

Inauguration Vol. 1 | Issue 1 | February 2015

इषाण्वेत्ति

A Journal of Science and Heritage Initiatives

Sponsored by the Ministry of Human Resources Development, Government of India



भारतीय प्रौद्योगिकी संस्थान खड़गपुर

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

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Theme of logo & cover page

In mythology, the Mayan calendar depicts the four quadrants of truth.

The cardinals represent a year bound time-movement of the sun-god.

In ancient Hermeneutics, the four Vedas are located at four corners or placements (Char-dham) having four cyclic principles namely Agni or the ascending outpouring fire or tapas (Rig Veda); Vayu or the psychic power-movement (Yajur Veda); Surya or the convergence of rays as core knowledge (Sama Veda); and Soma or the descending and inpouring ambrosia which is siddhi (Atharva Veda). It is the basis of cosmic thermodynamics as embedded in the 'Secret of the Vedas'.

The four quadrants are the locations of four Buddha(s) (Kala-chakra-yana). They stand for all-round judgment in the Asokan pillar.

In Chinese iconography or I-Ching, the cruciform stands for 'spring and autumn' i.e., death and resurrection. The ancient quadrant of Pasargadae in Persia became the Garden of Eden in Semitic faiths – the eternal Paradise. It is called Char-Bagh.

In pattern-recognition and shape grammar, the two regulating lines embedded in the calendar as diagonals are the two Karna-sutras. The crossing of the two oars (ears) stands for conjoint-complementarities of construction and deconstruction in visual semiotics and sensory semantics.

In Cosmogony, it is a yearly cycle of the mortals (Samvatsara) or it can expand to be a Mandala, reflecting a similar but larger aeon or cosmic cycle of dissolution and creation (Sana or the year of Brahma-chakra).

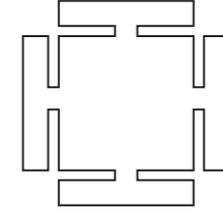
In Tantric Lore, it is the guardian matrix of Lalita-mahatripura-sundari, and her Yantra therefore becomes the sacred cosmic footprint or schema arrayed in her own womb. It is her self-luminous divine beauty (Shri) which she self-exudes and self-extends (based on the root / etymos tan: giving rise to words like 'Tat', 'Tanu', 'Tantuja', 'Tantra' in Sankrit and 'Tension', 'Tender', 'Thunder' and 'Tent' in English meaning looming or weaving or networking through space) like a spider as the web of universal manifestation and assimilation.

The web of universal manifestation and assimilation is the spirit of SandHI.

Developed based on various excerpts from:

Chevalier, Jean and Alain Gheerbrant, the Penguin *Dictionary of Symbols*, Paris, 1982. [Translated from French into English by John Buchanan-Brown]

SandHI, Ankana (Iconography) projects 1 and 2
IIT Kharagpur
February 2015



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Published in February 2015

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ISBN 978-93-80813-32-5

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Message

Let me begin by congratulating the entire IIT SandHI team for formulating a rich variety of pilot projects in select cities, which is inclusive of PROJECT VARANASI and other heritage based urban renewal and smart urban engineering projects. As I said in my earlier message, which has cut across the e-web, that I am proud of the achievements of the Team IIT Project SandHI, which is a multi-disciplinary and cross-institutional 'Science and Heritage initiative', focusing on both recognizing the ancient knowledge systems and inculcating the state-of-the art solutions for developing sustainable habitat initiative.

Through the making of the SandHI Journal, a dynamic innovation platform will be created, where the future seeds of understanding and reviving the traditional knowledge systems through science and technology will be best nurtured thereby augmenting the Indian way of scientific thinking and problem-solving, which I believe is the 'need of the hour'.

Special felicitations to IIT Kharagpur to fore-run and steer the making of the Journal on behalf of the entire IIT SandHI team.

Smriti Zubin Irani
Honourable Minister
Ministry of Human Resources Development
Government of India

February 2015

From Sarasvati to Ganga

Michel Danino

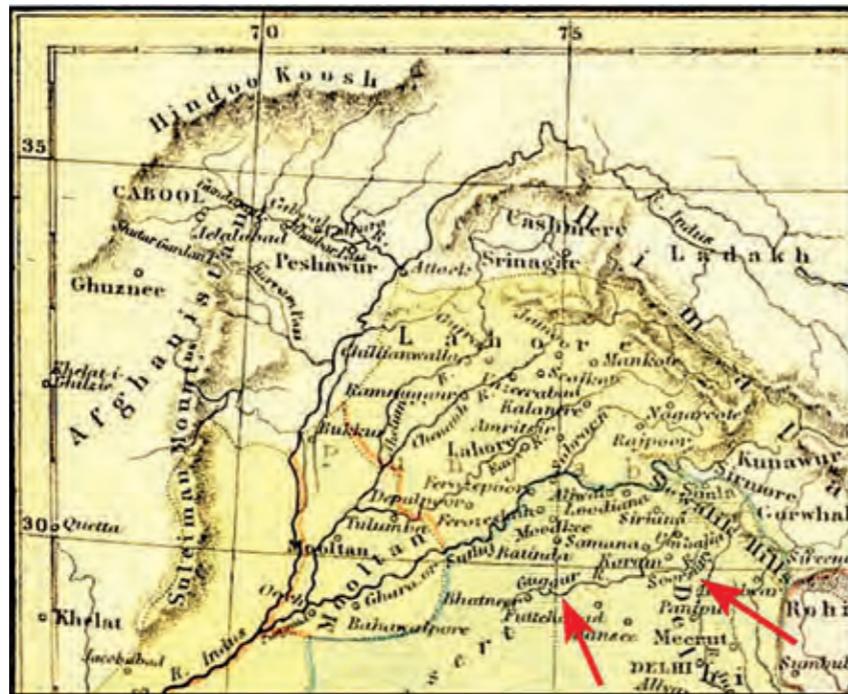
Guest Professor, IIT Gandhinagar

The problem and its solutions

Despite the broad consensus, some scholars started in the 1980s questioning this term and the identification between Ghaggar and Sarasvati. What prompted this rather late reaction? The pattern of settlements in the Sarasvati basin now revealed that in its central part—roughly southwest Haryana, southern Punjab and northern Rajasthan—most Harappan sites were abandoned sometime around 1900 BCE, a period coinciding with the end of the urban phase of the Indus civilization. Clearly, the river system collapsed—which archaeologists now see as a contributing factor in the decline of the brilliant Indus civilization.

Praised in the Rig-Veda as a 'mighty' river flowing 'from the mountain to the sea' somewhere between the Yamuna and the Sutlej, the Sarasvati is reported a few centuries later to be disappearing in the desert at a point called *Vinashana*, then a revered pilgrimage site. The river went on dwindling down, eventually becoming 'mythical', finally relocated at the confluence between Ganga and Yamuna as an 'invisible' river so she would be remembered (Danino, 2010).

As early as in 1760, a map from *The Library Atlas* (Bryce, Collier & Schmitz) showed the Sarasvati (spelt 'Soorsuty') joining the Ghaggar ('Guggur') in Punjab; indeed, even today a small stream called 'Sarsuti' seasonally flows there. In 1778, James Rennell, a noted English geographer and cartographer, published a *Map of Hindoostan or the Mogul Empire* with similar details. In the early 19th century, British topographers surveyed the bed of the Ghaggar, a

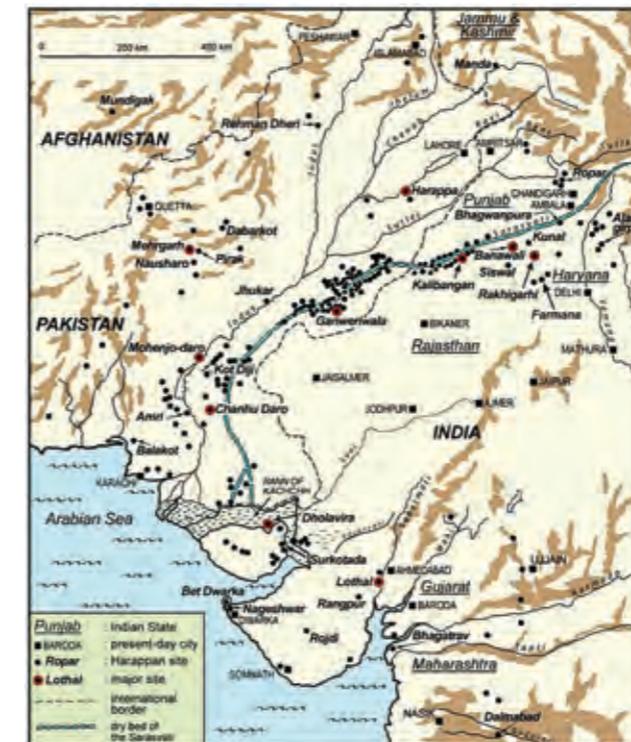


The Sarasvati and the Ghaggar marked by the two arrows in this detail of a 1760 British map. (Courtesy Prof. Frances Pritchett of Columbia University, www.columbia.edu/itc/mealac/pritchett/00maplinks/colonial/india1760/india1760.html)

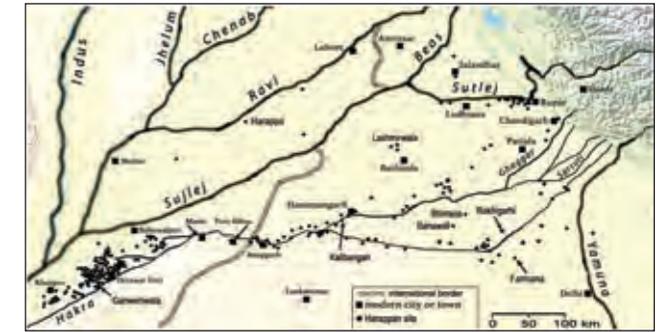
seasonal river flowing down from the Shivalik hills, and found it much too wide for the paltry waters it carried during monsoons. The first scholar to propose, in 1855, that the Ghaggar-Sarasvati was the relic of the Vedic Sarasvati was the noted French geographer Louis Vivien de Saint-Martin (Vivien de Saint-Martin, 1858). Subsequently, nearly all Indologists, from Max Müller to Monier-Williams, Macdonell, Renou accepted this thesis. Geologists such as R. D. Oldham (1886) joined in, followed by geographers such as the Indian Shamsul Islam Siddiqi (1944) or the German Herbert Wilhelm (1969).

The Sarasvati and the Indus Civilization

Archaeology sprung a major surprise by redefining the Sarasvati's role. In the 1920s, the Bronze Age cities of Harappa and Mohenjo-daro came to light; initial findings were limited to the Indus Valley and Baluchistan, but in 1941, the intrepid explorer and Sanskritist Marc Aurel



General map of the Indus-Sarasvati civilization (map by Michel Danino)



Mature Harappan sites in the Sarasvati basin (map by Michel Danino)

Stein conducted an expedition in the Bahawalpur State—today's Cholistan, an arid region of Pakistan where the Ghaggar's dry bed continues under the name of 'Hakra' (Stein, 1942). There, Stein stumbled upon many ruined sites of Harappan culture. Decades of further explorations both in India and Pakistan have established that the Sarasvati basin was home to at least 360 sites of the Mature (or urban) Harappan phase (2600–1900 BCE). This includes settlements such as Bhirrana, Rakhigarhi, Kunal or Banawali (all in Haryana), Kalibangan (Rajasthan) or Ganweriwala (Cholistan)—which explains the alternative term of 'Indus-Sarasvati Civilization'.

The Sarasvati and the Aryan Issue

Despite the broad consensus, some scholars started in the 1980s questioning this term and the identification between Ghaggar and Sarasvati. What prompted this rather late reaction? The pattern of settlements in the Sarasvati basin now revealed that in its central part—roughly southwest Haryana, southern Punjab and northern Rajasthan—most Harappan sites were abandoned sometime around 1900 BCE, a period coinciding with the end of the urban phase of the Indus civilization. Clearly, the river system collapsed—which archaeologists now see as a contributing factor in the decline of the brilliant Indus civilization.

Let us recall that the Rig-Veda's hymns are commonly said to have been composed by Indo-Aryans shortly after their migration to India around 1500 BCE. However, by that time, the Sarasvati had been reduced to a minor seasonal stream: how then could the said Aryans praise it as a 'mighty river', the 'best of rivers', 'mother of waters',

etc.? There is a chronological impossibility. Either the composers of the hymns lived much earlier, contradicting mainstream Indology, or, as the objectors now asserted, the Ghaggar-Hakra was not the Sarasvati extolled in the Rig-Veda. But their alternative explanations have run against the Rig-Veda's own testimony that the river flowed between the Yamuna and the Sutlej.

New Research on the Sarasvati

Leaving aside the controversy, we now have scientific research combining geology and river studies. Satellite imagery is another useful tool, but cannot by itself date the numerous buried palaeo-channels (ancient waterways) it has brought to light; anyone can today access websites such as Google Earth and view the well-marked bed of the Ghaggar, but when did a perennial river last flow through it?

Recent studies have thrown new light on the ancient river. In 2009, U.K. geologist Peter Clift found that 'between 2000 and 3000 BCE, flow along a presently driedup course known as the Ghaggar-Hakra River ceased, probably driven by the weakening monsoon and possibly also because of headwater capture into the adjacent Yamuna and Sutlej Rivers' (Clift, 2009). Three years later, Clift's multi-national team, basing itself on U-Pb dating of zircon sand grains, concluded that the Yamuna once flowed into the Ghaggar-Hakra, but switched eastward tens of thousands of years ago; the Sutlej also contributed to the Ghaggar system but abandoned it 10,000 years ago or earlier (Clift et al., 2012). But the paper remained non-committal as regards the precise time for the drying of the Ghaggar itself.

In 2012, too, Liviu Giosan, Peter Clift and other geoscientists disagreed that 'large glacier-fed Himalayan river watered the Harappan heartland on the interfluvium between the Indus and Ganges basins'; rather, 'only monsoonal-fed rivers were active there during the Holocene' (that is, the last 10,000 years or so). In particular, 'rivers were undoubtedly active in this region during the Urban Harappan Phase'. Indeed, the geoscientists found 'sandy fluvial deposits approximately 5,400 [years] old at Fort Abbas in Pakistan, and recent work on the upper Ghaggar-Hakra interfluvium in India also documented Holocene channel sands that are approximately 4,300 [years] old.' (Giosan et al., 2012) In a later comment on the paper, Giosan clarified, 'Our

research points to a perennial monsoonal-fed Sarasvati river system with benign floods along its course' (Giosan et al., 2013). The Ghaggar-Hakra was thus active during the urban Harappan period, although apparently not (or no longer) fed by glacial sources.

The last point remains an object of debate among geologists. What matters is the acknowledgement of a perennial Ghaggar's role in sustaining numerous Harappan urban settlements, and the coincidence between its dwindling down and the withdrawal of Harappan sites from its central basin. This is further supported by another 2012 study, directed by the Indian geologist Rajiv Sinha, which mapped palaeo-river sedimentary bodies in the subsurface by measuring their electrical resistivity (water-bearing sediments having a lower resistivity than dry ones). The study offered 'the first stratigraphic evidence that a palaeochannel exists in the sub-surface alluvium in the Ghaggar valley. The fact that the major urban sites of Kalibangan and Kunal lie adjacent to the newly discovered subsurface fluvial channel body ... suggests that there may be a spatial relationship between the Ghaggar-Hakra palaeochannel and Harappan site distribution' (Sinha et al., 2013).

Such a conclusion had been reached by archaeologists long ago, since Kalibangan, for instance, shows no evidence of independent water supply; unlike Mohenjodaro, it had very few wells, and unlike Dholavira, no reservoirs, yet it was continually occupied for several centuries: for its water supply through the year, it must therefore have depended on the Sarasvati, on whose left bank it lay, with entries into its fortified enclosures facing the riverbed.

Apart from river studies, many palaeoclimatic studies have in recent years pointed to a weakening of the Indian summer monsoon from 2200 BCE onward (Danino, 2015). Whether the long drought that followed is the cause for the break-up of the Sarasvati is likely but remains to be firmly established.

From Sarasvati to Ganga

Two lessons flow from the river's disappearance. The first is that it forced migrations of Harappans in several directions, in particular eastward, crossing Ganga and mingling with agrarian communities long established in the Gangetic plains. The Late Harappans, as they are called, reverted to rural lifestyles but carried some of

their culture with them, which explains the transmission of a host of Harappan cultural features, symbols, practices and technologies to the later Ganga-Vindhya civilization. Besides, Indological studies have shown that the sacredness of the Sarasvati and her attributes as a goddess was transmitted to Ganga in the course of centuries.

Secondly, it is now clear that climatic and environmental disruptions played a major part in the break-up of the Indus civilization. No one can deny anymore that we are now undergoing another major climatic change. With human interference (deforestation, excessive damming, etc.) compounding the problem, there have been warnings that Ganga may turn into a seasonal river sometime this century; we must hope that mitigating steps will be urgently taken to save Ganga from becoming another Sarasvati. Harappans had time and space to relocate, if Ganga and some of its tributaries such as the Brahmaputra disappear, we may have neither.

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