earlier on the Hakra than on the Ghaggar... trial excavation at Sandhanawala Ther, 3 miles to the north-west of Fort Abbas... some sherds with incised characters which appear on many inscribed seals from Mohenjodaro and Harappa, chief sites of the Indus Valley culture... The great height and size of several others indicate prolonged settlement... the evidence shows that down to historical times the Ghaggar carried water for irrigation under existing climatic conditions much farther than it does now. This makes it intelligible how the Sarasvati has come in hymns of the *Rigveda* to be praised as a great river... upper portion of the ancient bed... drying up during historical times ... hastened by diversion of flood water for irrigation brought about by more settled conditions and the resulting pressure of population. Lower down on the Hakra the main change was due to the Sutlej having in late prehistoric times abandoned the bed which before had joined the Ghaggar: the result of a law affecting all rivers whose course lies over alluvial plains...'

D. A. Holmes, 1968: ``…Lambrick H.T. (1967) believes that the union of the Sutlej with the Beas (and thence with the Indus) in the West Punjab had already occurred prior to the time of Alexander. It must be assumed that the Nara was continuing to flow as a result of seasonal overspill from both the Indus and the Sutlej, the latter floods using the now dry Ghaggar channel (which is a remnant of the Sutlej-Nara system)..."

Mahàbhàrata describes Dwàraka as a fortress with bridges and boat traffic*:* ***prakrtyà vishamam durgam prakrtyà ca surak±itam, prakrtyà***

MBh. 3.16.17: by nature a rough (or odd) fortress (or place of difficult access) and by nature carefully guarded, and naturally causing agitation). The mouth of the ancient Sarasvati would perhaps be near Dholavira-Prabhàsa. [*The Imperial Gazetteer of India*, Vol. XXII, p. 97: 'Sarasvatì (2): a small but holy river of Western India, rising at the south-west end of the Aravalli range near the shrine of Amba Bhawànì and flowing south-westwards for about 110 miles, through the lands of Pàlanpur, Ràdhanpur, Mahì Kantha and Baroda, and past the ancient cities of Pàtan, Anhilvàda and Sidhpur, into the lesser Rann of Cutch, near Anvarpur. West of Pàtan its course is underground for some miles, and its stream is small, except in the rains. The river is visited by Hindus, especially those who have lost their mothers. Sidhpur is considered especially appropriate place at which to perform rites in honour of a deceased mother.']

In 1951 Ghosh explored the lost Sarasvati from Hanumangarh to Anupgarh and found 25 Harppan mounds, including Kalibangan, Sothi and Nohar. Sothi, in the district of Sri Ganganagar, Rajasthan (74.50N 29.10E) is located in the plains of the Sarasvati, about 10 km. south-west of Nohar, a railway station. Deposit of 3 m. of the Sothi culture has also been found at Banawali. Sites of Sothi culture abound in Cholistan around Bahawalpur region, Pakistan, northern Rajasthan, Haryana and southern Punjab. Sothi ware have been reported in the late levels of Kot Diji at Sarai Khola and also at 'mature' Harappan sites. It would appear that the Sothi was contemporaneous with the 'mature' Harappan in the Indus valley.

"Mughal M.R., (1981) has located 41 (Early Harappan c. early third millennium B.C., contemporary with Kot Dijian) sites on the Hakra in the Cholistan desert (Pakistan), and more than 60 sites are known on the Ghaggar and its tributaries in Rajasthan, Punjab and Haryana. From this distribution pattern it is clear that the focus of this phase of the Harappan culture was the Hakra-Ghaggar valley… The recent discovery of sites associated with Hakra ware and dated tentatively to the fourth millennium B.C. in the Hakra-Ghaggar valley by Mughal (1981) and Katy Dalal (1981), shows that the village-farming way of life had already been firmly established on this river before the Early Harappan period. Perhaps contemporary to this phase as also the ensuing Mature Harappan culture is the culture represented at some forty sites in the Sikar Aravallis which we have designated Ganeshwar culture. These sites are located on the Sabi, the Dohan, the Kasaunti (Krishnavati) and the Kantli rivers which, rising in the Sikar Aravallis, flow eastward into the Yamuna or northward to dry up in the sands in Haryana, though the Kantli may have, of old, flowed into the Drishadvati… Mughal (1981: 34) has recorded 166 sites of this (Mature Harappan c. mid- and second half of third millennium B.C.) phase as against only 41 of the Early Harappan. Further south in the lower Sind, Louis Flam (1981) has located several sites on this river. In Gujarat there are 18 sites of this

phase as against only 1 or 2 of the Early Harappan (Possehl, Gregory L., 1980, p. 9). In the Indus valley proper, there are 16 sites as against only 4 of the Early Harappan. A very noticeable increase is seen in northern Punjab where there are 34 Harappan sites, mainly along the Sutlej, as against only 8 or 10 of the Early Harappan… Of the over 800 Harappan sites (not including OCP) known at present (Jansen, M., 1980), more than 530 sites are located on the Hakra-Ghaggar system. If we add to this the nearly 200 Harappan sites from Kutch-Saurashtra and the nearly 70 Late Harappan (second millennium B.C.) sites from the Yamuna valley in Uttar Pradesh, probably less than a hundred sites are left in the Indus Valley proper and in Baluchistan. The Harappan culture is, therefore, essentially a culture of the Hakra-Ghaggar valley… The width of the Hakra bed varies from 3 to 10 kms. in different parts of its course. It was obviously, therefore, a very large river during its lifetime. The large number of settlements found along its course dating broadly to the period 4000 - 600 B.C., also shows that it must have been a perennially flowing mighty river… in the *Mahàbhàrata*, the river is described as having lost itself in the sands… The *Mahàbhàrata* period has, on archaeological grounds, been shown to coincide with the P.G.W. culture (first half of the first millennium B.C.) (Lal, B.B., 1954-55, 1981) which can be dated broadly to c. 1000 - 600 B.C. It can, therefore, be said that the Sarasvati was a fully flowing river in the second millennium B.C. (and by implication earlier) but had dried up by c. 1000 B.C… Because of its flat topography, the vast area covered by these rivers (Yamuna and Sutlej) is, and has always been, susceptible to flooding by the waters of the Sutlej. This leads to the formation of vast lakes and their filling up by abundant silt and clay sediments brought in by the rivers… C.F. Oldham (Oldham, C.F., 1893; Sir A. Burnes, 1834) beds, specially between the Ghaggar and the Sutlej… The Ghaggar or Hakra is formed by a combination of two rivers which meet near Wallur (Oldham 1893: 57) or to the west of Anupgarh (Erikson, K. Gosta, 1959) on the Indo-Pakistan border. These are named the eastern and western Hakra by Oldham, while Ghosh (1952) who explored the ‘eastern Hakra’ uses the name Ghaggar for it. The eastern arm of the Hakra is formed by a combination of four rivers which are named from east to west: (1) Chautang (Chitrung of Oldham) or Drishadvati; (2) Sarasvati; (3) Ghaggar; and (4) Wah or Sonamwal or Sirhind Nadi. The Chautang flows almost parallel and close to the Yamuna from the hills down to a little north of Karnal where the two rivers diverge, the Chautang taking a south-westerly course and the Yamuna turning south. At present, the Chautang dried up near the village of Safidom, but Ghosh (Ghosh, A., 1952) was able to trace its course for a considerable distance further to the south-west, past the towns of Bhadra and Nohar to near Suratgarh where it must have joined the Ghaggar. The Hansi branch of the Western Yamuna canal runs through this dry bed. Another river running west of, and parallel to it, is also known as Chautang (Erikson 1959: 22, fig. 3) and joins the Sarasvati at the town of

Pehowa… The Harappan site of Banawali is probably located on its dry bed. To its west is the Sarasvati (also known as the Markanda in its upper course) which joins the Ghaggar near the village of Rasula, a few kilometers south-east of the small town of Shatrana… Wah, the westernmost branch of the eastern arm of the Hakra, at one time joined the latter east of Sirsa, but today it dries up nearly 100 kms. north-east of this town. The western arm of the Hakra is formed by a combination of three rivers each of which is known as Naiwal. They are designated eastern, middle and western Naiwal. According to Oldham (1893: 58) these streams meet near Kurrulwala (29.33N 73.52E) south of the town of Abohar in Punjab… In the map published by Pande (Pande, B.M., 1977, fig. 2.21) the eastern and middle Naiwals are shown joining the Ghaggar south of Hanumangarh, as well as the western Naiwal a little further west. Between the western Naiwal and the Sutlej, Oldham has shown two more dry beds both of which join the Sutlej. The eastern of these beds is known as the Dhunda. Oldham was of the opinion that the Sutlej flowed into the Hakra or Sarasvati through each of these dry beds, gradually shifting its course from east to west. When the Sutlej shifted its course westward 'and abandoned the eastern arm of the Hakra, the Sarasvati, which had been a tributary, was left in possession of the deserted channel, in the sands of which its waters were swallowed up (Oldham 1893: 59)"(Misra, V.N., 1984).

The Harappan civilization is thus extended beyond the Indus river valley. Indus is an aggrading river with its bed higher than the surrounding plain and with a gradient of 4.8 cm. per kilometre in the Sind region. Indus is prone to floods after the melting of snow in March-April and after the south-west monsoon in August; this also helped the raising of both kharif and rabi crops. Hakra is a degrading river with a well-cut bed in the alluvium, but without a large delta. The western Yamuna canal (now linked with Chautang and Yamuna) had flowed westwards in the past feeding into the Hakra (Raikes, R.L., 1968). The snow-fed Sutlej had also linked with Hakra in the past, contributing to the increased width of the Hakra river-bed westwards of Fort Abbas and beyond Lurewala. The ancient Sarasvati was Hakra with it tributaries, Sirhind, Markanda and Patialvi fed by the monsoons in the Siwaliks and with the channels of the snow-fed Sutlej. It would appear, that once the western Yamuna canal ceased its links with Sarasvati and once the snow-fed channels of Sutlej ceased their links with Sarasvati, the mighty Sarasvati dried up. Banawali located on the banks of the Sarasvati yielded two fine examples of terracotta figurines of the mother goddess with an elaborate head-dress. By the end of second millennium B.C., the settlement pattern in Cholistan (around Fort Abbas) had altered and villages had been established within the entrenchment of the Sarasvati.

Most complex settlements such as Harappa (on the Ravi river) and Kalibangan (on the Sarasvati river) had been abandoned during the early

centuries of the second millennium B.C. It would appear that the Sarasvati and her streams started drying up during the early centuries of the second millennium and had fully dried up beyond Anupgarh by the end of the era.

It is reasonable to formulate a hypothesis that (a) Sarasvati was the centre of the settlements of the civilization; (b) the gradual decline of the Harappan civilization circa 1500 B.C. and the resulting migrations southward and eastward of the Harappan peoples were principally caused by the drying up of the Sarasvati river, west-ward migratory changes in the course of the Sutlej, Beas and Ravi rivers and gradual inundation of the Rann of Kutch which was an island circa 2000 B.C. with a navigable surrounding sea. Another hypothesis which can be postulated is based on the early observations of Marshall: "…What seems prima facie more probable is that this forgotten civilization, of which the excavations of Harappa and Mohenjo-daro have now given us a first total glimpse, was developed in the Indus valley itself… there is no reason to assume that the culture of this region was imported from other lands, or that its character was primarily modified by outside influences." (Marshall, 1924: 548). The hypothesis is that the civilization was developed and nurtured in the valleys of two great rivers: the Sindhu and Sarasvati rivers. This modified the hypothesis postulated by Amalanda Ghosh in 1964: a homogenous pre-Harappan culture in Gujarat, Rajasthan, Sind, Punjab and Baluchistan, named the Sothi culture after the name of the site in the Drishadvati basin with Kalibangan I pre-Harappan pottery. Ghosh also sees Sothi-type ware in the deep levels of Mohenjo-daro and in sites like Kalibangan and Ropar. (Ghosh, 1965). On the indigenous development of the civilization in pre-Harappan times, the following observation of Mughal is noteworthy: "We already have the evidence of fairly large towns along the river valleys, fortifications, knowledge of stone and metal technology reflecting specialized craftsmanship, wheeled means of transport, trade of lapis lazuli with outside regions and an emerging system of writing. Only two elements of urbanized society are lacking: (i) large cities like Mohenjo-daro, Harappa and Kalibangan, and (ii) increased specialization to engage in full time crafts like seal-engraving, sculpture, modelling and metallurgy, which in turn were related to increased access to raw material or means of obtaining them and availability of resources to support craftsmen not directly involved in subsistence activities… The Mature Harappan culture, therefore, was the ultimate result of these processes." (Mughal, R.M., 1973).

SARASVATI: *SOMA* YAJÑA AND THE VEDA

The argument: Rigveda is a metallurgical allegory; soma is electrum ore

According to Louis Renou, the immense Rigvedic collection is present in nuce in the themes related to ***Soma***. About 120 hymns out of a total of 1028 hymns or a thousand verses and almost the entire ninth book deal with ***Soma***. ***Soma*** is a material and also the only process elaborated in the *Rigveda*. The rest of the hymns related to Agni, Indra or other facets of vedic life will have to be concordant with this process which seems to constitute the very essence of vedic life, a process integral to the day-to-day living of the vedic seeker. The amšu were pressed and processed almost like a religious act.

Soma yajña in Rigvedic days, in particular, connotes the process of parting/extracting gold and silver from ***Soma***, electrum ore (gold-silver pyrite ore). This may be called auri-faction in alchemical terms; the ri±is or sages who composed riks abounding in philological brilliance, perhaps believed that they were in fact producing gold.

The interpretation of the *Rigveda* as a metallurgical allegory, in respect of the processing of ***Soma***, declares a change of paradigm in vedic studies.

The oral tradition of transmitting the knowledge of gold-smelting operations was continued over millennia to maintain secrecy. The tradition of secrecy becomes allegorical as the bràhma¯as and Šrautasùtras bureaucratize the process with allegorically-coded manuals for smelting operations. A nexus develops between the brahmans and the ruling classes and the former are generally in the employ of kings, led by a r.twij and a purohita; and live in the same quarters of the royal palace, where goldsmiths live. The processes indicate that the alchemical tradition sustained by the ruling-priestly class-consortium was auri-fiction; that is, the priests knew that they were not, in fact, producing gold. The state-power was used to monopolize this operation of accumulating gold and silver metals into the state treasuries.

The analysis is advanced with reference to three historical milestones, and three related facets of alchemy as an enterprise:

(1) *Rigveda* and aurifaction;

(2) Šatapatha Bràhma¯a and aurifiction; and

(3) Arthašàstra and alchemy as a state enterprise.

Soma, as a metaphorical elixir of immortality

> We have drunk the ***Soma*** and become immortal;
> We have attained the light the gods discovered.
> What can hostility now do against us?
> And what, immortal God, the spite of mortals?
> (R.V. VIII.48.3)

This hymn from the world's oldest recorded oral literature seems to deal with the preparation and use of an 'elixir'. This hymn sets the framework for tracing the Indian alchemical tradition and its science potentials. The trace will perhaps lead us to the earliest alchemical tradition of the ancient world. It is significant that in a contemporary civilization, Gilgamesh of Babylonian myths too sets out to discover eternal life and finds a miraculous plant of immortality growing at the bottom of the sea. He plucks it, leaves it unguarded. It is stolen by a water snake. Water, plant and snake symbolisms are indeed central to all alchemical traditions.

Soma is not a drink

Chàndogya Upani±ad (V.10.4) is emphatic:

> *es.a somo ràjà. tad devànàam annam. tam devà bhak±yanti.*
> ***Soma*** is king. ***Soma*** is food for the gods. Gods eat ***Soma***.

Two vedic hymns reiterate that ***Soma*** is not a drink of mortals:

> 'One thinks to have drunk ***Soma***, when they crush the plant. Of him (***Soma***), which the bràhma¯as know, no one ever tastes.' (RV X.85.3; the same hymn in AV XIV.1.3).

> 'O ***Soma***, guarded by that which is meant to cover you, guarded by him who lives in the high (heaven?), you stand listening to the pressing stones. No earthly one eats you.' (RV X.85.4).

Atharva veda refers to the deficiency in name; this stanza is used, as a primary authority by some scholars, to justify the identification of ***Soma*** as the moon, since dars'a is interpreted as the slender crescent of the moon:

> 'O stem of ***Soma*** (*somasyamšo*), lord of the combatant (*yudhàm*), you are indeed not-deficient by name (*nùno nama*); make me, O first sight (*darša*) not-deficient (*anùnam*), both by progeny and wealth.' (AV. VII.86.3).

Soma, has the radical *su*, to press; pressing is the key process. ***Soma*** is that which is pressed. In the developing allegory, ***Soma*** is seen to be

released from the cover, Vritra or the 'aryan dragon motif or Vritra, who possesses the waters, using the vajra thunderbolt. Buschardt also observes that the mountains which are Vritra's body are also the same on which the ***Soma*** plants grow; Vritra-killing and ***Soma***-pressing are one and the same act; ***Soma***-pressing is ***Soma***-killing; killing signifies making him 'whole' and this is creation. Vajra is a concept related to the reducing agents: Lahiri summarizes Buschardt's perceptions succinctly. "Buschardt traced the origin of the vajra, the weapon with which Indra kills Vritra, to the cultic implements the pressing stone used to crush the ***Soma***-stalks, or pestle.

The cultic implements on icons are remarkable records of alchemical legacy. Since the artist wanted to symbolize the representation with great fidelity, he used enormous degrees of freedom in adding to the icons four, six or eight hands; so that on each hand, he could represent the symbolism related to a cult implement such as a kaman.d.alu, an aks.a ma_la, a ladle, a ***vajra***, etc. Many of these implements are alchemist's tools and relate to his apparatus. If this iconographic tradition can be extrapolated to the proto-indus seals, the so-called 'cult object' in front of the unicorn comes alive as a smelter-filter of the lapidary, the centre-piece of his very craft and life-mission.

Sometimes, even *àjya* (melted butter), *sphya* (spade of *khadira* wood), *abhri* (spade), *yùpa* (posts in the sacrificial site where the victim used to be bound), the waters etc. are styled *vajra*... the cult instrument which happens to be decisive at that particular moment is referred to as vajra...

Linking vajra with the waters finds significant support from dravidian etyma: DEDR 761: Kannada.vajjara, ojjara a spring, fountain; **orale** oozing, **oravu** spring; Tamil. **ùru** to spring, flow (as water in a well); **ùral** small spring, spring-water, oozing, percolation; Kui. **urpa** to ooze, spring up; Maltese. **orbe** to fall in showers. The imagery sought to be evoked by the vedic poet-artisan is relatable to the intense desire to use a weapon that will enforce the flow of the metallic essence, *rasa. vajra*, therefore, connotes the resin that flows from the male trees!

“Vajra is the cult's demon killing power as such, and Buschardt thought that the origin of vajra must be traced to the pressing stones which play a dominant role in the central moment of the cult, the pressing of the ***Soma***... At the ***Soma*** pressing water is poured over the ***Soma*** stalks and hence they actually take part in the ***Soma*** pressing, that is, Vritra-killing...The separation of ***Soma*** and Vritra becomes complete with the purified ***Soma*** on the one side, and the crushed lifeless demon on the other. This ***Soma*** 'clear flowing' fills up the gathering vessel...Thus the conflict is over." (Buschardt,L., *Vrtra: Det Rituelle Daemondrab iden Vediske Soma-kult*, Kobenhavn 1945, p.48; loc.cit. Lahiri, A.K., *Vedic Vrtra*, Delhi, Munshiram Manoharlal, 1984, p.21.)

Crysocole, or copper carbonate, was used by goldworkers as a solder. Two oxides of copper, red and black, were known. Mary, the Jewess-alchemist, often refers to the 'little leaf of copper', the copper foil hung

on the kerotakis to be subjected to the attack of mercury vapours or of sulphur vapours which was sublimed in the aludel fitted with kerotakis. cf. Hopkins, A.J., Alchemy, 1967, p.108. The 'leaf' motif has a remarkable parallel in Indus script signs and in an exquisitely executed pictorial motif which depicts two 'unicorn' heads surrounding a stylized 'sublimation device', may be kampat.t.am, topped by nine leaves [**Fig.14**]. In the jeweler's art, a process called 'royal cement' is used, which may perhaps be traced to Tvashtr's gilding techniques. "To a large quantity of fused base metal a little gold was added and the whole cooled to form one 'metal', and this solid solution was then shaped into some form such as a ring. This was then etched on the surface by alum or other mordant salt. The surface of the base metal, such as lead, by this process would be dissolved away, leaving granules of pure gold in relief, thus making the ring appear to be made wholly of gold. This process had been known from very early times." Hopkins, A.J., *Alchemy*, 1967, p.49. Some etyma: RV iv.20.6 **vajra** mark; in RV. x.108.7 **vajrabhir-nryu±²ah** qualifying **nidhi**; in vi.22.5 **vajra-hastam** holding **vajra** in hand. Pali.**vajira** Indra or Sakka's thunderbolt; diamond. Tamil (lex.) **vaccira-kantam** yellow orpiment; **vaccirakam** pericarp of the lotus; **vaccirappacai** a kind of glue; **vacciram** a treatise on architecture; **vaccira-ya_ppu** glue-ing, in woodwork; **vaccira-rasam** purified mercury. DEDR 5214 Tamil. **vaci** rain, water; Kannada. **basi, bose** to drip, drop, trickle.

Atharva veda (AV.IX.6) can be interpreted as providing the clearest statement on the smelting process of the ***Soma*** yaja which is echoed in later-day alchemical texts:

"...the shed for housing the ***Soma*** cars...green sticks that surround the sacrificial altars (as a fence to restrict the range of fire)...The grains of rice and barley that are selected are just filaments of the ***Soma*** plant. The pestle and mortar are really the stones of the ***Soma*** press. The winnowing-basket is the filter, the chaff the ***Soma*** dregs, the water the pressing-gear. Spoon, ladle, fork, stirring prong are the wooden ***Soma*** tubs; the earthen cooking pots are the mortar-shaped ***Soma*** vessels; this earth is just the black-antelope's skin...The man who supplies food hath always pressing stones adjusted, a wet ***Soma*** filter, well-prepared religious rites...he who hath this knowledge wins the luminous spheres."

Metals were not fully distinguished from their alloys; all carried names such as aes, electrum etc. Ayas meant metal. Asem denoted the natural alloy of silver and gold; it also meant any bright metal made with copper, tin, lead, zinc, arsenic and mercury. Twelve or thirteen different alloys were called asem (Needham, Joseph, *Science and Civilization in China*, vol. 5, pt. II, p.45) "At Gungeria, in district Balaghat, 102 pieces of silver plates were discovered along with 424 copper implements. The silver was found to be admixed with 3.7% gold (...1100 B.C. - 800 B.C.). The presence of 3.7% gold in these silver pieces indicates the extraction of silver from electrum..." (Smith, V., 1905, *Indian Antiquary*, pp. 233 ff.; loc.cit. Bharadwaj, H.C., *Aspects of Ancient Indian Technology*, Delhi, Motilal Banarsidass, 1979, p. 138).

Asem was ***Soma***; this hypothesis will be the running-thread of this review of the alchemical tradition of ancient India, dating back to R.gveda. Hopkins states: "The existence of this alloy (asse*m) may have been the original cause for the suggestion of transmutation since by adding silver to it, one would get a metal nearly identical with the crude silver from the mine; and by adding gold, something indistinguishable from gold. [The paucity of the Egyptian language may perhaps have been responsible for a confusion. Gold was the 'yellow metal', and the alloy produced was also a 'yellow metal'.]" (Hopkins, A.J., *Alchemy*, 1967, pp. 103-104).

The parallels with the Indian alchemical tradition are apparent: taµkam gold in dravidian-Chinese becomes t.an.kan.a borax (a reagent!) in indo-aryan, ²aµka gold coin; the terms hiran.yam, hema-bìjam, connote the yellow metal.

"The use of borax (pheng sha) as a preparatory agent for soldering and brazing (in the molten state it cleans metal surfaces by dissolving metallic oxides) goes back in China to the +11th century, for it is mentioned by Su Sung (kho han chin yin)... Li shi-Chen says that borax 'kills' the five metals, as saltpetre does; presumably this refers to the preparation of metallic salts. The mild and non-irritant antiseptic quality which has given it such wide use in Western and even modern, medicine, was appreciated by the Chinese pharmacists, who prescribed it for all kinds of external, including phthalic, affections." (Needham, J., *SCC*, vol. III, 1959, p. 663).

In the Babylonian Talmud (+2nd century), asemon is a commonly used word referring to bullion (gold, silver or mixed.) Leiden X papyrus (c. +3rd century) says: "no.8. It will be asem, (i.e. electrum, an alloy of gold and silver) which will deceive even the artisans (a tin-copper-gold-silver alloy); no.12. Falsification of gold (a zinc-copper-lead-gold alloy)..." (cited in Needham, Joseph, *SCC*, vol. 5, Pt. II, pp. 18-21). ***Soma*** *yajña* as a ritual, can be interpreted as an elaborate justification for the memories of processing asemon, asem, electrum.

A Tamil lexicon of Winslow (1862) provides a philological trace: ***Soma*** *ma¯al*, is interpreted as meaning ve³³i ma¯al, sand containing silver ore!

Soma, ***Soma*** ma¯al, asemon, asem, electrum may perhaps denote the same substance that dazzled and drew travellers of antiquity in search of indus gold. It may perhaps be the same substance [which required the purificatory 'mineral waters'] contained in the kaman.d.alu symbols in the icons of the yaks.a legacy. It may perhaps be the same substance said to be am°tam which was considered to be the elixir of life, of

immortality. It may perhaps be the same substance referred to, in sheer poetry, as amritam *àyur hira¯yam*. Gold is immortality.

Soma! The very justification for the vedic hymns; the quintessence of the only technological process elaborated in magnificent poetry and philological excursus in the grand allegory, the *Rigveda*.

These findings are further elaborated in the work: *Indian Alchemy: Soma in the Veda*, by Dr. S. Kalyanaraman (in press; forthcoming (1997) publication of Munshiram Manoharlal, Delhi).

SARASVATI: HERITAGE, AND LANGUAGE

Cultural continuity in the sub-continent

The Great epic continues the Vedic tradition of extolling the Sarasvati river and provides vivid geographical accounts of the pilgrimage sites along the river.

Sangam literature of ancient Tamils, is replete with references to the Vedic traditions. *Tolkàppiyam* (Akatti¯ai iyal 5) divides the entire Tamil country into five, namely, Mullai (jungle) with Vi±¯u as its presiding deity, Ku°iñji (hilly) with Muruka¬ as deity, Marutam (plains) with Indra as deity, Neytal (seashore) with Varu¯a as deity and Pàlai (wasteland) with Ko°°avai (Durgà) as deity…

It may be hypothesized that Marutam [Tamil word: meaning 'fertile (alluvial) plain'] relates to Marusthali (Sanskrit), the Thar desert which was, circa 3000 B.C., a fertile plain close to the banks of the Sarasvati river and caused by the alluvium deposited by the river.

Tamilnadu celebrates Sarasvatì pùjà as àyudha pùjà, celebrating the arts and crafts integral to life activities. *Tiruppukazh* calls her ***caraccuti*** (Ti. 337), ***ma°aimaka³*** (Ti. 399: ***ma°ai*** = vedas).

Balarama's pilgrimage from Dwaraka to Mathura

The pilgrimage starts from the place where Sarasvati joins the ocean.

tasmims tìrthe mahà bhàga padma lak±a¯a lak±itàh
adyàpi mudrà d°šyante tad adbhutam arimdama
trišùlàk±à¯I padmàni d°šyante kuru nandana
mahà devasya sàmnidhyam tatraiva bharata °±abha (MBh 3.80.84)

In this pilgrimage site signs with lotuses are seen; even nowadays seals are seen; this is a marvelous home of faithfulness. Lotuses marked with tridents are seen there, in the presence of the great god [i.e. where K°±¯a lives].

sarasvatì pu¯ya vahà… samudragà mahà vegà (MBh 3.88.2)

[In the north] there is Sarasvatì… she goes to the ocean, the greatly impetuous one.

sàgarasya ca sindhoš ca samgamam pràpya bhàrata
tìrthe salila ràjasya snàtvà prayata mànasah (MBh 3.80.85)

Having reached the confluence of the ocean and the Sindhu [one should bathe] at the pilgrimage site of the king of the water [Varu¯a].

tato gaccheta dharmajña prabhàsam loka višrutam
yatra samnihito nityam svyam eva huta ašanah
devatànàm mukham vìra analo anila sàrathih (MBh 3.80.79)

Then one should go to the world-famous Prabhàsa, where the oblation-carrying fire is always present in person, the wind-driven fire, the mouth of the gods.

tato gaccheta dharmajña himavat sutam arbudam
p°thivyàm yatra vai chidram pùrvam àsìd yudhi±²ira (MBh 3.80.74)

[After traveling to the river Narmadà, and the southern river, and the Carma¯vatì] then one goes on to Arbuda, the son of Himalaya, where formerly there was a cleft in the earth. [Arbuda is a sacred hill in western India extending up to mahì-sàgara-sangama; this is Mount Abu in Rajasthan. (*Skandapurà¯a*, I.ii.2.75)[cf. geomorphological evidence of the continuing rise of the Aravalli (Arbuda) ranges].

tato gatvà sarasvatyàh sàgarasya ca samgame
go sahasra phalam pràpya svarga loke mahìyate
dìpyamàno agnivan nityam prabhayà bharata °±abha (MBh 3.80.82)

tato dvàravatìm gacchen niyato niyata ašanah
pi¯®àrake narah snàtvà labhed bahu suvar¯akam (MBh 3.80.83)

[Proceeding from Arbuda or Mt. Abu] Then after going to the confluence of the Sarasvatì with the ocean, and after obtaining a reward of a thousand cows, in the glorious world of heaven one is blazing forever with splendour like fire.

[After going from there to Varadàna] one should proceed to Dvàravatì [Dvàrakà]…

tato vinašana gacchen niyato niyata ašanah
gacchaty antar hità yatra maru p°±²he sarasvatì
camase ca šivobhede nàgobhede ca d°šyate (MBh 3.80.118)

Then one should go to Vinašana, where the Sarasvati disappears in the desert and reappears at Camasobheda, Šivobheda, and Nàgobheda

àkàša nìkàša ta²àm nìpa nìvàra samkulàm
babhùva caratàm har±ah pu¯ya tìrthàm sarasvatìm (MBh 3.179.14)

Her banks having open space (at some places) or being completely filled (at other places), abounding in kadambas (= nìpa, *nauclea cadamba* or *azadirachta indica*) and wild rice (or rice growing spontaneously) [***nìpa*** = land fertilized by alluvial silt, low ground; niwàr = a kind of hardy rice growing at high altitudes (K.)] they [the Pà¯®avas] roamed happily Sarasvatì's virtuous pilgrimage sites.

tàm yak±a gandharva maha°±ì kàntàm àyàga bhùtàm iva devatànàm
sarasvatìm prìti yutàš carantah sukham vijahrur nara deva putràh
(MBh 3.174.24)

That [feminine] is dear to the seers, Gandharvas, and Yak±as, as if obtained by the sacrifice of the gods; in a friendly disposition the associates pleasantly roamed along the Sarasvatì, the human sons of gods gave up comfort.

One should dwell for a month by the Sarasvatì, O Yudhi±²hira, where the gods led by Brahmà, the seers, Siddhas, Càra¯as, Gandharvas, Apsaràs, Yak±as, and snakes visit holy brahma-k±etra.

tato vinašanam ràjann àjagàma hala àyudhah
šùdra àbhìràn prati dve±àd yatra na±²à sarasvatì
yasmàt sà bharata šre±²ha dve±àn na±²à sarasvatì
tasmàt tad °±ayo nityam pràhur vinašana it ha (MBh 9.36.1-2)

Then Baladeva, O king, proceed to **Vinašana**, where the Sarasvatì had become lost out of contempt for **Sùdras and Abhìras**. Since Sarasvatì was lost out of contempt the °±is always name this place **Vinašana**.

e±à sarasvatì pu¯yà divyà coghavatì nadì
etad vinašanam nàma sarasvatyà višàm pate (MBh 3.130.3)

This is Sarasvatì, the auspicious, divine river with a strong stream; this is called Vinašana [the vanishing point] of Sarasvatì. [cf. vègavatì or vaikai in Tamil land].

dvàram ni±àda rà±²rasya ye±àm dve±àt sarasvatì
pravi±²à p°thivìm vìra mà ni±àdà hi màm viduh (MBh 3.130.4)

Hero, it is the gateway to the Ni±àda kingdom, out of hatred for whom the Sarasvatì entered the earth, thinking, 'they should not know (see) me.'

tato gaccheta ràjendra samgamam loka višrutam
sarasvatyà mahà pu¯yam upàsante janàrdanam (MBh 3.80.130)

Then [right before going to Kuruk±etra] one should go to the famous and greatly auspicious area of confluence with Sarasvati.

e±a vai camasa udbhedio yatra d°šyà sarasvatì
yatra enàm abhyavartanta divyàh pu¯yàh samudra gàh (MBh 3.130.5)

This is the Camasa spring, where Sarasvatì can be seen, and here converge into her all the divine, auspicious, ocean-bound (rivers).

pu¯yam àhuh kuruk±etram kuruk±etràt sarasvatìm
sarasvatyàš ca tìrthàni tìrthebhyaš ca p°thùdakam (MBh 3.81.125)

They call Kuruk±etra holy, but holier than Kuruk±etra is the Sarasvatì, holier than the Sarasvatì are the pilgrimage sites, and holier than the pilgrimage sites is P°thùdaka.

dak±i¯ena sarasvatyà uttare¯a d°±advatìm
ye vasanti kuruk±etre te vasanti trivi±²ape (MBh 3.81.175)

With the south away from the Sarasvatì [i.e. south of the Sarasvatì], with the north away from the D°±advatì [i.e. north of the D°±advatì], those who live in Kuruk±etra live in the third (highest) heaven.

tatra pu¯yatamam tìrtham plak±a avatara¯am šivam
yatra sàrasvatair i±²và gacchanty avabh°tam dvijàh (MBh 3.88.3)

There is the meritorious pilgrimage site, descending at the auspicious Plak±a [the place of the pipal tree]: there, having longed for [Sarasvatì] with the sàrasvata rites, the Bràhma¯as go and immerse themselves [or perform a purificatory ritual].

[Balarama's pilgrimage also recounts the source of Sarasvatì:]

prabhavam ca sarasvatyàh plak±a prasrava¯am balah
sampràptah kàra pacanam tìrtha pravaram uttamam (MBh 9.53.11)

[While ascending the Himalaya] prominent with Sarasvatì, Balaràma (saw) Plak±a Prasrava¯a; he next reached another excellent pilgrimage site called Kàrapacava [by the Yamuna's source]. [cf. Paonta Saheb where the Yamuna pirates the Sarasvati river].

V°ddhakanyàka is Sàrasvata tìrtha, cf. Devala cited in *k°tyakalpataru* of bha²²a lak±mìdhara, ed. K.V. Rangaswami Aiyangar, G.O.S., Baroda, 1942, p. 250:

plak±apràsrava¯am v°ddhakanyàkam
sàrasvatamàdityatìrtham kauberam vaijayantam

p°thùdakam naimi±am vinašanam vamšotbhedam
prabhàsamiti sàrasvatàni.

Balarama's pilgrimage in the Mahàbhàrata along the Sarasvatì

ànayadhvam dvàrakàyà agnìn vai yàjakàms tathà
suvar¯am rajatam caiva dhenur vàsàmsi vàjinah
kuñjaràmš ca rathàmš caiva khara u±²ram vàhanàni ca
k±ipram ànìyatàm sarvam tìrtha hetoh paricchadam
pratisrotah sarasvatyà gachadhvam šìghra gàminah
°tvijašca ànayadhvam vai šatašaš ca dvija-°±abhàn
tìrtha yàtràm yayau ràjan kurù¯àm vaišase tadà
sarasvatìm pratisrotah samudràd abhijagmivàn (MBh 9.34.15-18)

[Balaràma is about to set out on a pilgrimage along the Sarasvatì; he orders his servants:] Bring the fire from Dvàrakà and the sacrificers. Bring gold, silver, cows, clothes, horses, elephants, chariots, donkeys, camels (or buffaloes), and other conveyances. Bring everything quickly, all the necessaries for traveling to the pilgrimage sites. Up the stream of Sarasvatì, set out swiftly and move on; bring also priests and hundreds of twice-born (Brahmin) sages. The procession moved swiftly to the pilgrimage sites at the time of the war of the Kurus; going upstream along the Sarasvatì, from the ocean onwards.

MBh 9.34.66-70; 9.36.33-57; 9.38.23-29; 9.41.11-39:

[Višvàmitra, while having a quarrel with Vasi±²ha, thought to himself:] This Sarasvatì shall quickly bring, by force of her current, that foremost of ascetics [Vasi±²ha] to my presence. After he is brought here I shall, without doubt, slay that foremost of regenerate one. Having settled this, the illustrious and great °±i Višvàmitra, his eyes red in wrath, thought of that foremost of rivers. Thus remembered by the ascetic, she became exceedingly agitated. The beautiful lady, however, repaired to that °±I of great energy and wrath. Pale and trembling, Sarasvatì, with joined hands appeared before that foremost of sages. Indeed, she was much afflicted with grief, like a woman who has lost her mighty husband. And she said unto that best of sages: 'Tell me what is there that I shall do for you.' Filled with rage, the ascetic said to her: 'Bring here Vasi±²ha without delay, so that I may slay him.' Hearing these words, the river became agitated. With joined hands, the lotus-eyed began to tremble exceedingly in fear as if a creeper shaken by the wind. Beholding the great river in that plight, the ascetic said to her: 'Without scruple, bring Vasi±²ha into my presence.' Hearing these words of his and knowing the evil he intended to do, and acquainted also with the prowess of Vasi±²ha that was unrivaled on earth, she repaired to Vasi±²ha and informed him what the intelligent Višvàmitra had said to her. Fearing the course of both, she trembled repeatedly. Indeed, her heart was on the grievous

curse. She stood in terror of both. Seeing her pale and plunged into anxiety, the righteous-souled Vasi±²ha, that foremost of men, said these words to her: 'O foremost of rivers, save yourself. O you of rapid current, bear me away, otherwise Višvàmitra will curse you. Do not feel any scruple.' Hearing these words of that compassionate °±I, the river began to think as to what course would be best for her to follow. These were the thoughts that arose in her mind: 'Vasi±²ha showed great compassion for me. It is proper for me that I should serve him.' Beholding then that best of °±is engaged in silent recitation on her bank, and seeing Kušika's son [Višvàmitra] also engaged in offering oblations, Sarasvatì thought: 'This is my opportunity.' Then that foremost of rivers, by her current, washed away one of her banks. In washing away that bank, she bore Vasi±²ha away. While being borne away, Vasi±²ha praised the river with these words: 'From the grandfather's [Manasa] lake you have taken your rise, O Sarasvatì. This whole universe is filled with your excellent waters. Traveling through the sky, O goddessess, you give your waters to the clouds. All the waters are yours. Through you we exercise our thinking faculties. You are Pu±²ì, Dyutì, Siddhì, Umà. You are speech, you are svàhà. This whole universe is depending on you. It is you who dwells in all beings, in four forms.' Thus praised by the great °±I, Sarasvatì speedily bore that brà«ma¯a towards Višvàmitra's place, and repeatedly represented to the latter the arrival of the former. Beholding Vasi±²ha thus brought before him by Sarasvatì, Višvàmitra, filled with rage, began to look for a weapon to kill that bràhma¯a. Seeing him filled with wrath, the river, fearing a bràhma¯a's slaughter, quickly bore Vasi±²ha away to her eastern bank once more. She thus had obeyed the words of both, although she deceived the son of Gadhi by her act. Seeing that the best of °±is (Vasi±²ha) borne away, the vindictive Višvàmitra, filled with wrath, addressed Sarasvatì saying: 'Since, O foremost of rivers, you have gone away, having deceived me, let your current be changed into blood good enough for ràk±asas.' Then, cursed by the intelligent Višvàmitra, Sarasvatì flowed for a whole year bearing blood mixed with water.

tatah sarasvatì kùle same±u maru dhanvasu
kàmyakam nàma dad°šur vanam muni jana priyam (MBh 3.6.3)

Then amidst the desert plains on the banks of the Sarasvatì they (Pà¯®avas on their journey from Gangà to Kuruk±etra) found the forest called Kàmyaka, which is very dear to the hermit crowd. In MBh 3.26.1, there is a reference to the benign forests of šàla trees by the Sarasvatì: šive±u sarasvatì šàla vane±u te±u/

Mahàbhàrata starts with the commonly associated invocation:

nàràya¯am namask°tya naram caiva narottamam
devìm sarasvatìm vyàsam tato jayam udìrayet (MBh 1.1.1)

sarasvatìm ìraya Veda ju±²àm eka ak±aràm bahu rùpàm viràjam
aµga àtmànam sama vek±asva bàlam kim šlàghase durlabhà vàda siddhih (MBh 3.133.8)

[Speak of] Sarasvatì, she who is liked for having brought to life the Vedas, she who has one syllable and many forms, she who is brilliant.

Obeisances are to be offered to Nàràya¯a and to Nara, the supreme human being, to divine Sarasvatì and to Vyàsa; then victory should be attained.

Mahàbhàrata (Bhì±maparva, 6.49,50) refers to seven divyagaµgas: nalinì, pàvanì, sarasvatì, jambu, sìtà, gaµgà and sindhu. The epic locates kuruk±etra to the south of sarasvatì and to the north of D°±advatì (iii,83.204). [This area is defined as Bra«mavarta, the seat of distinguished sages in *Manu Sm°ti* 2.17]. [Vinašana where the Sarasvatì became invisible was the abode of Vyàsa, the compiler of the vedas and the purà¯as. Vinašana lay on top of the maru desert (marup°±²e : *MBh, Vana.* 80.118)]. When the vedas had been forgotten, Sàrasvata instructed the bràhma¯as about the vedas. A drought occurred for 12 years; the r±is wandered about for food and thus lost the vedas: te±àm k±udhà parìtànàm na±²a« vedà abhidhàva²am (*MBh Šalyaparvan*: verse 2960). Sàrasvata also was about to depart, but Sarasvatì dissuades her son: 'Do not go, my son; I shall give you excellent fish for food.' He remained there and preserved the vedas: prà¯àm vedà¶šca dhàrayam. K°±¯a, Bhàrata and Bàlakhilya had performed sacrifices on the banks of the Sarasvatì; the hermitage of Dadhìcì, the Daivatavana and Kàmyakavana, the sacrifice of Yayàti had been on her banks. She originated from pitàmahasya sarasa«, the mànasa lake. The doab formed by these two rivers thus becomes the locus of the Bharata war of kuruk±etra (fought on five lakes: samanta-pañcaka; said to be the northern sacrificial altar of brahmà: *MB, Vana*, lxxxiii). [Alberuni found, in 1000 A.D., a holy lake in Kuruk±etra]. The epic provides an account of Balàrama's sojourn along this river dotted with centers of learning and austerities. [The dividing line of Dr±advati is at Chunar near Vàra¯àsi; the modern name is Rak±i].

atra màsam vased vìra sarasvatyàm yudhi±²hira
yatra brahmàdayo deva °±ayah siddha càra¯àh (MBh 3.81.3)

sarasvatì pu¯ya vahà… samudragà mahà vegà (MBh 3.88.2)

[In the north] there is Sarasvatì… she goes to the ocean, the greatly impetuous one.

tatra pu¯yatamam tìrtham plak±a avatara¯am šivam

yatra sàrasvatair i±²và gacchanty avabh°tam dvijàh (MBh 3.88.3)

There is the meritorious pilgrimage site, descending at the auspicious Plak±a [the place of the pipal tree]: there, having longed for [Sarasvatì] with the sàrasvata rites, the Bràhma¯as go and immerse themselves [or perform a purificatory ritual].

[Balarama's pilgrimage also recounts the source of Sarasvatì:]

prabhavam ca sarasvatyàh plak±a prasava¯am balah
sampràptah kàra pacanam tìrtha pravaram uttamam (MBh 9.53.11)

[While ascending the Himalaya] prominent with Sarasvatì, Balaràma (saw) Plak±a Prasrava¯a; he next reached another excellent pilgrimage site called Kàrapacava [by the Yamuna's source]. This geophysical evidence in the text is consistent with the scientific studies which have established the source of the Sarasvati from Har-ki-dun glacier close to Yamunotri. [It is notable that a people called 'parwati' (mountain-people) live in the the picturesque Har-ki-dun valley, studded with colourful flowers, and celebrate a festival venerating Duryodhana as a god, an apparent recollection of the ancient memory of the events of the Mahabharata period.]

tato hi sà sarit šre±²hà nadìnàm uttamà nadì
plak±àd devì srutà ràjan mahà pu¯yà sarasvatì
tatra abhi±ekam kurvìta valmìkan ni«s°te jale
arcayitvà pit°n devàn ašvamedha phalam labhet (MBh 3.82.5-6)

Then there is the best of streams, the topmost of rivers, flowing from Plak±a, the greatly auspicious divine Sarasvatì. One should take a bath there in the water that comes from an anthill; having worshipped the forefathers and gods, one gains the result of an ašvamedha sacrifice. (MBh 3.82.5-6) The reference to plak±a prasrava¯a (the spring of the pipal tree) occurs in *Pañcavimša Bràhma¯a*: 25.10.11-12: by means of the Sarasvatì, the gods propped the sun but she could not sustain it and collapsed; hence (the Sarasvatì) is full of bendings. They (devotees taking dìk±à) move against the stream, for it is not (possible) to reach Plak±a along the stream. This means that since Sarasvati flows from east to west, only by going against the stream can the devotees reach the Plak±a which is situated to the east. The location of Plak±a on the river stretch is indicated in *PVB* 25.10.16: at a distance of a journey of forty days on horseback from the spot where the Sarasvati is lost (in the desert-sands) (is situated) Plak±a Prašrava¯a. At the same distance from here (from the earth) (is situated) the world of heaven: they go to the world of heaven by a journey commensurate with the Sarasvatì. When they reach Plak±a Prašrava¯a they perform an i±²i (sacrifice) for Agni Kàma (*PVB* 25.10.22); at Kàrapacava they descend for the lustral bath into the Yamunà (*PVB* 25.10.23).

etat plak±àvatara¯am yamunà tìrtham ucyate
etad vainàka p°±²hasya dvàram àhur manì±i¯a« (MBh 3.129.13)

This pilgrimage site at (near) the Yamunà they call it Plak±a-avatara¯a [the descending place by the pipal tree]; this, the sages say, is the door to the vault of heaven.

Tà¯®ya Bràhma¯a mentions the distance between Plak±a prasrava¯a and Vinašana as forty four àšvinas (catuš catvàrimšad àšvìnàni: *TB.* XXV. 10.16). Äšvina is the length of journey made in a day by a horseman. *Atharvaveda* (VI.131.3) defines it as 5 yojanas plus: yad dhàvasi triyojanam pañcayojanam àšvinam. Patañjali states that an average horse goes four yojanas, while a superior one covers yojanas a day: (MB. V.3.55: *ašvoyam yaš catvàri yojanàni gacchati, ašvataro yam yo ±²au yojanàni gacchati*). One yojana is 4 krošas; one kroša is 2 miles; thus one yojana is 8 miles. (Cunningham, Alexander, *The Ancient Geography of India*, Varanasi, 1963, pp. 483-484). Monier Williams equates a yojana with 2.5 to 5 English miles. Thus the distance could be (44x4 =) 176 x 5 = 880 miles.

sarasvatì nadì sadbhih satatam pàrtha pùjità
vàlakhilyair mahà ràja yatra i±²am °±ibhih purà (MBh 3.88.9)

The river Sarasvatì is constantly worshipped by wise people; with the Vàlakhilya hymns (RV 8.49-59) there, from old and up to the present time, she is sought after by the sages.

atašca yàtvà marudhanva pàršvam sadà dhanus Veda rati pradhànàh
sarasvatìm etya nivàsa kàmàh saras tato dvaita vanam pratìyuh
(MBh 3.174.21)

Thereafter they [the five Pà¯®avas and Draupadì] went to the desert's edge, those men devoted to archery; and coming to the river Sarasvatì, sought out lake Dvaita, to settle there.

samìk±ya tàn dvaitavane nivi±²àn nivàsinas tatra tato abhijagmuh
tapo dama àcàra samàdhi yuktàs t°¯a uda pàtra àhara¯a ašma ku²²àh
(MBh 3.174.22)

On seeing them come to Dvaitavana [the Dvaita forest] and settling there, the ascetics arrived, subdued, behaved, contemplative folk, with water, straw, vessels, food, grinding stones.

plak±a ak±a rauhìtaka vetasàš ca snuhà badaryah khadiràh širì±àh
bilva iµgudàh pìlu šamì karìràh sarasvatì tìraruhà babhùvuh
(MBh 3.174.23)

Fig trees, nut tree, ròhitakas, cane, and spurges and jujubes, khadiras (*acacia catechu*), širì±as (flower of this tree is regarded as a delicacy, *acacia speciosa or sirissa or stipulata or mimosa sirissa*), bilvas *(aegle marmelos*, wood-apple), ingudas (*terminalia catappa*), *pilus (salvadora persia or careya arborea*), šamis (said to contain fire, *prospis spicigera* or *mimosa suma* used in kindling fire) and thorns covered the river Sarasvatì's banks.

àkàša nìkàša ta²àm nìpa nìvàra samkulàm
babhùva caratàm har±ah pu¯ya tìrthàm sarasvatìm (MBh 3.179.14)

Her banks having open space (at some places) or being completely filled (at other places), abounding in kadambas (= nìpa, nauclea cadamba or azadirachta indica) and wild rice (or rice growing spontaneously) [nìpa = land fertilized by alluvial silt, low ground; niwàr = a kind of hardy rice growing at high altitudes (K.)] they [the Pà¯®avas] roamed happily Sarasvatì's virtuous pilgrimage sites.

tàm yak±a gandharva maha°±ì kàntàm àyàga bhùtàm iva devatànàm
sarasvatìm prìti yutàš carantah sukham vijahrur nara deva putràh
(MBh 3.174.24)

That [feminine] is dear to the seers, Gandharvas, and Yak±as, as if obtained by the sacrifice of the gods; in a friendly disposition the associates pleasantly roamed along the Sarasvatì, the human sons of gods gave up comfort.

One should dwell for a month by the Sarasvatì, O Yudhi±²hira, where the gods led by Brahmà, the seers, Siddhas, Càra¯as, Gandharvas, Apsaràs, Yak±as, and snakes visit holy brahma-k±etra.

pu¯yam àhuh kuruk±etram kuruk±etràt sarasvatìm
sarasvatyàš ca tìrthàni tìrthebhyaš ca p°thùdakam (MBh 3.81.125)

They call Kuruk±etra holy, but holier than Kuruk±etra is the Sarasvatì, holier than the Sarasvatì are the pilgrimage sites, and holier than the pilgrimage sites is P°thùdaka.

dak±i¯ena sarasvatyà uttare¯a d°±advatìm
ye vasanti kuruk±etre te vasanti trivi±²ape (MBh 3.81.175)

With the south away from the Sarasvatì [i.e. south of the Sarasvatì], with the north away from the D°±advatì [i.e. north of the D°±advatì], those who live in Kuruk±etra live in the third (highest) heaven.

tato gaccheta dharmajña himavat sutam arbudam

p°thivyàm yatra vai chidram pùrvam àsìd yudhi±²ira (MBh 3.80.74)

[After traveling to the river Narmadà, and the southern river, and the Carma¯vatì] then one goes on to Arbuda, the son of Himalaya, where formerly there was a cleft in the earth. [Arbuda is a sacred hill in western India extending up to mahì-sàgara-sangama; this is Mount Abu in Rajasthan. (Skandapurà¯a, I.ii.2.75).

tato gaccheta dharmajña prabhàsam loka višrutam
yatra samnihito nityam svyam eva huta ašanah
devatànàm mukham vìra analo anila sàrathih (MBh 3.80.79)

Then one should go to the world-famous Prabhàsa, where the oblation-carrying fire is always present in person, the wind-driven fire, the mouth of the gods.

tato gatvà sarasvatyàh sàgarasya ca samgame
go sahasra phalam pràpya svarga loke mahìyate
dìpyamàno agnivan nityam prabhayà bharata °±abha (MBh 3.80.82)

tato dvàravatìm gacchen niyato niyata ašanah
pi¯®àrake narah snàtvà labhed bahu suvar¯akam (MBh 3.80.83)

Then after going to the confluence of the Sarasvatì with the ocean, and after obtaining a reward of a thousand cows, in the glorious world of heaven one is blazing forever with splendour like fire.
[After going from there to Varadàna] one should proceed to Dvàravatì [Dvàrakà]…

tasmims tìrthe mahà bhàga padma lak±a¯a lak±itàh
adyàpi mudrà d°šyante tad adbhutam arimdama
trišùlàk±à¯I padmàni d°šyante kuru nandana
mahà devasya sàmnidhyam tatraiva bharata °±abha (MBh 3.80.84)

In this pilgrimage site signs with lotuses are seen; even nowadays seals are seen; this is a marvelous home of faithfulness. Lotuses marked with tridents are seen there, in the presence of the great god [i.e. where K°±¯a lives].

sàgarasya ca sindhoš ca samgamam pràpya bhàrata
tìrthe salila ràjasya snàtvà prayata mànasah (MBh 3.80.85)

Having reached the confluence of the ocean and the Sindhu [one should bathe] at the pilgrimage site of the king of the water [Varu¯a].

tato vinašana gacchen niyato niyata ašanah
gacchaty antar hità yatra maru p°±²he sarasvatì

camase ca šivobhede nàgobhede ca d°šyate (MBh 3.80.118)

Then one should go to Vinašana, where the Sarasvati disappears in the desert and reappears at Camasobheda, Šivobheda, and Nàgobheda.

camas unmajjanam vipràs tatràpi kathayanty uta
prabhàsam ca udadhau tìrtham tridašànàm yudhi±²hira (MBh 3.86.17)

The bràhma¯as speak there of Camasonmajjana and, on the sea, the pilgrimage site called Prabhàsa of the thirty gods, O Yudhi±²hira.

pu¯yà dvàravatì tatra yatra àste madhu sùdanah
sàk±àd devah purà¯o asau sa hi dharmah sanàtanah (MBh 3.86.21)

There, too, is holy Dvàravatì, where Madhusudana is [residing]; he is visibly the divine Purà¯a, he indeed is eternal dharma.

prabhàsa tìrtham sampràpya pu¯yam tìrtham mahà udadheh (MBh 3.119.3)

They [the Pà¯®avas and the V°±¯is] encountered one another at the pilgrimage site of Prabhàsa, the holy site of the big ocean.

tato vinašanam ràjann àjagàma hala àyudhah
šùdra àbhìràn prati dve±àd yatra na±²à sarasvatì
yasmàt sà bharata šre±²ha dve±àn na±²à sarasvatì
tasmàt tad °±ayo nityam pràhur vinašana it ha (MBh 9.36.1-2)

Then Baladeva, O king, proceed to Vinašana, where the Sarasvatì had become lost out of contempt for Sùdras and Abhìras. Since Sarasvatì was lost out of contempt the °±is always name this place Vinašana.

e±à sarasvatì pu¯yà divyà coghavatì nadì
etad vinašanam nàma sarasvatyà višàm pate (MBh 3.130.3)

This is Sarasvatì, the auspicious, divine river with a strong stream; this is called Vinašana [the vanishing point] of Sarasvatì.

dvàram ni±àda rà±²rasya ye±àm dve±àt sarasvatì
pravi±²à p°thivìm vìra mà ni±àdà hi màm viduh (MBh 3.130.4)

O hero, it is the gateway to the Ni±àda kingdom, out of hatred for whom the Sarasvatì entered the earth, thinking, ‘they should not know (see) me.’

e±a vai camasa udbhedio yatra d°šyà sarasvatì
yatra enàm abhyavartanta divyàh pu¯yàh samudra gàh (MBh 3.130.5)

This is the Camasa spring, where Sarasvatì can be seen, and here converge into her all the divine, auspicious, ocean-bound (rivers).

d°šya ad°šyà ca bhavati bhavati tatra tatra sarasvatì
età divyàh sapta gaµgàs tri±u loke±u višrutàh (MBh 6.7.47)

Sarasvatì became at places visible and at other places invisible; the seven divine rivers [gaµgà, a generic name for river] are famous in the three worlds.

ràjan sapta sarasvatyo yàbhir vyàptam idam jagat
àhùta balavadbhir hi tatra tatra sarasvatì
suprabhà kàñcana ak±ì ca višàlà mànasa hradà
sarasvatì oghavatì suve¯ur vimala udakàh (MBh 9.37.3-4)

O king, the seven Sarasvatìs cover this universe; wherever Sarasvatì was called by persons of great energy, there she (came). Sarasvatì is Suprabhà, Kàñcanàk±ì, Višàlà, Mànasa-hradà, Oghavatì, Suve¯ù, Vimalodaka.

tato gaccheta ràjendra samgamam loka višrutam
sarasvatyà mahà pu¯yam upàsante janàrdanam (MBh 3.80.130)

Then [right before going to Kuruk±etra] one should go to the famous and greatly auspicious area of confluence with Sarasvati.

Continuity of the tradition in South India: Mujavat, Šibi, Sauvìras and Sindhu : ara²²a (a-raca¬, rà±²rika)

We have been exposed to analyses suggesting the IE and Indo-Aryan and Dravidian divides for quite some time now. A new look at the sociolinguistics of the region is warranted. See for example, the extraordinary 'content' in the sangam literature related to the so-called Aryan tradition. R. Raghava Iyengar's *Kocar: a study* (Annamalai U., 1961) refers to the Tamil tradition that *kocar* entered the Tamil land from Konka¯a and Tulu lands; so did Vè³ir from these regions.

Sangam works are replete with references to the vedic traditions and patronage by the kings...

M. Raghava Iyengar in *Vè³ir varalà-u* (1964) refers to the ancestors from Tuvarai (Dwaraka) of the soaring bronze walls, to Agastya, the pitcher sage, that VeeLir considered themselves yàdava.

This is the social history. Now, to the language problem. Tamil script was found adequate to cope with the phonetics of the spoken tongue of

that age. So, too braahmi did not evolve the script signs for the long e, the long o. Tamil 'zh' is close to 'sh' and 'L'. It s notable that the early script used for Tamil was braahmi. I have attempted to lend 'voice' to the magnificent pictorials of the script of the civilization: the unicorn, the 'device in front of the 'unicorn', the zebu and so on. I am sure these pictorials had names tagged to them which would be invoked as soon as the user of the seal or the seal impression or the tablet saw the glyph. So far, these pictorials had been dismissed as 'totem symbols'. Even if they are, what were the phonemes or sememes attached to these glyphs? I have attempted a rational approach to answering this question. The results will be published in a separate monograph.

Our civilization problems require collaborative efforts of multidisciplinary scholarship. [The following summary is based on: I. Mahadevan, Dravidian Parallel in proto-Indian Script, *Journal of Tamil* Studies, 1970, Vol. II, No. 1, Chennai, Institute of Tamil Studies]. The dynasties of Tamil land, the cèra, cò´a, pà¯®ya, are referred to as mùvèntar. The refrain is: vèntarum vè³irum [kings (primarily, cèra, cò´a) and nobles, who shared common names such as àta¬, ka¯²a¬, -mà¬]. The vè³ir who were divided into 'numbered' phratries or groups (ranging from 5 to 21; and divided into two clans, the ày, àviyar and òy, òviyar) were in control of the west and east coasts, engaged in sea-borne trade. Nacci¬àrkki¬iyar refers to the right of vè³ir to the services of vè³à³a and describes their chieftains as 'those who lived by causing (the lands) to be ploughed' vè³à³a as those who lived by ploughing the lands' (Nacc. on *Tol. Po.* 34). The six occupations of the vè³à³a are: agriculture, animal husbandry, trade, bead-making, smithy and service to the 'twice-born' (*Tivàkaram*). vè³vi connotes a yajna. It is likely that the vè³ir were exponents of the yajna. Hoysalas also styled themselves as ba³³à³as (vè³à³as Ta.)

Descended from 'fortynine generations' from the initial origin from the pitcher of a northern sage, Agastya, the vè³ir chieftains had ruled over Tuvarai (Dwaraka) of the 'soaring bronze walls' (*Pu-am*. 201). Earlier, the yàdavas had migrated from Mathura to Dwaraka on the wes coast (to escape prosecution by Jaràsanda and sišupàla). Agastya led a migration of eighteen kings, descendents of ne²umu²ia¯¯al (k°±¯a) and of eighteen families of vè³ir from Tuvaràpati (Dwaraka) to Potiyil (of Tamil land: Nacc. on Tol. Pàyiram: Poru³. 34). Chalukya are also referred to as descendants of the pitcher sage; and, are vè³ir chieftains, according to Tamil nika¯²us. vè³ir considered themselves as yàdavas. vè³ ày family are described as v°±¯ikula (àyku²i plates: T.A.S., 1,12). Thus vè³ir are linked with many dynasties of the South such as andhras, kadambas, kàkatìyas, yàdavas (Devagiri). (M. Raghava Iyengar, 1964, *vè³ir varalà-u*, 3rd. edn., Madras)

kòcar and pà¯®ya royalty were affiliates; the formeer formed the bulk of the latter's fighting forces as commanders, chieftains and nobles; kòcar and pà¯®ya royalty were affiliates. A stretch in south-east coast was controlled by pà¯®ya. kòcar migrated from kònà²u or koµku. kòcar were in four groups (nà--kòcar), perhaps exogamous phatries. kòcar are often called i³aµ-kòcar or i³aiyar or mo´i-k-kòcar kòcar served as palace attendants; so did ka³³ar and ma´avar who were called akam-u²aiyàr in the cò´a country. [i³a, ai³a, ai³ava refer to the ancestry of Kuru and Pà¯®u; moro = a stroke of a sword (Gujarati); ma´u = battle-axe; ma´ava¬ = warrior (Ta.)]. The cèra commanders pi²²a¬ and ko--a¬ were kòcar chieftains. Sangam works are replee with stories of battles between kòcar and vè³ir. At Pà´i, Miñili, the kòcar chieftain killed Ve³iya¬ Vè¯mà¬ and drove off Na¬¬a¬, both Vè³ir chieftains (*Akam*. , 208). (N. Subrahmanian, N., 1966, *Pre-Pallavan Tamil Index,* Madras; R. Raghava Iyengar, 1951, kòcar: A Study, Annamalai University; Dr. Dorai Rangaswamy, The surnames of the Sangam Age, Literary and Tribal, Madras University, 1968)

From N.N. Bhattacharyya, *The Geographical Dictionary--Ancient and Early Medieval India,* 1991, Munshiram, provides the following explanation for Mujavant, Mujavat : A people that took their name from Mujavant, a mountain in the Himalayas. they are mentioned along with the Mahavr±as, Gandhàris and Bàlhikas in AV V.22.5-14. They are also mentioned in *Taitt. Sam*. I.8.62; *Kàthaka Sam*.IX.7, XXXVI.14; *Mait. Sam*. .4.10.20; *Vàj. Sam*. III.61; *Sat. Br* II.6.2.17; *Baudh. D.S*. II.5 The following references in Macdonell and Keith, *Vedic Index*, 1958, Motilal are apposite: Mùjavant is the name of a people who, along with the mahàv°±as, the gandhàris, and the balhikas, are mentioned in the *Atharvaveda* (v.22,5.7.9.14 cf. *Baudhàyana Srauta Sùtra*, ii.5) as dwelling far away, and to whom fever is to be banished. Similarly in the yajurveda *samhitàs* (*Taittirìya S, I.8,6,2*; *Kathaka S, ix.7; xxxvi.14; Maitràya¯ì s, i.4,10.20; Vàjasneyi s, iii.61; Šatapatha b, ii.6,2,17*) the mùjavants are chosen as a type of distant folk, beyond which rudra with his bow is entreated to depart. In the RV. x.34,1 ***Soma*** is described as maujavata, 'coming from the mùjavants,' or, as Yà±ka (*Nirukta*¶, ix.8) takes it, 'from mount mùjavant.' The Indian commentators (mahìdhara on *V*àjasneyi s, loc.cit.; Šàya¯a on RV. i.161,8; *Baudhàyana Šrauta sùtra* and prayoga, cited by Hillebrandt, *Vedische mythologie,* 1,63) agree with Yà±ka in taking mùjavant as the name of a mountain, and though Hillebrandt (op.cit., 1,65) is justified in saying that the identification of mùjavant by Zimmer (*Altindisches leben,* 29) with one of the lower hills on the south-west of Kashmir lacks evidence, it is not reasonable to deny that mùjavant was a hill from which the people took their name. Yà±ka (loc. cit. cf. *Siddhànta kaumudì on Pà¯ini,* iv.4,110, where instead of maujavata in RV x.34, maunjavata is read) suggests that mùjavant is equivalent to munjavant, which actually occurs later, in the epic

(*Mahàbhàrata,* x.785; xiv,180) as the name of a mountain in the Himàlaya.

tato muñjava²am nàma mahàdevasya dhìmatah
upo±ya rajanìmekàm gà¯apatyamavàpnuyàt
kuruk±etrasya taddvàram višrutam pu¯yavardhanam
pradak±i¯amupàvartyam bràhma¯ànbhojayettatah

(*Vàmana P., Sm.,* 13.38 and 41) [Vinašana was the gate towards the ni±àdarà±²ra, cf. *MBh. Vana,* 130.4 cited above).

Cola kings were also considered to have descended from the north Indian king Šibi the munificent of *Mahàbhàrata* fame (*Pu°a.* 39; 43).

Šibis are also called mùjavatas who occupied the areas of Jind, Hisar and Sirsa in the narrowing doab of the rivers Sarasvatì and D°±advatì. (O.P. Bharadwaj, 1991).

The Pà¯®yan kings equalled the Colas in the promotion of Vedic studies and rituals. One of the greatest of Pà¯®ya rulers, Muduku®umi Peruvazhuti is described to have carefully collected the sacrificial materials prescribed in vedic and dharmašàstra texts and performed several sacrifices and also set up sacrificial posts where the sacrifices were performed (*Pu°a.* 2; 15). The Pà¯®ya rulers prided themselves as to have descended from the Pà¯®avas, the heroes of Mahàbhàrata (*Pu°a.* 3; 58; *Akanà¬ù°*u 70; 342)… (Balaràma) is mentioned as the elder brother of Lord K°±¯a, as fair in colour, wearing blue clothes, having the palmyra tree as his emblem and holding the plough as his weapon, all in line with the purà¯as (*Paripà²al* 2. 20-23; *Pu°a*. 56. 3-4; 58.14; *Kali.* 104, 7-8). Cf. An important article on the antiquity of relation between Tamil and Sanskrit: Sharma, K.V. 1983. "Spread of Vedic culture in ancient south India" *Adyar Library Bulletin* 47:1-1

The weavers [***kòlika*** (Skt.)**,** ***kò²ikar*** (Ta.)] who adorned [***kòla*** ornament, decoration (Ka.)] the civilization, miners who worked on mineral ores in the Khetri copper belt (close to the Sarasvatì river), the Vedic people who lived on the banks of the Sarasvatì river (smelting ***soma,*** electrum) and the Harapppan people who lived on the banks of the Sindhu river coexisted in a shared economic system, for over a millennium from the proto-historic period circa 3000 B.C.

During the *Rigvedic* period, the Sarasvatì river was flowing into sàgara; during the period when *Mahàbhàrata* episodes occurred, the river had dried up in the sands of the desert. Clusters of hundreds of archaeological sites discovered along the banks of the river, help establish the date of drying-up of the river.

Co³a kings claim descent from Šibi the munificent.

Mujavat is a region close to the Sarasvatì river, possibly in Rajasthan. This is the place from which the ***Soma*** is brought by sellers to be sold to the °gvedic artisans performing the ***Soma*** yajña. (Elsewhere, it has been argued that ***Soma*** was electrum (silver-gold compound or quartz containing pyrite ores mixed with gold/silver; cf. the author's Indian Alchemy, ***Soma*** in the Veda (in press). From N.N. Bhattacharyya, *The Geographical Dictionary--Ancient and Early Medieval India*, 1991, Munshiram, provides the following explanation for Mujavant, Mujavat : A people that took their name from Mujavant, a mountain in the Himalayas. they are mentioned along with the Mahavrsas, Gandhàris and Bàlhikas in AV V.22.5-14. They are also mentioned in *Taitt. Sam*. I.8.62; *Kàthaka Sam*.IX.7, XXXVI.14; *Mait. Sam*. .4.10.20; *Vàj. Sam*. III.61; *Sat. Br* II.6.2.17; *Baudh. D.S*. II.5 The following references in Macdonell and Keith, *Vedic Index*, 1958, Motilal are apposite: Mùjavant is the name of a people who, along with the mahàv°±as, the gandhàris, and the balhikas, are mentioned in the *Atharvaveda* (v.22,5.7.9.14 cf. *Baudhàyana Srauta Sùtra*, ii.5) as dwelling far away, and to whom fever is to be banished. Similarly in the yajurveda *samhitàs* (*Taittirìya S, I.8,6,2*; *Kathaka S, ix.7; xxxvi.14; Maitràya¯ì s, i.4,10.20; Vàjasneyi s, iii.61; Šatapatha b, ii.6,2,17*) the mùjavants are chosen as a type of distant folk, beyond which rudra with his bow is entreated to depart. In the RV. x.34,1 ***Soma*** is described as maujavata, 'coming from the mùjavants,' or, as Yà±ka (*Nirukta¶*, ix.8) takes it, 'from mount mùjavant.' The Indian commentators (mahìdhara on *V*àjasneyi s, loc.cit.; Šàya¯a on RV. i.161,8; *Baudhàyana Šrauta sùtra* and prayoga, cited by Hillebrandt, *Vedische mythologie*, 1,63) agree with Yà±ka in taking mUjavant as the name of a mountain, and though Hillebrandt (op.cit., 1,65) is justified in saying that the identification of mùjavant by Zimmer (*Altindisches leben*, 29) with one of the lower hills on the south-west of Kashmir lacks evidence, it is not reason able to deny that mUjavant was a hill from which the people took their name. Yà±ka (loc. cit. cf. *Siddhànta kaumudì on Pà¯ini*, iv.4,110, where instead of maujavata in RV x.34, maunjavata is read) suggests that mùjavant is equivalent to munjavant, which actually occurs later, in the epic (*Mahàbhàrata*, x.785; xiv,180) as the name of a mountain in the Himàlaya.

Would it be reasonable to search for names of mountains proximate to the banks of the sarasvati river, i.e. south of the Sarasvatì-D°±advatì in Rajasthan (Jawar mines) or south of the Sutlej, not too far from gandhàra? If so, could it be a mountain in the Khetri copper belt in Rajasthan?

RV 1.32.12 extols Indra for letting the seven rivers flow*: avàs°jas sartave saptà sindhùn*; RV 1.71.1 states that all offerings wait upon Agni 'as the seven mighty rivers seek the ocean: samudram na sravatas sapta yahvìh; RV 7.71.1 refers to the sun illuminated the eright quarters, the three

desert regions and the seven rivers: *a±²au vyakhyat kakubhah p°thivyàs trì dhanva yojanà sapta sindhùn.* RV 8.24.27 designates sapta-sindhu as a country watered by seven rivers: *ya °k±àdamhaso mucadyo vàryìt saptasindhu±u vadhardà sasya tuvin°m¯a nìnamah*: 'who would free (us) from ruinous woe or from the àrya (enemy) in the seven rivers; thou O valiant hero, bend the Dàsa's weapon (down).' This naming of the country is comparable to the Avesta referring to the Hapta-Hindu as a country once inhabited by Aryans, cf. Vendidad i.19. (Sardesai, N.G., The land of seven rivers in: Macdonell, A.A., M.A.Stein, B.G.Tilak, A.B.Keith, T.W.Rhys Davids, G.A.Grierson, V.A.Smith and various other oriental scholars, 1977, *Commemorative Essays,* Delhi, Nag Publishers, Repr. 1977, pp. 93-96). Pischel (*Vedische Studien*, vol. Ii, p.218, 1892) identified the àpaya of RV iii.23.4 with the àpagà assigned by the *Mahàbhàrata* to Kuruk±etra. Thus he refers to the Sarasvatì, D°±advatì and the Äpayà as the three principal rivers of the region. Bhàratas were °±is who were settled in the Kuruk±etra and had come to the Vipàs and Sutudri from a distance, i.e. from the east. (RV. iii.33.10). It would be correct to say that Vedic poets were well acquainted with Kuruk±etra. Indra cut [**aradat** (Skt.); **a°u-ttal** (Ta.)] the channels for the rivers as Beas and Sutlej (RV iii.33.6). 'The bàr or waste land between the Ravi and Chenab, now irrigated and colonized, does not seem to have always been such a barren waste as it was recently. The area contains a large number of 'theha' mounds strewn with pottery which indicate the sites of well-populated villages.' (Deva Singh, Colonization in the Rechna Doab, p.6, Monograph No. 7, *Punjab Government Record Office Publication*, loc. cit. Woolner, A.C., 1931, The *Rgveda and the Punjab*, in: Bloch, J., J. Charpentier and R.L. Turner eds., *Indian Studies, Volume in Honour of Edward James Rapson*, Delhi, Sri Satguru Publications, Repr. 1985 from the Bulletin of the School of Oriental and African Studies).

"While on the one hand (kuruk±etra) was equated with uttara-vedi of brahmà and called brahmàvarta, on the other hand the yak±as named tarantuka, arantuka, macakruka and kapila were placed at its four corners which, even if not clearly identified, restricted it virtually to a tract between the Sarasvatì and the D°±advatì. Plak±àvatara¯a to the north of Jagadhdari, V°ddhakanyaka tìrtha in the upper reaches of the Sarasvati-Ghaggar somewhere below Plak±aprasrava¯a or lavàsà in pacchà® and muñjava²a near Jind acquired the position of gates to the land of kuruk±etra." (Bharadwaj, O.P. opcit., p. 10).

Šibis are also called mùjavatas who occupied the areas of Jind, Hisar and Sirsa in the narrowing doab of the rivers Sarasvatì and D°±advatì, the land fashioned by gods, devanirmitam.

tarantukàrantukayoryadantaram ràmahradànàm ca macakrukasya ca
etat kuruk±etra samantapañcakam prajàpater uttaravedirucyate

(MBh., Šalya 52.20)

adya càtra nivatysyàmah k±apàm bharatasattama
dvàrametattu kaunteya kuruk±etrasya bhàrata
etatplak±àvara¯am yamunàtìrthamuttamam
etadvainàkap°±²hasya dvàramàhurmanì±i¯ah (MBh., Vana, 129.11 and 13)

samantapañcakadvàràt tato ni±kramya màdhavah
papracchar±iga¯àn ràmah kuruk±etrasya yatphalam (MBh. Šalya, 51.25)

[V°ddhakanyàka is Sàrasvata tìrtha, cf. Devala cited in k°tyakalpataru of bha²²a lak±mìdhara, ed. K.V. Rangaswami Aiyangar, G.O.S., Baroda, 1942, p. 250: plak±apràsrava¯am v°ddhakanyàkam sàrasvatamàdityatìrtham kauberam vaijayantam p°thùdakam naimi±am vinašanam vamšotbhedam prabhàsamiti sàrasvatàni).

The words such as *s*aµgam, cakkaram, va³ai, kalai are emphatically common occurrences in the spoken dravidian and Pràk°ts. There has been an extraordinary assimilation of words from the Pràk°ts into literary texts across the sub-continent which can be explained by a hypothesis of a linguistic area which is a continuing legacy from the Sarasvatì-Sindhu civilization. Cetiya (Skt. caitya) in Buddhism means a sacred spot or edifice or sanctuary popularly worshipped. Most places commemorated a name or relic. Gautama-nyagrodha caitya refers to a nyagrodha tree shrine. Tree worship is abundant in Buddhist art and literature. Bàrhut stùpa, Sàñci stùpa represent tree relics worshipped by the people. Ce²²u or ce®i (Telugu, Tamil) refers to a tree. The bodhi tree used by the Buddhas was fit for a shrine.

Sora, Co³a

Ašoka's rock edicts II and XIII refer to pracha¶ta dešas: including co®a as the unconquered kingdom (a¶tà avijità) along with pà¯®ya, satiyaputra (kùpaka), keralaputra, tambapa¯¯i and the realm of amtiyako yonaràjà (Antiochus Theos). Co³a or co®a is Tamil Sora and is perhaps identical with Sora of Ptolemy. The co³a capital was Uraiyur (Urgapura) with principal port at Kàviripa²²a¯am or pukàr on the northern bank of the kàveri river. (Law, Bimala Churn Law, 1932, *Geography of early Buddhism*, London, Kegal Paul, Trench and Trubner and Co., p. 63) Godavari river is sourced at Brahmagiri situated on the side of a village called T°yamvaka, 20 miles from Nàsika.

Melakkha

Mleccha trade was first mentioned by Sargon of Akkad (Mesopotamia 2370 B.C.) who stated that boats from Dilmun, Magan and Meluhha came to the quay of Akkad (Hirsch, H., 1963, Die Inschriften der Konige Von Agade, *Afo*, 20, pp. 37-38; Leemans, W.F., 1960, *Foreign*

Trade in the Old Babylonian Period, p. 164; Oppenheim, A.L., 1954, The seafaring merchants of Ur, *JAOS*, 74, pp. 6-17). The Mesopotamian imports from Meluhha were: woods, copper (ayas), gold, silver, carnelina, cotton. Gudea sent expeditions in 2200 B.C. to Makkan and Meluhha in search of hard wood. Seal impression with the cotton cloth from Umma (Scheil, V., 1925, Un Nouvea Sceau Hindou Pseudo-Sumerian, *RA*, 22/3, pp. 55-56) and cotton cloth piece stuck to the base of a silver vase from Mohenjodaro (Wheeler, R.E.M., 1965, *Indus Civilization*) are indicative evidence. Babylonian and Greek names for cotton were: sind, sindon. This is an apparent reference to the cotton produced in the black cotton soils of Sind and Gujarat. *Ch. Upa.* Refers to k±etram *àyatanàni (Ch. Up.* 181.12), fields and houses indicating instances of private wealth (rayi).

Mleccha in Pali is milakkha or milakkhu to describe those who dwell on the outskirts of a village. (Shendge, Malati, 1977, *The civilized demons: the Harappans in Rigveda*, *Rigveda*, Abhinav Publications). A milakkhu is disconnected from vac and does not speak Vedic; he spoke Prakrt. " *na àryà mlecchanti bhà±àbhir màyayà na caranty uta:* aryas do not speak with crude dialects like mlecchas, nor do they behave with duplicity (MBh. 2.53.8). a dear friend of Vidura who was a professional excavator is sent by Vidura to help the Pà¯®avas in confinement; this friend of Vidura has a conversation with Yudhisthira, the eldest Pà¯®ava: *"k°±¯a pak±e caturdasyàm ràtràv asya purocanah, bhavanasya tava dvàri pradàsyati hutàsanam, màtrà saha pradagdhavyàh pà¯®avàh puru±ar±abhàh, iti vyavasitam pàrtha dhàrtarà±²ràsya me šrutam, kiñcic ca vidurenkoto mleccha-vàcàsi pà¯®ava, tyayà ca tat tathety uktam etad visvàsa kàra¯am*: on the fourteenth evening of the dark fortnight, Purocana will put fire in the door of your house. 'The Pandavas are leaders of the people, and they are to be burned to death with their mother.' This, Pàrtha (Yudhi±²ira), is the determined plan of Dh°tarà±²ra's son, as I have heard it. When you were leaving the city, Pandava, Vidura spoke a few words to you in the dialect of the **mlecchas**, and you replied to him, 'So be it'. I say this to gain your trust.(*MBh.* 1.135.4-6). This passage shows that there were two Aryans distinguished by language and ethnicity, Yudhisthira and Vidura. Both are aryas, who could speak mlecchas' language; Dh°tarà±²ra and his people are NOT aryas only because of their behaviour.

A series of articles and counters had appeared in the *Journal of the Economic and social history of the Orient,* Vol.XXI, Pt.II, Elizabeth C.L. During Caspers and A. Govindankutty countering R.Thapar's dravidian hypothesis for the locations of Meluhha, Dilmun and Makan; Thapar's A Possible identification of Meluhha, Dilmun, and Makan appeared in the journal Vol. XVIII, Part I locating these on India's west coast. Bh. Krishnamurthy defended Thapar on linguistic grounds in Vol. XXVI, Pt. II: *mel-u-kku =3D highland, west; *teLmaN (=3D pure earth) ~ dilmun;

*makant =3D male child (Skt. vìra =3D male offspring. Have there been any further explorations on these lines to locate Meluhha? [K. Karttunen (1989). India in Early Greek Literature. Helsinki, Finnish Oriental Society. *Studia Orientalia.* Vol. 65. 293 pages. ISBN 951-9380-10-8, pp. 11 ff et passim. Asko Parpola (1975a). Isolation and tentative interpretation of a toponym in the Harappan inscriptions. Le dechiffrement des ecritures et des langues. *Colloque du XXXIXe congres des orientalistes*, Paris Juillet 1973. Paris, Le dechiffrement des ecritures et des langues. Colloque du XXXIXe congres des orientalistes, Paris Juillet 1973. 121-143 and Asko Parpola (1975b). "India's Name in Early Foreign Sources." *Sri Venkateswara University Oriental Journal*, Tirupati, 18: 9-19.]

What is the Prakrt language of the Melakkhas, the language which Vidura spoke? It is possibly **Kutchi**. Mlecchas resided in the Kutch region as seen from the evidence of *Mahàbhàrata*: Mlecchas lived on islands: *"sa sarvàn mleccha n°patin sàgara dvìpa vàsinah, aram àhàryàm àsa ratnàni vividhàni ca, andana aguru vastrà¯i ma¯i muktam anuttamam, àñcanam rajatam vajram vidrumam ca mahà dhanam:* (Bhima) arranged for all the mleccha kings, who dwell on the ocean islands, to bring varieties of gems, sandalwood, aloe, garments, and incomparable jewels and pearls, gold, silver, diamonds, and extremely valuable coral… great wealth." (*MBh.* 2.27.25-26).

We seem to be dealing with spoken dialects (Pràk°ts) which should be differentiated from the literary version of the linguistic area evidenced from vedic Sanskrit and saµgam Tamil.

The words mleccha, prakrti do not occur in the *Rigveda*.

Phonological: the sound L in the *Rigveda* corresponds to D in later dialects; *Rigveda* has r while the later dialects have both l and r. The accusative plural in vedic uses r after aa, ii, uu while the later dialects have only aan, iin, uun.

Accent: brahman, a neuter, action noun and brahmaan, a masculine, agent noun are different in meaning though derived from the same root. The positioning of an accent also determines if a compound is a tat-purusha or a bahu-vriihi.

Morphological: the dual number in nominal declension is restricted in vedic to natural pairs or to two gods invoked together, while in later dialects it is used whenever two items are being referred to. Vedic has asme (RV 10.17.8) instead of asmabhyam or asmaasu. Subjunctive aorist is present in RV 7.95.4: Sravat does not occur in later dialects.

Bh°gu-kutcha means 'high coast land'. It is identical with Barygaza of Ptolemy (pp. 38 and 152) and the Periplus of the Erythrean Sea (pp.

40 and 287) and the modern Broach in Kathiawar. Roruka of Sauvìra may be identical with Alor, an old city of Sindh. Cunningham, however, identifies Sovìra with Eder, a district in the provinces of Gujerat at the head of the Gulf of Cambay. The term sindhu-sauvìra suggests the location of sovìra beyond the Indus. In Pali literature, the assaka country was situated on the banks of the Godàvarì (*Sutta Nipàta*, 977). Pà¯ini refers to a±maka (Assaka) in the context of dak±inàtya (IV.2.98) and Kalinga (IV.1.178). Bràhma¯as use the term da¯®akabhoja indicating the proximity of bhojaka²a (perhaps, Bhojapura, the second capital of Vidarbha or modern Berar). The Mahàvamsa (pp. 166, 197 ff.) states that the dami³as once invaded lankà coming from the co³a country.

Marutam

Maru is the Sanskrit name of the desert that lies between the Indus-Sarasvati river valleys of south Asia. It is also called thar in India and thal in Pakistan.

For a maritime civilization, a zone exterior to the habitation is the marsh, the inundated area, and by extension, the sea. The recent geological studies and analysis of satellite images show the tracts of sub-soil water-channels in the thar desert and the channels of the dry-beds of the 'lost' sarasvati river which merge with the hakra [(cf. sàgara = ocean (Sanskrit)] channels in to the Rann of Kutch and the possibility that these zones were lush with alluvium brought in by the Sarasvati River, supported agriculture and hence, habitations in ancient times (circa 3000 B.C.)

<u>Jaina and Tamil traditions</u>

In the Jaina tradition, Sarasvatì is the supreme deity of knowledge and learning: the švetàmbaras hold special festivals to honour her on the jñànapañcami day, i.e. the fifth day of the bright fortnight in the month of kàrttikà; the digambaras celebrate šrutapañcami on the fifth day of the bright half of jye±²ha. Jainas also observe šrutadevatà-tapas, šrutaskanda-vratas, šrutajñàna-vratas and šruta-bhaktis. The vidyànuvàdàµga-jìnendra-kalyà¯àbhyudaya refers to Sarasvatì as bràhmì. As bhà±à she is described as white in complexion, riding on a swan, showing the pàša, the lotus, the book and the abhaya-mudrà in her four hands. *(Jinendra-kalyà¯àbhyudaya* MSS. Folio 23. Loc. cit. Shah, U.P., 'Iconography of the Jaina goddess Sarasvatì, *Journal of the University of Bombay*, Sept. 1941, p.207). Buddhist iconography depicts Sarasvatì as vajrasarasvatì, vajravì¯à sarasvatì, vajrašàradà and mahàsarasvatì. The earlies image comes from Gha¯²asàla in Andhra Pradesh, dated to circa 2nd century B.C. Sarasvatì is adored in the purà¯as, the àgamas, the šilpa texts and tantras and known by various names: vàgìšvarì, bhàratì, šàradà.

Continuity and Legacy

Vivid pictorial images attest to the continuity of the civilization in India.

The so-called 'mother goddess' image of the civilization with a unique head-gear (two lamp-cups) is mirrored in the image of a 'dancing girl' of Bulandbagh, Patna Museum (dated to 3rd cent. B.C.)

The toy cart of the civilization is identical to the cart used in Sindh in 1930s.

The 'dancing girl' bronze image wearing bangles from the wrist right up to the shoulder is mirrored in the traditions followed even today, by women in Rajasthan and other places in India.

The image of the 'priest' wearing an embroidered shawl is mirrored in the later-day traditions of wearing the uttariyam leaving the right shoulder bare.

Reference to seals occurs in the *Mahàbhàrata* in a region close to the Hakra joining the ocean (Rann of Kutch):

tasmims tìrthe mahà bhàga padma lak±a¯a lak±itàh
adyàpi mudrà d°šyante tad adbhutam arimdama
trišùlàk±àni padmàni d°šyante kuru nandana
mahà devasya sàmnidhyam tatraiva bharata °±abha (MBh 83-84)

[In this pilgrimage site of Dvàravatì] signs with lotuses are observed; even nowadays seals are seen; this is a marvellous home of faithfulness. Lotuses marked with tridents are seen there, in the presence of the great god (i.e. where K°±¯a lives).

Hart, G.L., *The relation between Tamil and classical Sanskrit literature*, Wiesbaden 1976. Speaking of the relations between Dravidian (Tamil) and Sanskrit, Hart remars in an *internet* message (1995): "Actually, Sanskrit has many Dravidian syntactic features as well as loan words from Dravidian. A few of these are very old -- even as old as the Rig Veda. Clearly, Sanskrit came to be spoken as a second language by Dravidian speakers, and, as is common in such situations, these speakers transferred syntax from their native languages into the new language. Such features include the use of api, of iti, and of evam, and also, I believe, of certain compounds. These ARE Indo-European words, not Dravidian, but their usage is equivalent to similar particles in Dravidian languages (e.g. Tamil -um, enRu, taan). Prof. Murray Emeneau has written at length on this phenomenon. The North-Indian Indo-Aryan languages are even more akin syntactically to Dravidian languages. I have tried to show that many of the major conventions of Sanskrit

literature, and especially of poetry, come from a Dravidian poetic tradition (e.g. the messenger poem such as Meghaduta, the idea of lovers suffering in separation during the monsoon, etc. etc.). The fact is, it is not possible to talk about Sanskrit as a separate "non-Dravidian" tradition -- the truth is far more complex. Presumably, the people who adopted Sanskrit (or something akin to it) in North India didn't have a highly developed literature -- there are still some Dravidian languages in N. India like that. On the other hand, history is full of cultivated languages that have been replaced by less developed newer ones -- e.g. Elamite speakers started speaking Persian and Elamite disappeared. People tend to speak whatever language gives them influence, prestige, and the ability to survive -- to some extent, English has this function in modern India (at least in some parts, e.g. IIT's). Most areas of the earth have changed their anguage 3 times in historical times (at least this is what I learned in a linguistics class at Harvard a long time ago). I wouldn't say Sanskrit is Dravidian -- it isn't. But it has many intriguing "Dravidian" features not found in other (non-Indian) Indo-European languages. (Retroflexes, for example -- called murdhanya in Skt). This stuff is interesting, isn't it? One of the most intriguing contributions of the Tamil area to Sanskrit is the Bhagavatapurana. It is pretty universally agreed that it was written by a Tamilian and that it is filled with motifs and themes from the Divyaprabandha and other Tamil literature. Its author also uses "Vedic" forms -- sometimes incorrectly! -- to try to make it sound old and hoary. This work has catalyzed Bhakti movements all over India and is, arguably, one of the most important works in the Sanskrit language. An example of a Tamilism is the word avamocana, "inn." This occurs nowhere else in Sanskrit -- it is clearly a translation of Tamil vi²uti. On the other hand, the greatest poet of all Indian literature, Kampan, took his story from Sanskrit. There has been an enormously productive interchange between Sanskrit and Tamil.

Aklujkar comments on these observations, again in a message on the *internet:* ‘While I agree with the thrust (the two linguistic traditions are much closer for a longer time than most introductory books depict) of Hart's views, it seems important to me to bear in mind that much of recent research points toward the desirability of assuming a 'linguistic area' in India from a very early time -- an area in which languages belonging to different families had begun to share each other's features. In this situation, it is not as easy to determine syntactic borrowings and borrowings of literary conventions as Prof. Hart seems to have assumed.’

Agastya

‘The earliest (geographical stratum) finds him lodged in the Agastyàšrama, a few miles north of Nàsik, the ancient Pañcava²ì, on the northern borders of the Da¯®akàra¯ya forest. His marriage to lopàmudrà,

the daughter of the Vidarbha king and Rama's first interview with him take place here. The second stratum begins with his residence at Malakù²a, three miles east of BaDami (the ancient Vàtàpipura) otherwise known as Dak±i¯akàši, in the Kaladgi district of Bombay Presidency (about 300 miles down south of Nàsik). Agastya's eating up Vàtàpi and his destruction if Ilvala (known also as Vilvala) may be referred to this period of his sojourn in the south. The third stratum of stories gathers round him at Pothiyil, known also as Malaya, one of the southernmost promontories of the western ghats, in the Pà¯®ya country… he is credited with having founded the first Tamil academy and having presided over it, besides writing an extensive Tamil grammar and sundry other works on medicine, mysticism, and even magic… *Paripà²al* (11th, dated circa 372 A.D.) refers to star canopus: potiyi¬ mu¬iva¬ puravarai kì°i… a Buddhist tratiton that Avalòkitèšvara, a buddhist sage was residing in podalaga or pothiyil mountain… In stanza 166 of pu°a¬à¬ù°u, the poet Avùr Mùlamki³àr praises one Pùñcà°°ùr Pàrppà¬ Ka¯¯iya¬ Vi¬¬antàya¬ for performing the twenty-one yàgas, not being misled therein by the false preachings of the heretical secaries… (One of the traditions) refers to Agastya bringing with him eighteen families of kings, vè³irs and aruvà³ars from Tuvaràpati, the modern Dwàrasamudram in the Mysore State, and the other to Parašuràma peopling Kerala with colonists from the banks of the Godavari and the Kri±¯a. The Travancore State Manual in page 213 refers to the latter tradition thus: 'The new land was not fit for habitation; the settling down had not been completed. The quaking did not cease, so the Purà¯a says: hence Parašuràma sprinkled some gold dust and buried coins and thus formed a treasure-trove which stopped the quaking of the land. He prepared a great yàgam (sacrifice) at Varkala for the same purpose. Thereafter Parašuràma brought colonies of Brahmins from the north, from the banks of the Kri±¯a, the Godàvari, the Narmadà, the Kàveri and from Madura, Mysore and Mahàrà±²ra and from many other places and peopled Keralam. The brahmin colonists so brought belonged to eight gotrams or families… The following quotations from Pu°anà¬ù°u:

i°aiñcuka perumani¬ ce¬¬ì ci°anta

nà¬ ma°ai mu¬iva rèntukai yetirè (6: Kàriki³àr)

àvu mà¬iya° pàrppa¬a màkka³um (9: Ne²²imaiyàr)

pàrppàrt tappiya ko²umaiyòrkkum (34: Älattùrkki³àr)

… ni¬ mu¬¬ò rellàm pàrppàr nòva¬a ceyyalar (43: Tàmappalka¯¯anàr)

[Sivarajapillai, K.N., *Agastya in the Tamil Land*, Delhi, Asian Educational Services, repr. 1985].

An important article on the antiquity of relation between Tamil and Sanskrit is: Sharma, K.V. 1983. "Spread of Vedic culture in ancient

south India" *Adyar Library Bulletin* 47:1-1. "Among the interesting facts that emerge from a study of the progressive spread of vedic culture from the North-West to the other parts of India, is its infusion, with noticeable intensity, in the extreme south of India where, unlike in other parts, a well-developed Dravidian culture was already in vogue… *Tolkàppiyam* which is the earliest available work of the saµgam classics, is a technical text in 1610 aphorisms, divided into three sections, dealing respectively, with phonetics, grammar and poetics… The other available saµgam works are three sets of collected poems, being, *pattu-ppà²²u* (Ten idylls), *e²²u-ttokai* (Eight collections) and *patinekì³ka¯akku* (eighteen secondary texts), which last appears to pertain to the late period of the saµgam age. The ten poems are: *tirumurukà°°uppa²ai, poru¯arà°°u-ppa²ai, ci°upà¯à°°uppa²ai, perumpà¯à°°uppa²ai, mullaippà²²u, maturaikkàñci, ne²unelvà²ai, kuriñcippà²²u, pa²²inappàlai* and *malaipa²uka²àm*. All the above idylls are compositions of individual poets, and, except for the first, which is devotional and possibly, pertains to late saµgam age, are centred round the royal courts of the Cera, Cola and Pà¯®ya kings, depicting the contemporary elite scholarly society and youthful life. The second category consists of Eight collections: *na°°I¯ai, ku°untokai, aiµku°unù°u, pati°°ujppattu, paripà²al, kali-ttokai, akanà¬ù°u* and *pu°anà¬ù°u*. All these collections are highly poetic and self-contained stray verses of different poets put together in consideration of their contents. The third category consists of eighteen miscellaneous texts, some of them being collections of stray verses of different poets and some composed by individual authors. They are: *tirukku°a³, nàla²iyàr, pazhamozhi, tirika²ukam, nà¬ma¯ikka²ikai, ci°upañcamùlam, elàti, àcàrakòvai, mutumozhi-kkàñci, kalavazhi-nà°patu, initu-nà°patu, ti¯aimàlainù²²aimpatu, ainti¯ai-y-ezhupatu, kainnilai, ainti¯ai-yanpatu, ti¯aimozhi-y-aimpatu* and *kà°-nà°patu*. The verses in these works also refer to social customs and local soverigns. The above works picture a well-knit and well-developed society having a distinct identity of its own. The frequent mention, in saµgam poems, of the Cera, Cola and Pà¯®ya kings as the munificent patrons of the poets… and the archaeological evidence provided by 76 rock inscriptions in Tamil-Bràhmi script which corrobate the contents of the saµgam works, in 26 sites in Tamilnadu (Mahadevan, I., Tamil Brahmi inscriptions of the Sangam age, *Proc. Second International Conference Seminar of Tamil Studies*, I, Madras, 1971, pp. 73-106) help to fix the date of the classical saµgam classics in their present form to between 100 B.C. and 250 A.D… reference to the Pà¯®yan kingdom by Megasthenes, Greek ambassador to the court of Candragupta Maurya (c. 324-300 B.C.) are also in point. On these and allied grounds, the saµgam period of Tamil literature might be taken to have extended from about the 5th century B.C. to the 3rd century A.D… It is highly interesting that saµgam literature is replete with references to the vedas and different facets of vedic literature and culture, pointing to considerable appreciation, and literary, linguistic and cultural fusion of vedic-sanskrit culture of the north with the social and religious pattern of life in south India when the

saµgam classics were in the making… The vedas and their preservers, the bràhmans, are frequently referred to with reverence (*Pu°anà¬ù°u* 6, 15 and 166; *Maturaikkàñci* 468; *tiruka²ukam* 70, *nà¬ma¯ikka²ikai* 89, *initu-nà°patu* 8). The vedic mantra is stated as the exalted expressions of great sages (*Tolkàppiyam*, Poru³ 166, 176). While the great God Šiva is referred as the source of the four vedas (*Pu°a.* 166), it is added that the twice-born (bràhman) learnt the four vedas and the six vedàµgas in the course of 48 *years (Tiru-murukà°°uppa²ai,* 179-82). The vedas were not written down but were handed down by word of mouth from teacher to pupil (*Ku°untokai* 156), and so was called ke³vi (lit. what is heard, šruti)(*Pati°°ippattu* 64.4-5; 70.18-19; 74, 1-2; *Pu°a.* 361. 3-4). The bràhmans realized God through *the vedas (Paripà²al 9. 12-13) and recited loftily in vedic schools (Maturaikkàñci* 468-76; 656)… the danger to the world if the bràhman discontinued the study of the veda is stressed in *tirukku°a³* 560. If the saµgam classics are any criteria, the knowledge and practice of vedic sacrifices were very much in vogue in early south India. The sacrifices were performed by bràhmans strictly according to the injunctions of the vedic mantras (*tirumurukà°°uppa²ai* 94-96; *kalittokai* 36). The three sacred fires (*gàrhapatya, àhavaniya* and *dak±inàgni*) were fed at dawn and dusk by bràhmans in order to propitiate the gods (*Kalittokai* 119l *Pu°a.* 2; 99; 122; *Ku°iñcippà²²u* 225). *Paripà²al* 2. 60-70 stipulates, in line with vedic sacrificial texts, that each sacrifice had a specific presiding deity, that pašus (sacrificial animals) were required for the sacrifice and that the sacrificial fire rose to a great height. The vedic practice of placing a tortoise at the bottom of the sacrificial pit is referred to in Akanà¬ù°u 361… *Pati°°uppattu* 64 and 70 glorify the Cera king Celvakka²uµkovazhiyàta¬ who propitiated the gods through a sacrifice performed by learned vedic scholars and distributed profuse wealth amongst them. Another Cera king, Perum-ceral Irumpo°ai is indicated in Pati°°uppattu 74 to have performed the Putrakàme±²I sacrifice for the birth of his son I³amceral irumpo°ai. The Cola ruler Peru-na°ki³³I was renowned as Ràjasùyam vè²²a colan for his having performed the ràjasùya sacrifice; another Cola ruler Na°ki³³i, too, was celebrated as a sacrificer (*Pu°a.* 363; 400). The Cola kings were also considered to have descended from the north Indian king Šibi the munificent of *Mahàbhàrata* fame (*Pu°a.* 39; 43). The patronage accorded to vedic studies and sacrifices is illustrated also by the descriptive mention, in *Pu°a.* 166, of a great vedic scholar Vi¯¯antàya¬ of the Kau¯®inya-gotra who lived at Pùñjà°°ùr in the Cola realm under royal patronage. It is stated that Vi¯¯antàya¬ had mastered the four vedas and six vedàµgas, denounced non-vedic schools, and performed the seven pàkayajñas, seven ***Soma***-yajñas and seven havir-yajñas as prescribed in vedic texts. The Pà¯®yan kings equalled the Colas in the promotion of Vedic studies and rituals. One of the greatest of Pà¯®ya rulers, Muduku®umi Peruvazhuti is described to have carefully collected the sacrificial materials prescribed in vedic and dharmašàstra texts and performed several sacrifices and also set up sacrificial posts where the sacrifices were performed (*Pu°a.* 2; 15).

Maturaikkàñci (759-63) mentions him with the appellation pal-šàlai (pal-yàga-šàlai of later Ve³vikku®I and other inscriptions), 'one who set up several sacrificial halls'. The Pà¯®ya rulers prided themselves as to have descended from the Pà¯®avas, the heroes of Mahàbhàrata (*Pu°a.* 3; 58; *Akanà¬ù°*u 70; 342)… God Brahmà is mentioned to have arisen, in the beginning of creation, with four faces, from the lotus navel of God Vi±¯u (*Paripà²al* 8.3; *Kalittokai* 2; *Perumpà¯à°°uppa²ai* 402-04; *Tirumurukà°°uppa²ai* 164-65; *Iniyavai-nàrpatu* 1). It is also stated that Brahmà had the swan as vehicle (*Innà-nàrpatu* 1). Vi±¯u is profusely referred to. He is the lord of the Mullai region (Tol. Akatti¯ai 5) and encompasses all the Trinity (*Paripà²al* 13.37). He is blue-eyed (Pu°a. 174), lotus-eyed (*Paripà²al* 15.49), yellow-clothed (*Paripà²al* 13.1-2), holds the conch and the discus in his two hands and bears goddess Lak±mì on his breast (*Mullaippà²²*u 1-3; *Perumpà¯* 29-30; *Kali.* 104; 105; 145), was born under the asterism Tiru-o¯am (*Maturai*. 591), and Garu®a-bannered (*Pu°a.* 56.6; *Paripà²al* 13.4). Of Vi±¯uite episodes are mentioned his measuring the earth in three steps (*Kali*. 124.1), protecting his devotee Prahlàda by killing his father (*Pari.* 4. 12-21) and destroying the demon Kešin (*Kali.* 103.53-55). Šiva has been one of the most popular vedic-purà¯ic gods of the South. According to *Akanà¬ù°u* 360.6, Šiva and Vi±¯u are the greatest gods. He is three-eyed (*Pu°a.* 6.18; *Kali.* 2.4), wears a crescent moon on his forehead (*Pu°a.* 91.5; *Kali.* 103.15), and holds the axe as weapon (*Aka.* 220.5; *Pu°a.* 56.2). He bears river Gaµgà in his locks (*Kali.* 38.1; 150.9) and is blue-necked (*Pu°a.* 91.6; *Kali.* 142). He is born under the asterism *àtirai* (Skt. *àrdra*) (Kali. 150.20), has the bull for his vehicle (*Paripà²al* 8.2) and is seated under the banyan tree (*Aka.* 181). Once, while sitting in Kailàsa with Umà (Pàrvati), his consort (*Pari.* 5.27-28; *Pazhamozhi* 124), Ràva¯a, the ràk±asa king shook the Kailàsa and Šiva pressed the mountain down with his toe, crushing Ràva¯a and making him cry for mercy (*Kali.* 38). When the demon Tripura infested the gods, Šiva shot through the enemy cities with a single arrow and saved the gods (*Kali.* 2; Pu°a. 55; Paripà²al 5. 22-28). *Pu°anà¬ù°u* (6. 16-17) refers also to Šiva temples in the land and devotees walking round the temple in worship. God Skanda finds very prominent mention in saµgam classics, but as coalesced with the local deity Muruka¬, with most of the purà¯ic details of his birth and exploits against demons incorporated into the local tradition (*Paripà²al* 5. 26-70; *Tirumurukà°°uppa²ai*, the whole work). Mention is also made of Indra. (Balaràma) is mentioned as the elder brother of Lord K°±¯a, as fair in colour, wearing blue clothes, having the palmyra tree as his emblem and holding the ;lough as his weapon, all in line with the purà¯as (*Paripà²al* 2. 20-23; *Pu°a.* 56. 3-4; 58.14; *Kali.* 104, 7-8). *Tolkàppiyam* (Akatti¯ai iyal 5) divides the entire Tamil country into five, namely, Mullai (jungle) with Vi±¯u as its presiding deity, Ku°iñji (hilly) with Murukan as deity, Marutam (plains) with Indra as deity, Neytal (seashore) with Varu¯a as deity and Pàlai (wasteland) with Ko°°avai (Durgà) as deity… The saµgam works are replete with references to the

four castes into which the society was divided, namely, bràhma¯a, k±atriya, vaišya, and šùdra… bràhman anta¯a primarily concerned with books (*Tol. Mara.* 71), the k±atriya (***a-raša, ràja***) with the administration (*Tol. Mara.* 78) and šùdra with cultivation (*Tol. Mara.* 81)… It is also stated that marriage before the sacred fire was prescribed only for the first three castes; but the author adds that the customwas adopted by the fourth caste also in due course (*Tol. Ka°piyal* 3)… one cannot fail to identify in saµgam poetry the solid substratum of the distinct style, vocabulary and versification, on the one hand, and the equally distinct subject-matter, social setting and cultural traits, on the other, both of the Tamil genius and of vedic poetry. As far as the grammar of Dravidian is concerned, a detailed analytical study of Old Tamil as represented in *Tolkàppiyam*, with the vedic šik±às and pràtišàkhyas, has shown that, 'Tolkàppiyanàr clearly realized that Tamil was not related to Sanskrit either morphologically or genealogically… that he deftly exploited the ideas contained in the earlier grammatical literature, particularly in those works which dealt with vedic etymology, without doing the least violence to the genius of the Tamil language'. (Sastri, P.S.S., *History of Grammatical Theories in Tamil and their relation to the Grammatical literature in Sanskrit*, Madras, 1934, p. 231)… It would be clear from the foregoing that during the saµgam age there had already been intensive infusion of vedic culture in south India… Both the cultures coexisted, the additions often affecting only the upper layers of society… For novel names, concepts and ideas, the Sanskrit names were used as such, with minor changes to suit the Tamil alphabet (e.g. akkini for agni, vaicikan for vaišya, veta for veda, or translated (e.g. pàrpà¬ for daršaka, kè³vi for šruti). When, however, the concept already existted, in some form or other, the same word was used with extended sense (e.g. vè³vi for yàga; màl or màyan for Vi±¯u). Sometimes both the new vedic and extant Tamil words were used (e.g. tì for agni)… It is, however, important to note that the coming together of the two cultures, vedic and dravidian, was smooth, nonagressive and appreciative, as vouched for by the unobtrusive but pervasive presence of vedicism in the saµgam works. The advent of vedic culture into South India was, thus, a case of supplementation and not supplantation… it is a moot question as to when vedic culture first began to have its impact on dravidian culture which already existed in south India… the age of this spread (of vedic culture) has to be much earlier than the times of the Ràmàya¯a and Mahàbhàrata, both of which speak of vedic sages and vedic practices prevailing in the sub-continent. Literary and other traditions preserved both in north and south India attest to the part played by sage Agastya and Parašuràma in carrying vedic culture to the south. On the basis of analytical studies of these traditions the identification of geographical situations and a survey of the large number of Agastya temples in the Tamil country, G.S. Ghurye points to the firm establishment of the Agastya cult in South India by the early centuries before the Christian era (Ghurye, G.S., *Indian acculturation: Agastya and Skanda*, Bombay,

Popular Prakashan, 1977)… the considerable linguistic assimilation, in dravidian, of material of a pre-classical Sanskrit nature, it would be necessary to date the north-south acculturation in India to much earlier times."

The script decipherment problem

A major problem in establishing the continuity of the civilization in the sub-continent is the as yet unresolved problem of the decipherment of the inscriptions of the Sarasvati Sindhu civilization. The seals, tablets, copper plates, metallic implements found with inscriptions and pictorial motifs (field-symbols) in all major sites of the civilization and even a monolithic sign-board of Dholavira with ten signs, beckon every student of indology.

The formula in the rebus methodology is:

Image = Sound = Meaning

All words are semantic indicators. ***ellàccollum poru³ ku-ittanavè*** (*Tol. Col. Peya.* 1)

This suggestion is based on the following hypothesis: **semantic competence is the substratum in philogeny; grammar is only a surface layer in the neural networks.**

The pictorial motifs of the seals and sealings of the civilization, unearthed in archaeological excavations (and presented in the exquisite corpuses of Mahadevan and Parpola) are tagged to the morphemes of the languages of the sub-continent. Using the rebus principle, it will be possible to determine the homonyms with substantive meanings: such as, jeweller-smithy, turner, silver-trader.

The use of the rebus methodology is justified on the following evidence and analysis: An analysis of the frequencies of occurrence of signs shows that 88 signs occur solus (i.e., one sign constitutes the whole text of the inscription) for a total of 190 sign occurrences. According to the Parpola concordance which contains a corpus of 2942 inscriptions, 300 inscriptions are composed of either one sign or two signs. Many signs occur in predictable pairs; 57 pairwise combinations account for a total frequency of 3154 occurrences (32% of 9798 occurrences of all pairwise combinations). These statistics establish the fact that one sign and/or a pair of signs seem to be adequate to compose the core of the messages. Given the statistical evidence that the average length of a text is 5 signs, it is apparent that one sign or a pair of signs represents a 'substantive category' of information, i.e., a word or phrase. A number of signs appear in duplicated pairs: for example, Sign 245 (nine squares in a rectangle or a chequered-rectangle) occurs in 70 pairs. These are apparently not duplicated alphabets or syllables. Many pictorial motifs in field symbols also occur in pairs: two tigers, two bisons, two heads of the unicorn.

Twenty signs occur with the circumgraph of four short strokes; many of these 20 signs occur as final motifs of the text, functioning similar to the ‘jar’ sign which terminates many texts. The circumgraph may, therefore, be the terminating ‘word’ of the text.

This leads to the apparent conclusion that the solus sign or each sign in a pairwise combinations (which constitute the core of information conveyed) is not an alphabet or a syllable, but a WORD.

Copper tablets found in Mohenjodaro are incised with pictorial motifs and script signs. The historical periods record the evidence of the use of copper tablets to authenticate title deeds or property transactions.

It would be reasonable to hypothesise that many seals were the possessions of the workers of the civilization and that the messages might be similar to the messages conveyed in later-day traditions of the historical period, of conveying property rights through ‘copper-plate grants’.

SARASVATI RIVER BASIN (NW INDIA) WATERSHED DEVELOPMENT PROJECT

Executive Summary

The project proposal is to develop and implement micro-watershed-based Peoples' self-governing, integrated, self-sustaining rural development projects in North-West India on the Sarasvati River Basin.

The project proposed is consistent with and augments the initiatives taken so far by the Govt. of India and the State Governments to implement a range of development plans and projects in the region.

The project area (approx. .4 million sq.km. or over 10% of India's land area with over 3 crores population) is bounded by Sutlej on the north, Aravalli ranges (Ajmer-Delhi Railway line) on the south, Yamuna on the north-east, Rann of Kutch, Little Rann and Gulf of Khambat on the south-west and the Pakistan border on the west and northwest.

This project is based on scientific studies which have proved the existence of the mighty, perennial Sarasvati River in recent geological times (i.e., upto about 3500 years ago). The river which had flowed for thousands of years, across a stretch of about 1600 kms. draining an area 300 kms. wide along the river banks, has left behind alluvium, palaeo-channels and groundwater aquifers which can be harnessed

- to plan for rural development projects (farming, livestock, agro-processing industries).
- Small-scale electricity generation projects can be developed using solar and wind power which are abundant in the region.

The exploratory drillings for groundwater and project studies done so far have established three distinct strategies for three distinct ecological zones of North-Western India, i.e.

1. canal systems in the States of Punjab and Haryana;
2. semi-arid zone in Sarasvati River Basin in the State of Rajasthan; &
3. salt-marshes of the Rann of Kutch in the State of Gujarat.

The key components proposed include:

- development of over one million groundwater sanctuaries in the State of Rajasthan, particularly in the Sarasvati River Basin
  - to serve new integrated livestock and farming systems (minimizing/avoiding the use of surface water to avoid water-losses due to evapo-transpiration)
  - to grow high-income-yielding tree-crops (e.g. almonds, dates, olives)

- beneficial use of water-harvesting technologies and development of a Drainage System for North-Western India
    - to overcome the problems of water-logging in the States of Punjab and Haryana and
- development of projects for farming salt-resistant halophytes (such as *salicornia brachiata*, which yields edible oil) in the salt marshes in the Rann of Kutch, Gujarat and in the salty terrains of Rajasthan.

Project Concepts and Implementation Strategies

The major components of the Project and strategies proposed are as follows:

- On the lines of the North-Eastern Council, a North-Western Development Council should be formed, together with a nodal coordinating agency called the Sarasvati River Valley Authority
    - To provide a coordinating framework for implementation since the project area encompasses an area covering many States in North-Western and Western India (i.e. Haryana, Punjab, Rajasthan and Gujarat) and the project involves inter-state sharing of river waters.
- The projects will be segmented
    - to be coterminous with areas under the jurisdiction of the local-self-governance institutions so that the micro-watershed-based development plans and activities can be formulated and implemented at the levels of the Panchayati Raj institutions and Metropolitan Planning Committees, as Peoples' Projects, consistent with the powers conferred under the 73rd and 74th Amendments of the Constitution which incorporated the Eleventh and Twelth Schedules to coexist with Centre, State and Concurrent Lists.
    - with appropriate technical support and guidance from the concerned agencies/ institutions/organizations such as
        - the Central Ground Water Board
        - State Groundwater Departments
        - Irrigation Departments
        - Forestry, Agricultural and Livestock Development Agencies
        - NGOs, and Local Trusts
        - Research Institutions such as the
        - MSSwaminathan Research Foundation
        - Central Arid Zone Research Institute
        - Central Arid Zone Forest Research Institute
        - Satellite Remote Sensing Service Centres
        - Bhabha Atomic Research Centre
        - National Geophysical Research Institute
- Microwatersheds (with adequate recharge facilities for groundwater resources) will form the epicene for integrated development activities (farming, livestock,

agro-processing industries, use of solar and wind power for home-heating/lighting and for bore-pumps)[3].

- The desert in Rajasthan will be used as a groundwater reservoir (analogous to the techniques used in the Ngev desert in Israel to store fresh-water underground, over the seawater tables).
- Use of surface water will be avoided, to avoid loss of water due to evapo-transpiration.
- NW Drainage systems will be improved complementing the canal systems to overcome the problems of waterlogging and consequent desertification of arable land in NW India.
- Explorations will be started to generate electricity using solar panels and windmills for lighting/home-heating and bore-pumps respectively.
- High-income tree crops and salt-resistant halophyte shrubs such as *salicornia brachiata* (vernacular names: *machula* (Hindi) or *bholad* (Gujarati) or *umari* (Tamil/Malayalam), which yields edible oil) will be planted in selected demonstration project areas (in the States of Rajasthan and Gujarat).

Objectives of the Development Project

The objectives of the Sarasvati River Basin (NW India) Watershed Development Project are

- To revive the sacred Sarasvati River area in north-western India as a region of perennial springs, lakes and rivers;
- To improve the water availability and water quality for domestic needs, livestock and irrigation in a farming system compatible with a semi-arid to arid environment; and
- To promote integrated rural development and the cultural heritage preservation and advancement of the region.

To achieve these objectives, further detailed studies are needed, in the first phase, to prepare comprehensive project feasibility reports for representative areas in the watershed, will be undertaken by the Indus Sarasvati Research Centre (a non-profit, voluntary, non-governmental organization).

[3] The selection of areas and project locations should take due cognisance of the need to preserve archaeological (heritage and pilglrimage) sites as national monuments on the Sarasvati River Basin, to facilitate further development of these sites of great antiquity as places of tourist interest.

The proposed studies, in the first phase, will culminate in the preparation of a *Sarasvati River Area Development Demonstration Projects Plan* document, detailing, *inter alia,* the selection of fifty representative areas (consisting of about five contiguous panchayats) for development according to a strategy formulated in consultation with the people, local self-governance institutions and voluntary agencies, educational and banking institutions of the concerned area.

The above objectives are consistent with the recommendations made by the conference of Chief Ministers on Basic Minimum Services held at New Delhi on 4/5 July 1996, wherein specific priority has been given for provision of safe drinking water. The relevant recommendation, viz., item 3 of Part I reads as follows:

Quote
To tackle the drying of sources consequent to depletion of ground water. Location specific, recharged structures will be constructed with the specific objective of recharging and reactivating dried up sources, and the States would consider enacting the Ground Water Regulation Act on the pattern done by Maharashtra or the model Bill circulated by the Ministry of Water Resources.
Unquote

To fulfill this basic service, the preliminary studies proposed to be undertaken by the Indus Sarasvati Research Centre, will produce a report, *inter alia*:

- selecting representative areas for development of recharge structures and cultural practices (e.g. crops, cultivation practices)
recommending methods and organizational structures for recharging and reactivating dried up sources.

The unique character of this project is

- **the peoples' participatory approach to revive the Sarasvati river**
- **based on micro-watersheds**
- **for augmentation and exploitation of the groundwater potential of the terrain and**
- **exclusion of plans or measures for storing water on the surface.**

Studies proposed

Further scientific studies are required

- to gather additional climatological, geological and hydrological data to draw groundwater resource (both in terms of quality and quantity) maps,

and conduct soil surveys and prepare climatological, geological, ground water and soil maps

- to conduct geomorphological, soil, hydrological and demographic field surveys all along the 1000 km. long dry beds of the old river channels of the Sarasvati river (which has, in stretches, a massive width of 8 kms.), to study the relationships between the archaeological sites, the present settlements and environmental hazards and agricultural potential
- to conduct field surveys to assess and find solutions to the problems of salinity, alkalinity and waterlogging caused by prolonged irrigation under inadequate drainage conditions in the Rajasthan canal command area
- to investigate the formation of hard pans by calcium sulphate and carbonate (gypsum and lime) in the surface and sub-surface soil layers, and to devise measures to break the pans and to prevent their reformation

Peoples' support is also required to create an awareness to preserve the ancient heritage and the development potential of the region by sustaining and augmenting the groundwater aquifers. By augmenting the groundwater storage using the thick sand beds as a natural storage space, and with the hopeful diversion of the excess river flows from the Yamuna, the Sarasvati lakes will emerge, thanks to the undulating terrain and the river will start flowing again.

The proposal to revive the Sarasvati is worthy of support by all development agencies, as it would preserve our glorious heritage sites and make the Marusthali desert bloom (like marutam, a word in Tamil meaning 'fertile plain'), paving the way for providing new livelihood opportunities for over 13 million people through rational development of the micro-watersheds in the Sarasvati River Basin.

It is a peoples' project with the cooperation of the Governments of Punjab, Haryana, Rajasthan, Gujarat, Himachal Pradesh and Uttar Pradesh as well as the Centre.

Expected Project Benefits

The Project is expected to:

- protect and enhance the environment by minimizing wind erosion and improving water availability as ground water
- minimize or mitigate he effect of draughts and floods
- increase the production of cereals, legumes, fruit, nuts, fibre
- increase the agro-industries based on processing of these products
- create a suitable ambience for the protection and exposition of our ancient cultural heritage as evidenced by the archaeological sites

Satellite images of the area have clearly shown the dried-up channels and the river bed. Available data indicate that it is possible to divert the excess water that otherwise could cause flooding of the lower reaches of the Yamuna into the headwaters of the rivers flowing south-west through the project area and hence, enhance its groundwater potential. Planting of bholad (Gujarati) or machula (Hindi) (*Salicornia brachiata*), a shrub that thrives on salty soil, will not only save the river and the canals from sand-storms (aandhi phenomenon, which was also a cause for the drying up of the Sarasvati) but also yield considerable edible oil.

> The details of the project have been provided by Dr. S. Kalyanaraman, Indus Sarasvati Research Centre, Chennai, in the document titled "Sarasvati River Area Development: Project Concept and Proposal" attached to the letter of 24 September 1996 addressed to the Ministry of Water Resources, Government of India in response to their letter No. 31/37/96/PP dated 7 August 1996 (on the subject: Sarasvati River Project: Research Scheme)

In a country used to socialized benefits, surface water, when available, and even the ground water, when electricity is supplied un-metred, tends to be used extravagantly. The shallow ground water source that the project intends to develop will be used by the farmers in a regulated manner (with restrictions on diameter and depth of wells and with appropriate electricity tariffs).

The other highlights of the project are as follows:

The participatory approach will be the underpinning for the Project in all aspects including the following design criteria:

Integrated development using a microwatershed approach

- To develop an integrated and a sustainable system of agriculture (for both irrigated and rain-fed areas)
- To conduct environmental impact analyses to ensure the sustainability of the ecosystem
- To introduce high-value perennial (fruit and nut) crops (such as almond, pistachio, dates and olives)
- To protect the soil and improve water infiltration into the soil
- To encourage the use of soil-reclaiming crops (such as Salicornia and Acacia) as necessary in salt and alkali-affected areas and for improving the soil-nitrogen content in general respectively
- To evolve a live-stock production system which incorporates controlled grazing with fences or paddock system and including stall-feeding of high-value fodder including irrigated (such as Salicornia-based animal feeds, alfalfa)
- To evolve an integrated use of water incorporating rain-fed farming with the conjunctive use of ground water

- To evolve a self-regulatory practice to maintain (and where necessary, to improve) the quality and quantity of ground water by developing norms to prevent over-drawing of ground water
- To develop a drainage plan to reclaim the salt and alkali-affected areas and even more importantly, for the other areas to prevent the development of saline and alkali problems
- To ensure that provisions are made for improvement of adult literacy, participation of women in development, improvements in health, nutrition and sanitation facilities among the population served by the project
- To promote the establishment of rural industries (such as agro-processing, leather processing, mat-making, stone polishing, spinning, weaving and textiles) and other home-based industries to supplement the farm income

Other Technical aspects

- All free surface water bodies like tanks, lakes, channels will be minimized, if not excluded; this measure if to avoid excessive evaporation of water
- Crops that require frequent surface saturation with water (e.g. rice and sugarcane) will be avoided
- High income tree crops: dates, almonds, olives, karob (pods used for animal fodder)

- establishment of nurseries based on quality seeds from proven varieties of the suitable tree crops
- propagation of seedlings and advisory service of planting and tending the plants
- transfer of technology for pruning and harvesting
- development of industries for processing of fruits, nuts and vegetable oils

- Multi-nucleated irrigation development: based on small-scale, shallow-well irrigation to serve the large number of microwatersheds demarcated on the basis of terrain
- Animal husbandry improvement and environment protection: improving the productivity (eggs, milk and meat) of livestock by improving the breeds and by a system of planned culling
  - Off-season employment generating activities such as polishing semi-precious stones, handicrafts based on leather, cotton, bamboo or matting grass
  - Community development projects including adult literary, health and sanitation, child care, primary schools, marketing and credit facilities by networking with the concerned agencies
- The archaeological sites will be preserved to enhance the awareness of the cultural heritage of the country. Development of the project components (solar energy panel arrays, irrigation shallow wells, tree crops

and cultivated crops) will take into account the location of the archaeological sites in order to maintain the low ground water levels in their vicinity and to allow for space requirements for further explorations and exposition.

Land allocation perspective:

- defence requirement zones
- solar panel arrays on high, rocky, agriculturally unsuitable lands, consistent with the long-term need to develop non-conventional energy sources and the high solar energy potential of the region;
- blocks and strips of high-value, climatically adapted tree crops and halophytes such as *salicornia brachiata*, to stabilize the sand and as a wind-break
- reorganizing cropping pattern of cultivated crops, to minimize acreage under crops with high water demand and maximize acreage of crops with low water demand
- reclamation/rehabilitation of Rajasthan canal command area (large parts of which are increasingly being rendered barren by salts, alkalis and/or water-logging)
- by integrating an effective drainage scheme into the existing irrigation network, and
- by introducing a change in cropping pattern, in favour of tree crops and water-efficient cultivated crops such as barley, jowar, millet, sesamum, cotton

Administrative Aspects

Organizational support network for the Project

The following organizations will also be net-worked for assistance and guidance:

- national research institutes (such as CAZRI, ICRISAT, CERSARD, Salt Research Institute, Anna University Centre for Remote Sensing, NRSA, Hyderabad, Irrigation Development Research Institute and institutes concerned with Aquaculture);
- governmental agencies at Central, State and Local levels (such as Ministries concerned with Water Resources, Agriculture, Livestock, Forestry, Environment, Roads, Survey of India, Geological Survey of India, National/regional remote sensing agencies)

Sarasvati River Valley Authority

The constitution of the Sarasvati River Valley Authority is suggested; the Authority should be the nodal agency for coordinating the planning and technical support required for implementing the project through local self-governance institutions.

The National Water Policy, adopted in September 1987, embodies the nation's resolve that planning and development of water resources should be governed by national perspective. It recommends integrated and multi-disciplinary approach to planning, formulation and implementation of projects, the need for having a Master Plan for flood control and management for each flood-prone basin through sound watershed management and establishment of extensive network for flood forecasting. The National Water Board was constituted by the Government in September 1990 to review the progress of implementation of National Water Policy and report to the National Water Resources Council for initiating effective measures for systematic development of country's water resources. A number of policy issues such as Water Information Bill, setting up of river basin organizations, national policy on resettlement and rehabilitation of persons affected by river valley projects etc., have been considered by the Board.

Quote from *India 1995*, New Delhi, Ministry of Information and Broadcasting, Govt. of India, Publications Division (p. 426): "Yamuna water dispute had been pending for more than 20 years. After vigorous persuasion made by Ministry of Water Resources, an agreement has been arrived at among the co-basin states of Haryana, Uttar Pradesh, Rajasthan, Himachal Pradesh and National Capital Territory of Delhi for sharing of Yamuna water upto Okhla. The MOU on this issue was signed by the chief ministers of these states on 12 May 1994. Haryana has been allocated 5.730 billion cubic metres (bcm), Uttar Pradesh 4.032 bcm, Rajasthan 1.119 bcm, Himachal Pradesh 0.378 bcm and NCT of Delhi 0.724 bcm of Yamuna water annually. The agreement takes care of the irrigation and consumptive drinking water requirements of all these basin states and provides for flow of 10 cumec in the river Yamuna throughout the year downstream of Tajewala and downstream of Okhla Headworks to take care of ecological considerations. Pending construction of storages in the upper reaches of the river, interim seasonal allocation of Yamuna water has also been provided in the MOU. The agreement opened up possibilities of development of the resources of water in the Upper Yamuna River Basin. Upper Yamuna River Board has been constituted by the Government of India on 11 March 1995. The members of the Upper Yamuna River Board and Upper Yamuna Review Committee were appointed in April 1995 and the Upper Yamuna River Board became operational on 22 April 1995. The Board is regulating allocation of available flows among the beneficiary states within the overall framework of the agreement. The MOU dated 12 May 1994 also provides that separate agreements will be executed in respect of each identified storage in Upper Yamuna River Basin within the framework of

overall allocation made under the agreement. Accordingly draft agreements among the basin states have also been finalised on the following projects: (I) Construction of Hathnikund Barrage Project in Haryana; (ii) Construction of Renuka Dam Project in Himachal Pradesh, and (iii) Construction of Kishau Dam Project in Uttar Pradesh. These agreements are in various stages of acceptance by the basin states."

Against this backdrop, we have proposed the constitution of the Sarasvati River Basin Authority to create a Master Plan for North Western India for the Sarasvati Project Area. It should be noted that any plans drawn up should be consistent with an International Agreement, the Indus Waters Treaty. India and Pakistan signed Indus Waters Treaty on 19 September 1990 fixing and delimiting the rights and obligations of the two countries with regard to the use of the water of the Indus river system. It came into force from 1 April 1960. A permanent Indus Commission representing both the governments had been set up to establish cooperative arrangements for implementation of the treaty. The Commission held its seventy-ninth meeting at New Delhi in May 1995 and finalized its annual report. As a gesture of good neighbourly relations, India is providing advance information to Pakistan about flood flows in the rivers of the Indus Basin.

Other organizations who will be involved in this project are: Central Water Commission, Central Soil and Materials Research Station, New Delhi, Central Water and Power Research Station, Pune and Central Ground Water Board (which has plans for monitoring ground water level and water quality through a network of more than 15,300 observation stations in the country), National Institute of Hydrology, Roorkee.

Area proposed for the Study

The project area covers approx. 4 lakh sq. km. and a population of approx. 3 crores.

The confines of the area are marked in the east by the Yamuna River from Delhi to Kalsi (in U.P. at 30^{o} 32'N, 77^{o} 50'E), in the north-east by the foothills of the Himalayas from Kalsi to Ropar (in Punjab at 30^{o} 59'N, 76^{o} 73'E), in the north by the Sutlej River from Ropar to Muazzam (in Punjab at 30^{o} 30'N, 74^{o} 00'E), in the north-west by the border with Pakistan, in the south-west by the Gujarat sea coast, and in the south-east by the Sabarmati River, the Aravalli Range and the railway line from Ajmer to Delhi.

Rainfall in the area is very low (ranging from 100 to 500 mm. per annum). But, the area is endowed with abundant sunshine and has a relatively low population density.

In view of this, proposals have been made in this project for establishing large, economic and sustainable farms.

An indication of the relatively low levels of water resource in the Sarasvati River watershed area may be seen from the following statistics: The all-India average of utilizable water resource is: 3043 cu.m. per sq.km. The average for the project area is less than 1000 cu.m.

This report also provides background information on:

- location, boundaries and extent;
- climate (rainfall, evapotranspiration);
- topography, relief and land types;
- soils; and
- vegetation.

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Rationale for the Development Strategy

The project rationale is governed by four basic principles:

- Ground water storage augmentation
- Peoples' participation on an equal basis
- Development of sustainable farming systems and afforestation appropriate to dry regions
- Preservation of the archaeological sites and cultural heritage as evidenced by the archaeological sites

Potential evapo- transpiration is very high in this region (which may go upto 7 to 9 mm. per day).. This means that augmenting ground water is a preferable, economic solution compared to the option of surface storage of water. Nevertheless, with a sustained management of surface and ground water for efficient agricultural development, it is expected that the ancient lakes of Sarasvati will gradually emerge.

The underlying design criterion is to increase the water supply in the region by augmenting the ground water storage and not by creating new surface reservoirs. This is a cost-effective, technically feasible solution in this area of deep and porous, unconsolidated material where the bed-rock is encountered at a great depth and many old, shallow river channels mark the landscape.

Structures and procedures for a Peoples' participatory approach to the planning and implementation of the project (as distinct from contract work) will be central to the project. Such participation should be on an equal basis at ALL stages from: problem awareness, evaluation of alternative solutions, project formulation, detailed planning, and

implementation. Such an approach though likely to be time-consuming and difficult, should be used for a sustainable and replicable method of development.

In evolving the project concept, based on this Peoples' participatory approach, grass-root level NGOs, Schools, Universities in the Project area and local banks, financial institutions and industries in the area; will be closely involved.

The development of the project will be in harmony with the need to preserve the ancient archaeological sites and under no circumstances will any project activity be undertaken that could destroy for all time the valuable information-repository of these sites.

A detailed list of archaeological sites is given in Annex 2 to be considered along with other factors (viz., physical suitability, peoples' participation and availability of NGOs with a proven record) in demarcating the representative areas.

PRINCIPAL COMPONENTS OF THE DEVELOPMENT STRATEGY

- ***Ground Water Storage Augmentation***

As the rain falls in the hot summer months when the potential evapotranspiration rates are very high, attempts to conserve the excess rain through surface run-off into large surface reservoirs are likely to be very inefficient and wasteful. In addition, conservation measures which promote surface run-off and storage in surface reservoirs (as opposed to conservation practices which promote infiltration of surface water into the soil and deep percolation to augment ground water storage) promote an insidious build-up of a salt concentration in the surface water without the benefit of a concomitant build-up of biomass. The wide open sparse vegetation and high winds only aggravate the high evaporation from surface water bodies due to the oasis effect.

The soil layers and the underlying loose sediments are generally very deep in this ancient depositional plain that was formed by rivers that flowed southwards and eastwards from the more humid highland regions into the semi-arid and arid lowlands. These soil and sediment layers form an excellent medium for storage of ground water, capable of yielding about 10 to 30 cm. of water per metre of sediment thickness.

The undulating topography is characterized by many old shallow river channels, meander scars and ox-bow depressions and sand dunes. This is not suited for laying a network of canals for irrigation from surface

reservoirs but would be utilized for promoting ground water storage. In other words, these palaeo-depressions will serve as percolation ponds.

Unlike surface storage that requires expensive large dams and long canals and extensive reservoirs which often cause displacement of people from their farms and homes, ground water storage augmentation is harmoniously linked with a 'wide spectrum mixed farming' development. Ground water storage provides a source of clean water purified from biological surface contaminants by percolation and stored in the deep aquifer, protected from contamination for any length of time.

If ground water is tapped for use at a rate commensurate with its average annual recharge rate, it could provide a clean, sweet water uncontaminated by the underlying basal brackish water layers. As the ground water storage gets progressively increased, the brackish water layer will be pushed into deeper sediments.

The model for development can be on the lines of the revival of the Ngev desert in Israel.

- ***Peoples' participation on an equal basis***

The proposed measures for mixed farming and regional afforestation can be sustained only if the people are aware of their necessity and have the power and will to work to bring about the needed changes. Top-down impositions or implementation by outside agencies (be it government departments or local contractors) will not guarantee sustained development. It is, therefore, imperative that the ownership of the project components should be with the local self-governance institutions enshrined by the 73rd and 74th Constitutional Amendments, consistent with the Eleventh and Twelfth Schedules of the Constitution, which mandate, *inter alia*, socio-economic development planning by local self-governance institutions.

- ***Development of farming systems and afforestation appropriate to dry regions***

Semi-arid and arid areas possess a unique potential for development provided agricultural crops and practices, and soil and water conservation practices and structures that are popular in sub-humid and humid areas and not imposed without due regard to their suitability.

Floods and seasonality of employment can be greatly ameliorated and droughts can be eliminated by undertaking a 'wide spectrum mixed farming' which includes food and cash crops and fodder crops on arable land and perennial tree crops for high-value nuts and dried fruits, fodder and fuel wood, and livestock raising based on controlled or fenced rotatory grazing supplemented by stall feeding, and most importantly a

community-regulated ground water exploitation for domestic needs, watering livestock and irrigating agreed-upon crops. (Drip-irrigation can be recommended for the technology-conversant, well-to-do farmers; earthen-porous pots with a hole at the bottom at the foot of each orchard tree is an appropriate method for the poorer farmers).

The relatively low population density allows for the possibility of establishing large economic and sustainable, mixed farms based on arable crops, tree crops, livestock and forestry, and to allow for the profitable implementation of simple soil and water conservation measures at the farm level on a cooperative or group basis among farms occupying the individual micro-watersheds.

In addition to developing mixed farming on a micro watershed basis, local communities should spearhead afforestation of their stream catchment areas. A well-coordinated, long-term (at least 10 years) program of afforestation (planting, protecting, bunding, watering and harvesting) of useful perennial shrubs and trees in lands belonging to Government departments (hospitals, law courts, revenue offices etc.), public and private institutions (e.g. schools, banks, factories), road sides and all participating farmers' lands is the key to obtaining a sustainable agricultural and livestock development in arid and semi-arid regions.

Perennial shrubs and trees provide a sound base for ensuring the amelioration of the adverse effects due to drought, seasonality of work, floods, wind erosion and water erosion (be it sheet erosion, rill erosion or gully erosion).

- ***Preservation of the archaeological sites and cultural heritage as evidenced by the archaeological sites***

A list of archaeological sites in the Sarasvati River Basin (NW India) Watershed area is provided in Annex 1.

It is notable that the majority of the sites of the Harappan period are on the banks of the Sarasvati river. Among these, the relatively recent sites of exploration in Rajasthan and Gujarat which have yielded Harappan-style seals and inscriptions are: Kalibangan, Banawali, Dholavira, Kotda, Lothal.

The currently available technologies support the storage of water underground; the project will recharge groundwater resources; springs and lakes will naturally emerge, bringing Sarasvati alive again in her pristine, sacred glory as the mother of all rivers (**naditame**).

In undertaking the project, and in utilizing the palaeo-channels, care should be taken to avoid inundating the archaeological sites so as not to prevent further detailed archaeological explorations.

The project should include provisions for preservation and improvement of the pilgrimage sites, all along the Sarasvati from Markanda river to Ghaggar-Hakra to Rann of Kutch to the Gulf of Khambat, as national monuments.

A traveler marching into the 21st century should be able to traverse the pilgrimage route which Balarama took from Dwaraka to Mathura along the banks of the Sarasvati (cf. the episodes described in the Salya parva of Mahabharata) thus authenticating the geophysical reality of the great epic.

Locus: Sarasvati River Project Area

Location, Boundaries and Extent

The area taken up for resources evaluation and preparation of project proposals lies between the latitude 20° 40'N and 31° 15'N and the longitudes 68 ° 20'E and 77 ° 50'E; it is about 125 km. long in the south-west to north-east direction and varies in width in the south-east to north-west direction between 35 km. and 45 km. and covers contiguous parts of Rajasthan, Gujarat, Punjab, Haryana, Delhi and Uttar Pradesh. Over 1200 archaeological sites have been found on the banks of the Sarasvati river. A list of major sites is provided in the Annex.

The confines of the area are marked in the east by the Yamuna River from Delhi to Kalsi (in U.P. at 30° 32'N, 77° 50'E), in the north-east by the foothills of the Himalayas from Kalsi to Ropar (in Punjab at 30° 59'N, 76° 73'E), in the north by the Sutlej River from Ropar to Muazzam (in Punjab at 30° 30'N, 74° 00'E), in the north-west by the border with Pakistan, in the south-west by the Gujarat sea coast, and in the south-east by the Sabarmati River, the Aravalli Range and the railway line from Ajmer to Delhi.

The project area covers approximately 400,000 sq. km. and has a population of about 3 crores; the average density of population is 75 person per sq. km. (i.e. only 1 1/3 hectares per man, woman or child); this is rather low for a rural economy in an arid to semi-arid region.

Climate (Rainfall, Evapotranspiration)

The south-eastern part of the project area has semi- and (or steppe-) climate, while the north-western part has an arid (or desert) climate. The average annual rainfall is very low, ranging from about 500 mm. in the

east and south to about 100 mm. in the west and north. Almost the entire annual rain falls in the hot summer months; the effectiveness of such rainfall is markedly lower than that of rainfall in the cool winter months. This is because the potential evapotranspiration which is generally high anyway (in a milieu of intense sunshine that gives rise to a warm or even hot ground surface and of open sparse vegetation that allows free air flow at ground level) can be as high as 7 to 11 mm. per day in the hot summer months. [The annual potential evapotranspiration if there were a free water surface throughout the year is about 2000 mm.]

The actual evapotranspiration is only about 200 mm. an year, and understandably so low, because the soils are most of the time much below field capacity and the regionally adapted plants are characterized by plant structures (bank, stem and leaf surface and shape), and processes (stomatal closing, photosynthesis pathways) that lead to a much reduced loss of water by the evapotranspiration than that of plants adapted to growth in the more humid areas.

Topography, Relief and Land Types

The topography ranges from strongly sloping areas in the highlands of the east and north-east, through undulating or gently sloping areas (sand desert, stony desert, dunes and salt desert) in the uplands of the north, west and centre, to the flat areas (marshes, swamps, flooded areas and saline marshes) in the lowlands of the south.

The project area has been delineated to ensure that the entire catchment areas of the tributary rivers and streams are included; and the stony, hilly upper reaches of the in-flowing streams are not excluded merely because they are vastly different in their nature and development potential from the main area. The kind and degree of water and soil conservation measures that could be adopted in any particular part of the river catchment in the project area depends to a greater degree on the extent of river catchment upstream and the quality of water and soil conservation measures prevalent there.

The north-western segment of the project area is a land of canals and rivers flowing from north-east to south-west in the upper reaches and from east-north-east to west-south-east in the lower reaches. This segment lies at an elevation of 200 to 250 m. above sea level in south-west Punjab and Haryana and the north-west contiguous parts in Rajasthan. The rivers and canals all of which disappear in the deep desert sands are Koda Bandh, Gagghar River, Markanda and the canals like Bhakra canal, Gang canal, Rajasthan canal, northern Gagghar canal arising from Bhakra Dam, Nangal Dam and Harike Barrage and lie to the west of West Yamuna canal. In the south and east of this segment, many hilly areas at an elevation of 400 to 500 m. or more are found.

The middle zone, occupying about half of the proposed project area consists of sand desert and sand dunes at an elevation of 100 to 350 m. and occurs entirely in Rajasthan.

The south-western segment, occurring in Gujarat and a part of Rajasthan, at an elevation of 0 to 200 m. consists of marsh, swamp, flood-area and saline marsh. Isolated hilly areas rising upto 500 m. occur in the central and western part of this segment.

Soils

The soils within the project area vary from black cotton soils in the south and south-east, red brown soils in the east and north-east, dunes and semi-fixed sands in the west and centre, sierozems and desert soils in the west and south-west, and marsh and swamp soils, saline marsh soils and flooded soils in the south-west and south, and alluvial soils along river channels.

Vegetation

The natural vegetation varies from marshy vegetation characterized by reeds, sedges and grasses in the south and by xerophytic vegetation such as succulent desert cacti, latex producing trees such as *ficus elastica*, and resin producing trees in the west and centre halophytic vegetation are also found in the salt marshes and mud flats in the south.

Activities and Equipment required

For the project to be undertaken, the people in the project area may have many questions to be answered. For this to be achieved, a program of pre-project studies which will require the following:

a) Satellite imagery (False Colour Composites corrected for fit with 1:250,000 topography maps)
b) Aerial photographs (on scale 1:40,000 to 1:20,000 and of different dates, where available)
c) Topography maps at scale 1: 250,000, 1:50,000 and 1:25,000 where available
d) Reports (published and unpublished) on soils, climate, topography, geology, hydrology, vegetation, agriculture, livestock, flora and fauna and socio-cultural-anthropology institutions of the areas in this region
e) Simple test-kits to determine the quality of soil and surface- and ground-water
f) Field observations on ground water level on a continuous basis at a pre-determined number of selected sites to be located on the basis of physiographic parameters (which will be determined from a preliminary

study of items (a) to (d) and involvement of local institutions for conducting these observations

g) Joint field trips with interested persons from CAZRI, Universities and Colleges in the States concerned, GSI, SI, and the Ministries mentioned earlier. These trips are intended to make a preliminary, technical assessment of the complexity and feasibility of the proposed developmental changes
h) Preparation of a Project Proposal dividing the area into homogeneous agro-climatic sub-zones and enumerating the project developmental activities proposed for each of these zones
i) Conduct seminars, discussion groups and participatory meetings
j) Disseminate information reports through the various media (newspapers, magazines, radio, television and video cassettes)

Materials required:

Cartographic materials (overlays, drawing equipment, drawing paper, blue prints, tracing paper)
Field Survey equipment
Mirror Stereoscopes (2) and Pocket stereoscopes (4)
Scanner and Plotter (attachment to Computer)

Work to be done (at the pre-planning stage)

Preparation of tentative thematic maps based on items (a) to (d) and selected field trips to gather ground-truth; the maps will show the following themes:

a) climate map (rainfall annual and by season, temperature)
b) demographic maps
c) topography maps [hills, ridges, rivers, meander scars, ox-bow lakes, dry channels, old levee bands, different kinds of sand dunes]
d) cultural heritage map (old archaeological sites, historical monuments)
e) soil quality map (well-drained, poorly-drained, saline, alkaline, arable/non-arable)
f) land-use/land-cover maps (vegetation, crops, livestock)
g) water quality map (brackish, medium-brackish, potable)
h) land-classification map (land-use capability map: four classes of arable land classified by degree of limitations on soil- and water-conservation measures required and/or range of crops; four classes of non-arable land classified by suitability for pasture, forest (renewable), forest (permanent cover), forest (reserve)
i) institutional infrastructure report and map (prospective villages, schools, banks, NGOs)
j) tentative selection of fifty representative areas (consisting of about five contiguous panchayats) for development and the development strategy formulated in consultation with the people of the concerned area

Cost Estimate

This is the project of a millennium. Rarely in human civilization do citizens get an opportunity to revive a great river spanning over 1600 kilometres and rejuvenate the lives of millions of people.

Since the project is on a monumental scale, conserving the most precious resource of human civilization, WATER, and since the proposed project dimensions are of a grandeur unsurpassed in human history, every endeavour will be made, by wide publicity, to attract the best talent and expertise to carefully design further stages of the project.

Every effort will also be made to contain the costs by recruiting experts and personnel on a voluntary basis or only on the basis of reimbursement of actual expenses incurred.

A preliminary cost estimate indicates that, on an average, the cost of each groundwater abstraction structure will be approx. Rupees four lakhs

The overall cost of the NW Drainage System stretching over 1600 kms. will have to be estimated after conducting preliminary feasibility studies and take into account the topographic features of the three ecological zones of the Project Area and the inter-linkages with the existing canal systems.

SARASVATI RIVER BASIN PROJECT: HARYANA

[Haryana Irrigation Research Management Institute, Kurukshetra,]

Sarasvati river system takes off from foothills of Sub-Himalayan Shivalik mountain ranges in the state of Haryana, India and had flown as a gigantic river right up to Gujarat, finally joining the Arabian Sea in ancient times. With passage of time, this sytem disintegrated into small rivers and run off lines. Presently due to heavy deposits of silt, the various small rivers and run off lines have ceased to be perennial and water is discharged through these channels during certain period of the year only. These channels are presently known as Beghna, Markanda, Chautang, Rakshi, Somb, Sarasvati, Ghaggar and Tangri. All these channels carry water from the mountain ranges, principally in the rainy season. Some of these channels are known to carry water discharged from foothills even in other periods of the year. While peak discharge of around 100,000 Cs. has been recorded in the Markanda and 125,000 Cs. has been recorded as peak discharge in the river Ghaggar. Markanda and Ghaggar are known to carry 60000-70000 Cs. of average discharge. Somb nadi also carried 15000-20000 Cs. peak discharge. While these discharges of water are noticed mainly in the flood season, due to lesser requirement of water for irrigation and tubewells in that season, it is noticed that this water is carried beyond this area into areas such as Anupgarh in Rajasthan and beyond, causing water logging and inundation problems in those areas. Moreover, this precious water flowing through State of Haryana is thus being sent away due to lack of proper mechanism for water harvesting. It has been observed that underground water table in this area is rapidly falling to the tune of 2-3 ft. per year, causing a lot of strain on the available water resources in this region.

This region is practically not covered by any irrigation channel, thus making irrigation needs totally dependent upon underground water. This is putting heavy strain on the available water resources, and the power supply position (as most of the tubewells are deep tube wells requiring heavy electricity load). Hence, there is a dire need of tapping water which flows through these channels and harvest it to be used either as a source for recharging underground water table or for irrigation purposes where topographic levels permit.

Harvesting of this water can be done by construction of percolation tanks or such small water harvesting structures, along the course of these channels and the water thus stored in these percolation tanks can be used for either irrigation or for recharging underground water table by percolation. Moreover, if these channels are properly desilted and channelised, the water intake capacity of these channels will improve and where levels permit, this water can be used for irrigation purposes. Farmers can also be encouraged to use this system for irrigation purposes along the course of these channels or along the water

harvesting system proposed to be constructed along the channels. In such a fashion, 5-6 regular river channels will be available to the area, which is presently not under any principal irrigation command. This will, to some extent, eliminate the necessity of having to bring this area under a new irrigation command. However, this will also the power supply position to some extent, due to the resultant rise in the underground water table. This will also effectively tap all the surplus water coming from the mountain ranges and will thus reduce the resultant floods caused by this surplus water. These channels will also act as a natural drainage system for this area during heavy flood season.

Hence, it is proposed that these channels be desilted and properly channelised and water harvesting structures be constructed along the course of these channels, so as to cover as much area as possible. Proposed area that is to be covered under this Project falls in Districts of Yamuna Nagar, Ambala, Kurukshetra and Kaithal initially. If the project is found feasible, scope can be extended to other areas also.

It is also proposed to link Dadupur headworks with Chautang River channel so that in times of need and where water levels permit, regular supply of water is given for irrigation purpose. It is pertinent to mention here that most of the land has been acquired for this purpose, as part of Dadupur-Nalvi project, which is already under construction with irrigation department, Govt. of Haryana.

Environmental Benefits of the Project

While this Project basically aims at tapping water from the foot hills of Sub-Himalayan Ranges, it will result in substantial environmental improvement in the area, as the resultant rise in water table would automatically lead to better vegetation and greenery. Inflow of rich alluvial soil will lead to improvement in the top soil texture of the area.

Creation of various percolation tanks would lead to enriching the ecological balance and would be promoting aquatic fauna. These ponds may be put to commercial use also, such as for breeding fresh water prawns and certain varieties of sustainable carps.

It is proposed to encourage farmers to use this water for irrigation purposes also, which will lead to sustainable practices in agriculture. Harvesting this water, will also check soil erosion and thus arrest growth of deposition of salts in soil texture. As this water is harvested, it will reduce problems of water logging in the tail areas. Water tapping in this fashion will be of immense use for the animals/cattle of the area.

Project Outline on Sarasvati River Basin Project

Objectives:

1. To harvest rain water resources available from Shiwalik Hills through Chautang, Rakshi, Markanda, Sarasvati and Somb river channels.

2. To promote water recharge of underground water table.
3. To promote minor irrigation wherever contours permit.
4. To use the system as an effective drainage mechanism during the flood season.

Description of River channels

1. **Chautang River channel**

   It offtakes near upstream Sadhaura-Bilaspur road crossings near Jagadhari and passes through various villages like Chuhrwala, Talakaur, Mustabad, Jhar Chandana and ultimately merges partly in to Sarasvati River channel and partly goes towards Kheri Gadian from Ladwa.

2. **Rakshi River channel**

   It offtakes near village Sudhal and goes along villages Badanpur, Chamrori, Kheri Dabdalan, Naggal Smalka and Sadli.

3. **Sarasvati River channel**

   It offtakes from Sulakhni and runs along various villages like Daulatpur, Gon Bhana, Ramgarh, Qurba, Ram Nagar and goes into Bibipur lake near Bhore.

4. **Markanda River**

   Markanda River offtakes from Shiwalik hills and Beghna Nadi and Sadadeni Nadi also merge into Markanda near village Paplautha and Sulakhni respectively. This river runs along villages Hemun Majra, Ghelri, Damli, Gumti Malikpur, Kalsana, Katwa, Jhansa, Jalbera, Nassi, Harigarh Bhaurakh etc. Part of it is linked with Bibipur lake via Kainthla channel.

5. **Somb River channel**

   It also offtakes from Shiwalik hills and falls into Yamuna near Dadupur.

Water Harvesting Structures and Channelisation

The Project envisages desilting and channelising of Chautang and Sarasvati river channels etc. which shall be partly used for irrigation, where possible, after recharging of the underground water table along its alignment.

Along with channelisation, work shall be taken up for desilting etc. within the land left in consolidation of above cited river channels and in case land is not available, at some places, the same shall be acauired for the purpose. By channelising these river channels, drainage system shall become more effective. Some villages along river Markanda namely Gumti Malikpur, Kalsana, Katwa, Bibipur lake, Jhansa, Jalbhera, Naisi, Madado, Jakhwala and Harigarh Bhorakh have village common lands where ponds can be constructed, which can be filled from Markanda river by providing

gated regulation. Similar exercise can be undertaken where land is available, for recharging and irrigation purposes.

By taking up these works, the water of Rakshi river channel which runs only during the flood season, can be put into Chautang river channel which joins Chautang near Ladwa and similarly the water of Chautang river channel can be put into Sarasvati river channel which joins Sarasvati River near Shehzadpur, ultimately feeding Bibipur lake.

Even Somb river can be connected with Chautang River channel near village Satgauli for feeding Bibipur Lake via Sarasvati River.

Annex 1

Maps, images and lists used for delineating the Sarasvati river and ancient sites of the civilization

1. Discovery sites of Indus seals and inscriptions (Parpola, 1991)
2. The Indus Plains: Routes of Communication [Ratnagar, Shereen, 1982, Fig. 23.1]
3. Principal sites of Indus civilisation and of cultures having Indus contacts [Raikes, R.L., 1979, Fig. 38.1, p.303]
4. Harappan Settlement Pattern on Sarasvati-Ghaggar-Hakra [Joshi, J.P. et al., 1984, p.517]
5. Settlements of Harappan Civilization [Misra, V.N., 1984, p.471]
6. Distribution of Harappan settlements [Possehl, Gregory L., 1982, Fig. 1]
7. Bhàrat Bhùracanà, National Atlas of India, Prel. Edn., Calcutta, 1957, Govt. of India
8. ibid., Delhi Plate 25
9. India: arid and semi-arid zones Thar [Dhir, R.P., et al., *Thar Desert in Rajasthan: Land, Man and Environment*, 1992, Fig. 1.2]
10. Location map of Sind [Lambrick, H.T., 1979, Fig. 40.1]
11. The Harappan map of Gujarat [Mehta, R.N., 1984, Fig. 26.1]
12. Gujarat: showing Harappan sites [Mehta, R.N., 1984, p. 229]
13. Dynamics of Harappan culture in Gujarat [Soundararajan, K.V., 1984, Fig. 25.1]
14. Archaeological exploration in North Gujarat and South Rajasthan : 1966-1967 [Misra, V.N., 1984, p.469]
15. Jodhpur Ganeshwar Culture: Map showing Ganeshwar and other sites (p. 158)
16. Map showing Harappan sites: North [Joshi, J.P. et al., 1984, p. 531]
17. Map showing Harappan sites: Gujarat [Joshi, J.P. et al., 1984,
18. Indus Sites: List [Joshi, J.P. et al., 1984, pp. 519-530]
19. Sketch map of the Ghaggar and Hakra bed by Sir Aurel Stein [Stein, Sir Aurel, 1942, *Geog. J.]*
20. Ancient sites along the Hakra river bed in Bahawalpur [Joshi, J.P. et al., 1984, p. 515]
21. Ancient sites in the Central Hakra region [Mughal, Rafique M., 1982, Fig. 7.2]
22. Key to the maps of sites (Hakra river bed in Bahawalpura and Central Hakra region; [Mughal, Rafique M., 1982, pp. 87-90)
23. Harappan and Pre-Harappan sites [Fentress, Marcia, 1982, Fig. 22.1]
24. List of sites on maps [Fentress, Marcia,1982, Harappan sites; pp. 250-258)
25. Distribution of Indus Civilization; chronological horizon [Thapar, B.K., 1982, Fig. 1]
26. Indus Civilization: Drainage system in northern region [Thapar, B.K., 1982, Fig. 2]

27. Indus Civilization: Drainage system in Nuclear region [Thapar, B.K., 1982, Fig. 3]
28. Indus Civilization: Drainage system in Southern region [Thapar, B.K., 1982, Fig. 4]
29. Ancient course of the Hakra river [After C.F. Oldham, 1893, p. 48 in: Misra, V.N., 1984, p.478]
30. Sketch Map showing course of Hakra [C.F. Oldham, 1893, p. 48]
31. Map showing Present and Ancient Courses of the Punjab rivers [R.D. Oldham, 1886, p.342]
32. Ancient river Courses in Thar desert
33. Map of Sind (Scale 48 miles to the inch) [Raverty, H.G., *JASB, 1892]*
34. The lower Indus Plain (Holmes, D.A., 1968, *Geog. J.*, Fig. 1, p. 300)
35. Map of the country surrounding the Gulf of Cambay [Rogers, Alex, 1870, p. 119]
36. The reconstructed course of the Indus as it may have existed in the period, 300 B.C. [Holmes, D.A., 1968, *Geog. J., p. 376]*
37. The probable course of the Indus in the ninth century A.D. [Holmes, D.A., 1968, *Geog. J.*, Fig. 4. P.378]
38. The Indus in the sixteenth century A.D. [Holmes, D.A., 1968, *Geog. J.*, Fig. 5, p. 380]
39. The lost courses of the Sarasvati river River [Ghose, Bimal et al., 1979, Fig. 1]
40. Mapping of the Sarasvai-Nara-Rann of Kutch connection from the satellite imagery. The map shows that the Sarasvati debouched into the Rann of Kutch through Nara [Yash Pal et al., 1980, Fig. 4]
41. LANDSAT photograph showing the suggested course of the Sarasvati River [Ghose, Bimal et al., 1979, Plate V]
42. LANDSAT photograph of the palaeo-channel and river bed near Anupgarh (Personally obtained from the University of California, Santa Barbara in September 1995)
43. Palaeo-channels of the Sarasvati from Siwalik ranges as deciphered from the Landsat imagery(p.227)
44. Northwestern Indian subcontinent with its present river system and the major palaeo-channels as deciphered from the Landsat imagery [Yash Pal et al., 1980, Fig. 1]
45. Palaeo-channels of the Sarasvati in Haryana-Rajasthan as deciphered from the Landsat imagery
46. A detailed delineation of the present river and palaeo-channels of the Sutlej and the Yamuna joining the old bed of Sarasvati [Yash Pal et al., 1980, Fig. 2]
47. Braided palaeo-channels of the Sutlej lying between the present Sutlej and the old Sarasvati bed. The present Ghaggar can also be seen in the figure [Yash Pal et al., 1980, Fig. 3]
48. Former courses of R. Sarasvati in Western Thar [Dhir, R.P., et al., *Thar Desert in Rajasthan: Land, Man and Environment*, 1992, p. 38]

49. Present and former stream courses in the eastern part of the Thar and its fringes thar [Dhir, R.P., et al., *Thar Desert in Rajasthan: Land, Man and Environment*, 1992, Fig. 1.18]
50. Valdiya, K.S., River Piracy: Sarasvati that Disappeared, *Resonance*, vol.1, no.5, 1996 with following maps and pictures: Sarasvati of vedic times, Main confluent of the Sarasati (Tons branch of the Yamuna), Source of Sutlej, Mt. Kailas, Dry channels of the Ghaggar (based on Yashpal et al, 1980), Sites of settlements of the stone-age people, Major settlements of the Harappan period, South-flowing branch of the Chambal, Sutlej's change of course at Ropar.

Annex 2

Locality Index: Archaeological Settlements, mostly on Sarasvati River Basin

RAJASTHAN: GANESHWAR PERIOD
DISTRICT: SIKAR

1.	Baleshwar	27.44N - 75.51E
2.	Balwar	27.35N - 75.38E
3.	Baneti	27.48N - 76.07E
4.	Banher	27.50N - 76.07E
5.	Barnagar	27.33N - 76.07E
6.	Basri	27.38N - 75.45E
7.	Beed-Ki-Jodhi	27.36N - 76.09E
8.	Bhabra	27.28N - 76.01E
9.	Bhadwari	27.34N - 75.40E
10.	Bhaikhri	27.34N - 76.07E
11.	Bhainsalana	27.39N - 76.05E
12.	Bhakhtawar-Ki-Dhani	27.51N - 76.06E
13.	Bihar	27.52N - 75.57E
14.	Biharipura	27.54N - 75.54E
15.	Bhojpura	27.33N - 75.35E
16.	Bhukha Bhar	27.37N - 76.10E
17.	Buchara	27.33N - 75.58E
18.	Burha	27.54N - 75.58E
19.	Butholi	27.41N - 75.46E
20.	Chardera	27.51N - 76.06E
21.	Chaudhri-Ka-Nangal	27.53N - 76.07E
22.	Chiplata	27.34N - 75.34E
23.	Dariba	27.41N - 75.54E
24.	Dilpura	27.50N - 76.04E
25.	Ganeshar	27.40N - 75.49E
26.	Ghata	27.35N - 75.51E
27.	Hothoka (Mothoka)	27.49N - 75.05E
28.	Hovra	27.55N - 75.59E
29.	Jodhpura	27.55N - 75.59E
30.	Khera	27.55N - 75.59E
31.	Kolyara	27.44N - 75.00E
32.	Malawali Dhani	27.43N - 75.46E
33.	Mando	27.44N - 75.00E
34.	Nimki	27.35N - 75.36E
35.	Pandtpur	27.36N - 76.03E
36.	Paragpura	27.36N - 76.03E
37.	Partheri	27.33N - 75.45E
38.	Purani Partheri	27.37N - 76.09E
39.	Rajnotha	27.36N - 76.10E
40.	Ranasar	27.44N - 75.43E
41.	Ram Jhalara	27.35N - 76.09E
42.	Sarohi	27.43N - 75.44E
43.	Sedoda	27.39N - 75.49E
44.	Somanya-Ki-Baoli	27.32N - 75.56E
45.	Thikria	27.32N - 76.06E
46.	Thoi	27.32N - 76.45E

UTTAR PRADESH (HARAPPAN PERIOD)
DISTRICT: SAHARANPUR

1.	Asan Wali	30.02N - 77.36E
2.	Badgam	30.00N - 77.32E
3.	Baundki	30.04N - 77.37E
4.	Bazidpur	30.03N - 77.36E
5.	Chhajpura	29.59N - 77.37E
6.	Chhapar Heri	29.54N - 77.30E
7.	Chilhera	30.02N - 77.39E
8.	Chuehti Shekh	29.54N - 77.43E
9.	Daudpur	30.05N - 77.36E
10.	Fahtepur (Gujar)	29.53N - 77.32E
11.	Fahtepur Jat	29.53N - 77.32E
12.	Ghana Khandi	30.04N - 77.36E
13.	Hulas Khera	29.42N - 77.22E
14.	Kabirpur	30.05N - 77.38E
15.	Kailaspur	29.59N - 77.39E
16.	Krishni	29.55N - 77.30E
17.	Mohiuddinpur	30.00N - 77.38E
18.	Mohiuddinpur	30.00N - 77.28E
19.	Matki Jharauli	30.04N - 77.35E
20.	Nawan Gaon	29.53N - 77.26E
21.	Piki	30.02N - 77.36E
22.	Pilakhni	30.01N - 77.29E
23.	Pinjaura	29.56N - 77.33E
24.	Rangel	29.56N - 77.40E
25.	Reri Malakpur	29.55N - 77.29E
26.	Salepur	29.56N - 77.21E
27.	Sarkari Sheikh	30.00N - 77.36E
28.	Sherpur (Gujar)	29.53N - 77.39E
29.	Tikrol	29.44N - 77.22E

DISTRICT: MEERUT

30.	Alamgirpur	29.00N - 77.30E
31.	Gulistanpur	28.30N - 77.30E

HARYANA (HARAPPAN PERIOD
DISTRICT: AMBALA

1.	Dukheri	30.16N - 76.53E

DISTRICT: KURUKSHETRA

2.	Ratta Kher Khuram	30.07N - 76.27E

DISTRICT: KARNAL

3.	Bahola	29.48N - 76.46E
4.	Bindrala	29.29N - 76.35E
5.	Dikadla	29.13N - 77.04E
6.	Jalmana	29.35N - 76.44E
7.	Maudi	29.47N - 76.46E
8.	Pujam	29.51N - 76.55E
9.	Urlana Khurd	29.22N - 76.43E

DISTRICT: JIND

10.	Balu	29.40N - 76.22E
11.	Bata (Rani Ran)	29.43N - 76.19E
12.	Dhakal	29.35N - 76.10E
13.	Ghatouli	29.11N - 76.23E
14.	Jind (Bir Band Ban)	29.19N - 76.19E

15.	Kalait	29.40N	- 76.16E
16.	Kharal-3	29.42N	- 76.03E
17.	Pauli	29.05N	- 76.28E
18.	Ritauli	29.25N	- 76.30E

DISTRICT: SONIPAT

19.	Chhapra	29.07N	- 76.32E
20.	Garhwal	29.11N	- 76.32E

DISTRICT: ROHTAK

21.	Baliana	28.53N	- 76.43E
22.	Lohat	28.32N	- 76.50E

DISTRICT: BHIWANI

23.	Mitathal	28.52N	- 76.11E

DISTRICT: HISSAR

24.	Banawali	29.36N	- 75.25E
25.	Barki	29.17N	- 75.46E
26.	Bhirrana	29.32N	- 75.32E
27.	Chanat-1,2,3	29.14N	- 75.55E
28.	Chimun	29.40N	- 75.40E
29.	Garhi	29.04N	- 76.07E
30.	Gular Wala	29.43N	- 75.46E
31.	Hansi	29.04N	- 76.59E
32.	Kharar	29.08N	- 75.54E
33.	Kirtan	29.08N	- 75.33E
34.	Kunal	29.38N	- 75.43E
35.	Masaudpur	29.14N	- 76.00E
36.	Mirchpur	29.18N	- 76.11E
37.	Nathwan	29.07N	- 75.35E
38.	Pali-I	29.08N	- 76.05E
39.	Rajpura	29.11N	- 76.07E
40.	Rakhi Garhi	29.17N	- 76.07E
41.	Ratta Theh	29.44N	- 75.45E
42.	Satrod Khurd	29.06N	- 75.47E
43.	Sisai - III	29.10N	- 76.00E
44.	Siswal	29.13N	- 75.30E

PUNJAB (HARAPPAN PERIOD
DISTRICT: AMRITSAR

1.	Vadalan	31.49N	- 76.48E

DISTRICT: KAPURTHALA

2.	Bhatrpura Kalan	31.01N	- 75.31E
3.	Domeli	31.20N	- 75.46E

DISTRICT: JULLUNDAR

4.	Dhogri	31.23N	- 75.40E

DISTRICT: ROPAR

5.	Kotla Nihang	30.56N	- 76.32E
6.	Kotli	30.53N	- 76.29E

7.	Ropar	30.58N - 76.31E

DISTRICT: PATIALA

8.	Dharm Heri	30.07N - 76.19E
9.	Gheora -12	30.07N - 76.16E
10.	Nagwan	30.07N - 76.23E
11.	Sasi	30.07N - 76.20E

DISTRICT: SANGRUR

12.	Budan	30.31N - 75.46E
13.	Jandali	30.38N - 75.51E
14.	Rohira	30.38N - 75.50E
14.A	Kalian	30.35N - 75.43E
14.B	Moholi	30.38N - 75.45E

DISTRICT: LUDHIANA

15.	Kanganwal	30.51N - 75.56E
16.	Malaud	30.38N - 75.57E
17.	Sanghol	30.47N - 76.24E
18.	Talwara	30.55N - 75.44E

DISTRICT: FARIDKOT

19.	Inewala Theh	30.33N - 75.25E
20.	Raja Sirkap	30.39N - 74.46E

DISTRICT: FEROZPUR

21.	Amiwala Theh	30.20N - 75.15E

DISTRICT: BHATINDA

22.	Ali-Da-Theh	30.20N - 75.20E
23.	Alipur Mandran	29.50N - 75.28E
24.	Bagliean-Da-Theh	29.56N - 75.29E
25.	Chhoti Mansa	29.59N - 75.26E
26.	Dale Wala-1,2	29.50N - 75.25E
27.	Dalewan	30.02N - 75.33E
28.	Gumi Kalan	29.59N - 75.33E
29.	Hassanpur	29.59N - 75.33E
30.	Hirke -I	29.44N - 75.22E
31.	Karanpura	29.52N - 75.23E
32.	Lakhmir Wala	29.52N - 75.22E
33.	Lallian Wali	29.52N - 75.20E
34.	Lalu Wala	29.59N - 75.27E
35.	Naiwala Theh	29.50N - 75.30E

RAJASTHAN (HARAPPAN PERIOD)
DISTRICT: HANUMANGARH

1.	Baror	29.10N - 73.20E
2.	Bhagwansar 1	29.22N - 73.53E
3.	Bhagwansar 2	29.23N - 73.53E
4.	Binjor -I	29.14N - 73.07E
5.	Binjor 3	29.00N - 77.12E
6.	Bugian	29.22N - 73.38E
7.	Chak-11	29.19N - 73.36E
8.	Chak-15/3	29.19N - 73.36E

9.	Chak-21	29.16N - 73.33E
10.	Chak 43	29.10N - 73.29E
11.	Chak 50	29.10N - 73.29E
12.	Chak 71	29.14N - 73.17E
13.	Chak 72/3	29.11N - 73.19E
14.	Chak 75	29.11N - 73.18E
15.	Chak 80	29.12N - 73.15E
16.	Jogiason Chak -1	29.10N - 74.45E
17.	Kalibangan	29.29N - 74.08E
18.	Karoti	29.10N - 74.52E
19.	Mallawala-Tioba	
20.	Mathula	29.14N - 74.34E
21.	Motasar Tibba -1	29.09N - 73.23E
22.	Motasar Tibba -2	29.09N - 73.27E
23.	Nohar	29.10N - 74.45E
24.	R.D -92/89	29.10N - 73.04E
25.	Sardar Garh -2	29.23N - 73.45E
26.	Sher Pura	29.10N - 75.15E
27.	Sothi	29.11N - 74.50E
28.	Tarkhana Wala Dera	29.14N - 73.14E

GUJARAT (HARAPPAN PERIOD)
DISTRICT: KUTCH

1.	Chitrol	23.24N - 70.40E
2.	Desalpur	23.29N - 69.10E
3.	Dholvira (Kotadi)	23.58N - 70.12E
4.	Gadhwaliwadi	23.30N - 69.03E
5.	Gunthai	23.28N - 69.09E
6.	Jatavadar	23.45N - 70.40E
7.	Kanthkot	23.29N - 70.29E
8.	Kerasi	23.40N - 70.44E
9.	Khakhra Dera	23.34N - 70.29E
10.	Khari-Ka-Khanda	23.27N - 70.19E
11.	Khedoi	23.03N - 69.57E
12.	Kotada Bhadli 1	23.22N - 69.26E
13.	Kotada Bhadli 2	23.22N - 69.26E
14.	Kotada	23.17N - 70.06E
15.	Kotadi	23.58N - 70.12E
16.	Kotara-Juni-Karan	24.00N - 69.45E
17.	Lakhapar	23.33N - 70.28E
18.	Lakhpat	23.50N - 68.47E
19.	Morvo	23.50N - 70.42E
20.	Narapa	23.34N - 69.05E
21.	Nenu-Ni-Dhar	23.51N - 69.44E
22.	Pirwada	23.20N - 70.00E
23.	Pabunath	23.38N - 70.31E
24.	Rampara (Vekera No Timbo)	23.30N - 70.45E
25.	Ramvav	23.32N - 70.28E
26.	Samaghoga	22.55N - 69.40E
27.	Selari	22.42N - 70.37E
28.	Surkotada	23.37N - 70.50E
29.	Todio	23.05N - 69.55E
30.	Vada	23.34N - 69.03E

DISTRICT: BANASKANTHA

31.	Atarnes	23.40N - 71.20E
32.	Benap	24.05N - 71.25E
33.	Jhekada	23.50N - 71.25E

DISTRICT: MEHSANA

34.	Dudka	23.32N	- 71.46E
35.	Kuwar	23.32N	- 71.37E
36.	Lalara	23.33N	- 71.47E
37.	Mahudi	23.30N	- 72.45E
38.	Pirozpur	23.30N	- 71.43E
38.A	Bolera	23.30N	- 71.45E
38.B	Khandia	23.32N	- 71.45E
38.C	Manverpur	23.35N	- 71.54E
38.D	Dhanora	23.31N	- 71.55E
38.E	Dantisana	23.30N	- 71.54E
38.F	Sushiya	23.28N	- 71.53E
38.G	Ervada	23.25N	- 71.53E
38.H	Panchasar	23.25N	- 71.49E
38.I	Panva	23.23N	- 71.49E
39.	Sibpur	23.33N	- 71.46E
40.	Sujnipur	23.53N	- 72.05E

DISTRICT: JAMNAGAR

41.	Ambaliala	22.56N	- 69.44E
42.	Bedwarka	22.28N	- 70.26E
43.	Bhayakhakharia	22.10N	- 71.50E
44.	Chanderwara	21.51N	- 69.24E
45.	Kotda	23.14N	- 70.21E
46.	Lakhan Timbo	22.29N	- 70.26E
47.	Mulpadar	21.56N	- 69.44E
48.	Saudevalio	22.00N	- 69.44E
49.	Tarana	22.43N	- 70.27E

DISTRICT: JUNAGAH

50.	Savani	20.58N	- 70.28E

DISTRICT: RAJKOT

51.	Bhut Kotada	22.35N	- 70.45E
52.	Dad	22.50N	- 70.55E
53.	Dhutapur	21.50N	- 71.00E
54.	Dumaini	21.45N	- 70.20E
55.	Dungarpur	22.71N	- 71.31E
56.	Gadhada -1	22.26N	- 70.36E
57.	Gadhada -2	22.26N	- 70.36E
58.	Gadhada -3	22.26N	- 70.36E
59.	Jhikri	21.55N	- 70.50E
60.	Jodhpur	22.40N	- 70.53E
61.	Karmar	21.50N	- 70.53E
62.	Khankhara Bela -1	22.29N	- 70.36E
63.	Khankhara Bela -2	22.29N	- 70.36E
64.	Khareda-No-Timbo	22.05N	- 70.48E
65.	Lukhela	21.50N	- 70.00E
66.	Malgodh	22.00N	- 70.34E
67.	Padar	21.59N	- 70.50E
68.	Pal	22.18N	- 70.43E
69.	Pithad	21.57N	- 70.44E
70.	Pithadia	21.48N	- 70.49E
71.	Rajathali	21.55N	- 70.01E
72.	Taraghada	21.50N	- 71.28E

73. Timaram	21.53N	- 70.30E
74. Vadasada	21.47N	- 70.30E
75. Vegadi	21.47N	- 70.30E

DISTRICT: AMRELI

76. Bhatiwadi	21.45N	- 70.50E
77. Dhankanio -2	21.47N	- 70.55E
78. Dhuapino	21.27N	- 71.49E
79. Vadera	21.36N	- 71.06E

DISTRICT: BHAVNAGAR

80. Gheolo Bund	21.58N	- 71.27E
81. Khodiyar	21.24N	- 71.09E
82. Lakhavav	21.30N	- 71.55E
83. Valpura	21.57N	- 71.42E

DISTRICT: SURENDRA NAGAR

84. Chashiana	22.25N	- 71.50E
85. Goni Timbo	22.27N	- 71.55E
86. Kaero Timbo	22.24N	- 71.55E
87. Khanpur	22.32N	- 71.58E
88. Rangpur	22.20N	- 71.55E
89. Samadhiala	22.19N	- 71.42E

DISTRICT: AHMEDABAD*

90. Bhimnath	22.15N	- 71.55E
91. Chhabasr	22.46N	- 72.16E
92. Devganga	22.18N	- 71.50E
93. Hadmatala	22.30N	- 72.03E
94. Kanasutaria	22.47N	- 72.16E
95. Lothal	22.31N	- 72.15E
96. Metal Maha No Timbo	22.47N	- 72.14E
97. Talwandi No Timbo	22.45N	- 72.20E

DISTRICT: KHERA

98. Kerisima No Timbo	22.28N	- 72.31E
99. Sai No Tikro	22.28N	- 72.31E

DISTRICT: BHARUCH

100. Manar	21.42N	- 72.47E

DISTRICT: SURAT

Navagam	21.16N	- 72.56E

CHOLISTAN DESERT, PAKISTAN

Bhawalpur area : archaeological sites in the Cholistan or Rohi desert, along 300 miles of the dry bed of the Hakra River (10-15 mile-wide-strip), the stretch of the Sarasvati river in Bahawalpur province adjoining the Rajasthan State (Marusthali or Thar desert)

(414 sites including Ganweriwala Ther, Gamuwali, Dunkkian, Wariyal, Sandhanawala) [cf. Rafique Mughal, *Ancient Cholistan*, 1997]

Principal Sites:

Arabian Sea
Bet Dwaraka island

Gulf of Khambat (Cambay)
Prabhas Patan (Somnath)
Rojdi 21.50N 70.45E
Lothal 22.31N 72.15E

Marusthali
Jodhpura 27.31N 76.05E
Ganeshwar 37.40N 75.51E

***Rann of* Kutch**
Kotada Timba, Kotadi
(Dholavira) 23.58N 70.12E
Surkotada 23.37N 70.50E
Pabumath 23.38N 70.31E
Desalpur 23.29N 69.10E

Sarasvati River
Gamanwala
Ganweriwala Ther 28.50N 71.10E
(Cholistan or Rohi Desert)

Khirsara, Khera-sara (Netra)
Tarkhanawala-dera 29.14N 73.14E
Sandhanawala-thera
(Near Fort Abbas)

Mohenjodaro

(Island between W. Nara

Loop-- Sarasvati river and Sindhu river)

Kalibangan 29.29N 74.08E
Banawali 29.37N 75.23E
Rakhigarhi 29.17N 76.07E
Alamgirpur 29.00N 77.30E
Hulas 29.42N 77.22E
Rohira 30.38N 75.50E
Chandigarh 30.45N 76.47E
Ropar 30.58N 76.31E

Godavari river
Daimabad 19.31N 74.42E

Sindhu river
Gharo Bhiro (Nuhato)
Allahdino
Bala Kot
Amri
Chanhujo-daro
Nindowari-damb
Lohumjo-daro
KotDiji
Naru-waro-daro
Jhukar

Mohenjo-daro
Nausharo
Sibri-damb
Pirak
Rahman-dheri
Tarakai Qila
Harappa

Oman

Ra's al-Hadd
Ra's al-Junaya

Persian Gulf

Tell Abraq
Bahrain
Failaka

Tigris-Euphrates rivers

Ur
Tello
Umma
Susa
Nippur
Kish
Tell-Asmar (Eshnunna)
Luristan
Tell as-Suleimani

Caspian Sea

Tepe Gawra

Makran

Tepe Yahya

Bactria

Shortugai

Turkmenistan

Altin Tepe

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CONTINUITY AND LEGACY OF SARASVATI CIVILIZATION: A PICTORIAL PRESENTATION

PROFESSIONS AND CRAFTS:

CELEBRATION OF THE LEGACY OF SARASVATI (AS RIVER GODDESS AND AS GODDESS OF THE CRAFTS AND ARTS)

USE OF FIRE BY
- LAPIDARIES AND COPPER-SMITHS
- BANGLE MAKERS
- BEAD-MAKERS, USERS OF DRILL
- TERRACOTTA SCULPTURES

NAVIGATORS (RIVERINE, MARITIME TRADE)

SCULPTORS (BRONZE STATUES)

MASONS AND ARCHITECTS (BUILDERS)

CELEBRATING THE LEGACY:

TEMPLE IN PATTAN MINARA ON THE BANKS OF THE SARASVATI RIVER

SCULPTURE OF SARASVATI AS RIVER IN ELLORA (5^{TH} CENT. A.D.)

SARASVATI TEMPLE ON THE BANKS OF THE GODAVARI RIVER

SARASVATI TEMPLE ON THE BANKS OF THE CAUVERY RIVER

MAPS AND SATELLITE IMAGES SHOWING THE COURSE OF THE VEDIC SARASVATI RIVER FROM THE HIMALAYAS TO THE GULF OF KHAMBAT

SARASVATI: MAPS AND FIGURES

Map 1 Course of the Vedic Sarasvati River
Map 2 Ancient Civilization Settlements on the Sarasvati River

Banawali: fire altars; drains needed to cope with 1500^{o}C
Cholistan: firing pots, using terracotta cakes to firm-up the packing (Mughal, 1997)
Mohenjodaro: Bangle making apparatus
Balakot: Inscribed Bangle

Banawali: Copper Implements

Mohenjodaro: Seal depicting a boat; Sindh: Mohanna boat (Today)
Mohenjodaro: Terracotta, toy cart; Sindh: cart (Marshall, 1931)
Mohenjodaro: Terracotta statue, wearing an embroidered shawl, leaving the right-shoulder bare, exquisitely trimmed beard
Mohenjodaro: Bronze statue, bangles worn from wrist to shoulder; similar to the bangles worn even today in Rajasthan

Mohenjodaro: Terracotta, Mother Goddess, with headgear to hold two lamps; Dancing Girl with headgear: Bulandbagh, Patna Museum, 300 B.C.
Dholavira: use of ringstones to mount pillars and superstructures (Bisht)

Map: Ancient India: Haraquaiti River (Tributary of Kubha River, Afthanistan); Sarasvati River (Witzel, 1987)
Map: Little Rann of Kutch, Gujarat: Sarasvati River
Map: Pushkar, Rajasthan: Sarasvati River, Tributary of Luni River

Pattan Minara: 'Pre-Islamic Shrine' on the banks of the Sarasvati River (Mughal, 1997)
Sarasvati River in Sculpture: Ellora, Vakataka, 5th cent. A.D.

Basara (Vyasapura), Godavari River: Goddess Sarasvati formed by three hand-fuls of sand from the river
Kuttanur, Cauvery River: Goddess Sarasvati (celebrated by Ottakkuttan)

Trekking Map (Yamunotri): Himalayas: Origin of Sarasvati (Tons) River from Bandarpunch Massif, Har-ki-dun glacier, W. Garhwal, U.P.

Mohenjodaro: Steatite Pectoral inlaid with red paste
Harapp: Miscellaneous beads
Mohenjodaro: Reconstruction of the drill

Har-ki-dun Glacier, Bandarpunch, W.Garhwal, Himalayas (Valdiya, 1996)
Map: Chambal (later named Yamuna) River, a southern tributary of Ganga captures Sarasvati (Tons) River at PaontaSaheb (Valdiya, 1996)

Map: Satellite image: Palaeo Channels of Sutlej and Sarasvati Rivers joining at Shatrana; Signatures Palaeo-Channels of west-ward migration of Sutlej River (Yashpal, 1980)
Map: Satellite (LANDSAT) image: palaeo-channel of Sarasvati in Rajasthan (Suratgarh, Anupgarh)(Yashpal, 1980)

Map: Satellite (LANDSAT) image:palaeo-channel of Sarasvati River: water-logging at Suratgarh, disappearance of the channel into the desert at Anupgarh (Kalyanaraman, from UC, Santa Barbara, 1996)
Map: Sarasvati River: Dry bed in Bahawalpur, Cholistan (Mughal, 1997)
Map: Ancient Sarasvati: Shatadru and Yamuna confluence at Shatrana; flowing into Rann of Kutch, Gujarat (Valdiya, 1996)

Map: Ancient Sarasvati river draining beyond Rann of Kutch, through Little Rann and Nal Lake into Gulf of Khambat (Nal Lake expands, during monsoon, into Little Rann and into Gulf of Khambat, cutting off the peninsula of Saurashtra from, Ahmedabad (S.R.Rao, Lothal Report; Gazetteers)
Satellite composite: Sarasvati River (NW India) Water Development Project Area (Composite satellite image, European Space Agency)