

# River Piracy

## Saraswati that Disappeared

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The legendary river Saraswati, which flowed from the Himalaya and emptied finally into the Gulf of Kachchh, has vanished. Tectonic movements change river courses, behead streams and sometimes even make large rivers such as the Saraswati disappear.

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### Mighty River of Vedic Time

There was this highly venerated river Saraswati flowing through Haryana, Marwar and Bahawalpur in Uttarapath and emptying itself in the Gulf of Kachchh, which has been described in glowing terms by the *Rigveda*. "Breaking through the mountain barrier", this "swift-flowing tempestuous river surpasses in majesty and might all other rivers" of the pre-Mahabharat Vedic

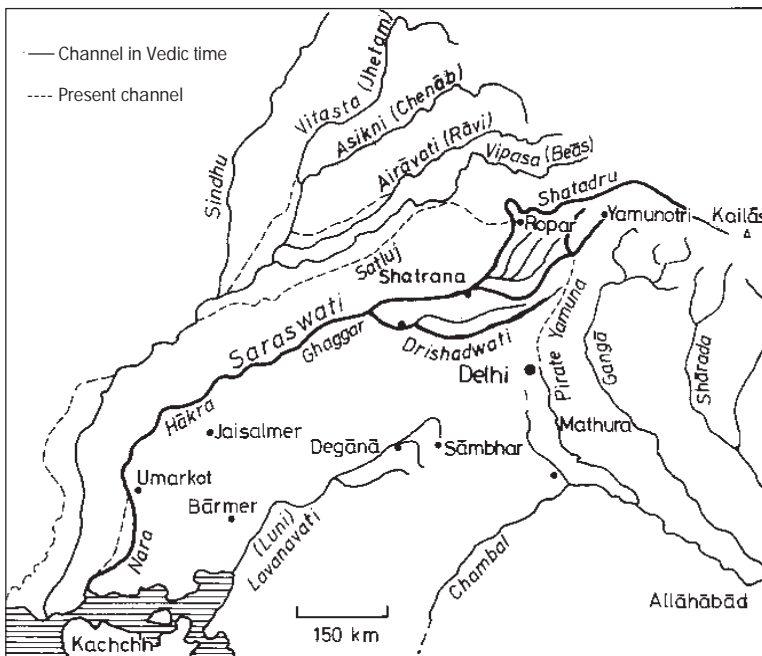


Figure 1 (bottom left) Legendary Saraswati of the Vedic times was formed by joining together of the Shatadru (Satluj) and what is today known as the Yamuna. The Aravali was not a highland but a thickly forested terrain sloping southwestwards.

Figure 2 (bottom) Satellite picture of the Haryana-Punjab region, showing the disproportionately wide channels (with little or no water) abandoned by big rivers which have migrated to the east or west.

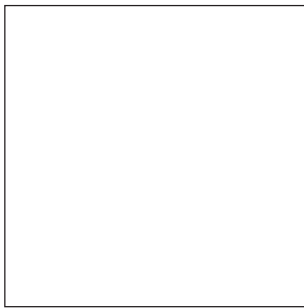
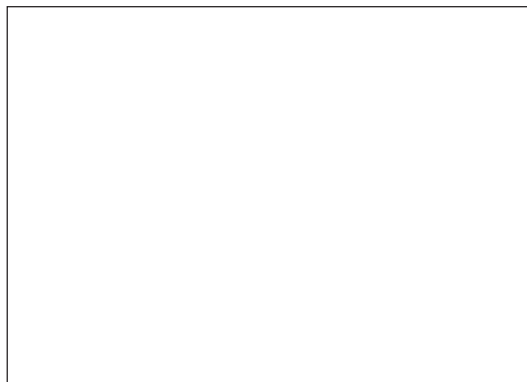


Figure 3(A) (left): Main confluence of the Saraswati, what is today called the Tons branch of the Yamuna, springs from the Har-ki-Dun glacier. (B) (right): Source of the other confluence of the Saraswati, the Satluj, lies beyond the Indo-Tibetan border range.



period. More than 1200 settlements, including many prosperous towns of the Harappan culture (4600 to 4100 years Before Present - BP) and ashrams of *rishis* (sages) lay on the banks of this life-line of the Vedic time.

Where has that great river gone? It is today represented by the disproportionately wide and astonishingly water-less, sand-filled channels of Ghaggar in Haryana and Marwar, Hakra in adjoining Bahawalpur, and Nara in Sindh (Figure 1). These channels, which discharge only floodwaters, are quite apparent in the satellite imageries (Figure 2).

The legendary Saraswati was indeed a great river which rose in the Bandarpunch massif of the Great Himalaya in western Garhwal (Figure 3A), flowed southwestward through a channel past Adibadri, Bhavanipur and Balchhapur in the foothills, and met the Shatadru or Satluj (which then veered towards the southeast). The Shatadru came from the region of Mount Kailas in southwestern Tibet (Figure 3B). The ancient Saraswati was thus formed by the confluence of what are today the Yamuna and Satluj rivers flowing in entirely different directions (Figure 1). The two joined at Shatrana, 25 km south of Patiala, and flowed through a 6 to 8 km wide channel (Figure 4) known today as the Ghaggar. Obviously, a large volume of water flowed down the Ghaggar channel. Even today the combined discharge of the Yamuna and Satluj is of the order of 2900 million cubic metres per year. It must have been many times more in those days.



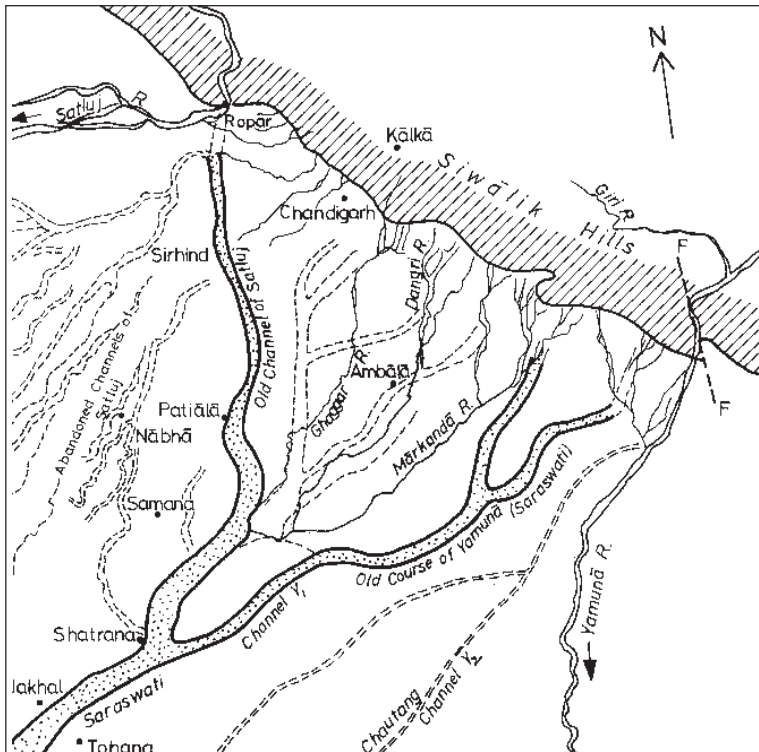


Figure 4 Dry channels of the Ghaggar and its tributaries seem to have been the former courses of the confluents of the Saraswati. (Based on Yashpal et al, 1980).

The Ghaggar is known as Hakra in northwestern Marwar and Bahawalpur (Pakistan) and as Nara in Sindh, before it discharges into the Gulf of Kachchh. Drishadwati - now a dry channel called Chautang - joined the Saraswati near Sirsa from the east (*Figure 1*). It was at Kurukshetra in Manu's Brahmavarta between the Saraswati and the Drishadwati where the epic battles of Mahabharat were fought in the post-Vedic period.

### Wetter Period in Marwar

Western Rajasthan - including the Thar tract - was a wetter region some 40,000 years ago. Periods of dryness alternated with phases of wetness. This is testified by pollen grains buried and trapped in the sediments of the Lunkaransar and Didwana lakes and by thermoluminescence of sands in dunes and floodplains. The Saraswati and its tributaries held sway in the northern part, and the Lavanavati (Luni) had an organized drainage network of perennial streams in the southern part. It was in this well-watered,

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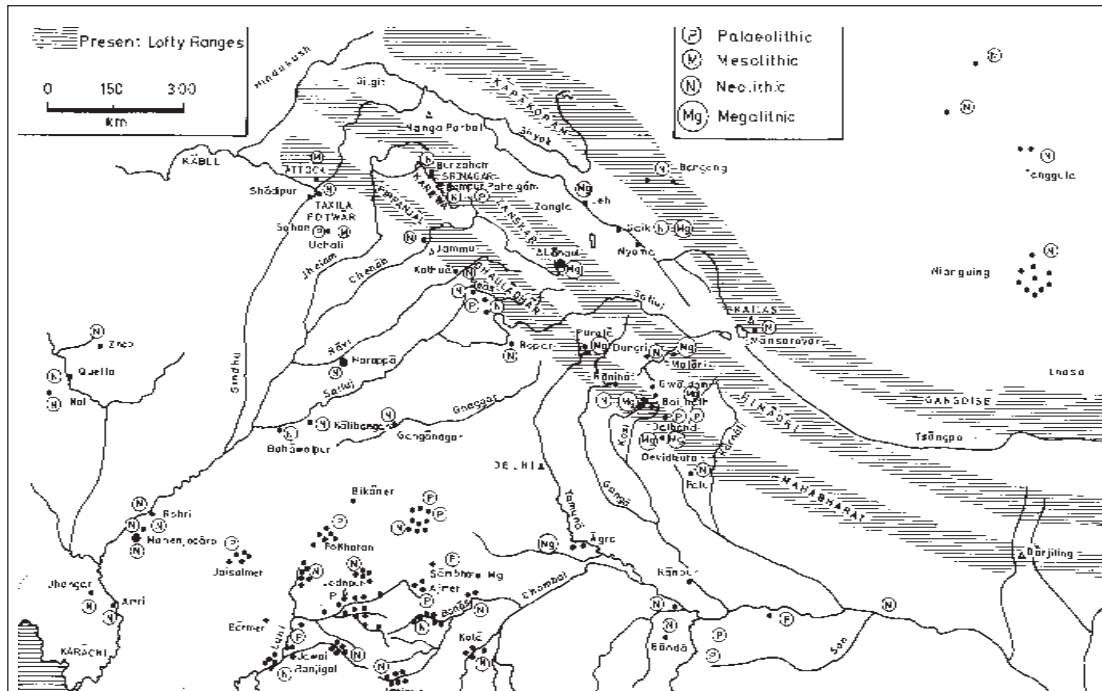


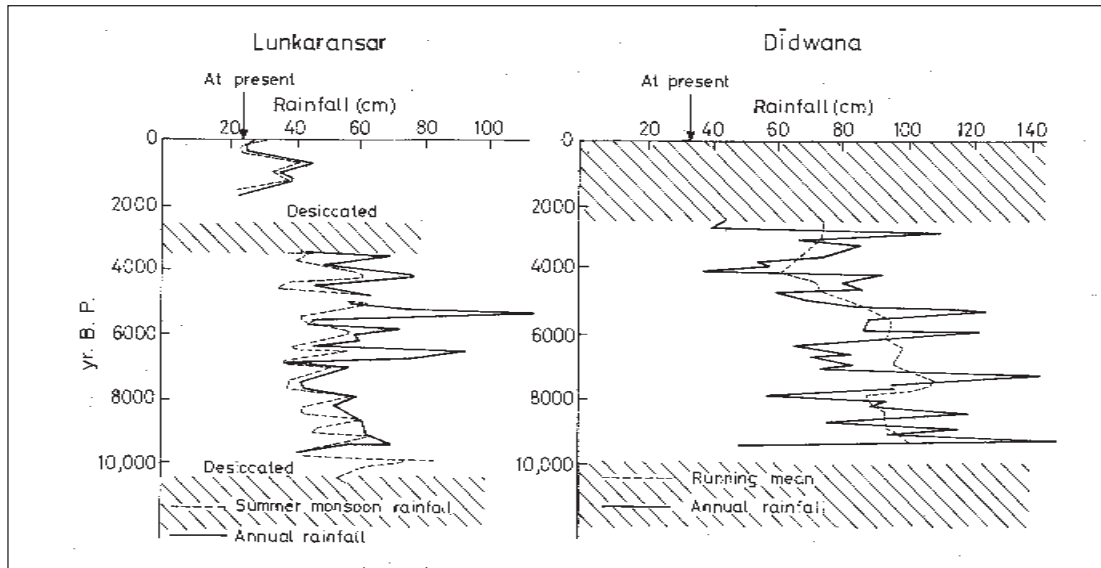
Figure 5 Site of settlements of the stone-age people in the Palaeolithic to Neolithic period (Based on V N Misra 1995 and other sources).

presumably fertile and congenial land of the Saraswati, Drishadwati and Luni that the stone – age people established their settlements (Figure 5), and developed their Palaeolithic, Mesolithic and Microlithic cultures.

Stone –age settlements evolved and developed their Palaeolithic, Mesolithic and Microlithic cultures in the well-watered, presumably fertile and congenial land of the Saraswati, Drishadwati and Luni.

From 10,000 to 3,500 years BP, the climate was quite wet - the rainfall being almost three times what it is now (Figure 6). This is indicated by the analysis of pollen (dominated by those of *Syzygium*, *Pinus* and *Astemisia*). Cutigens in pollens and fragments of charcoal of stubbles imply that these people had taken to agriculture - 9,400 years BP in the area of the Lunkaransar and 8,000 years BP in the Sambhar lake tract.

More than 75% of the 1,600 settlements of the Harappan culture have been found in the valley of the Saraswati, such as at Banawali and Kalibangan in the Ghaggar valley and AliMurad and Kot in the Hakra valley. The Harappan civilization, dating back to the period 4,600-4500 to 4,200-4,100 years BP, was spread over nearly 13 lakh square kilometre area, stretching from Sutkongedar in



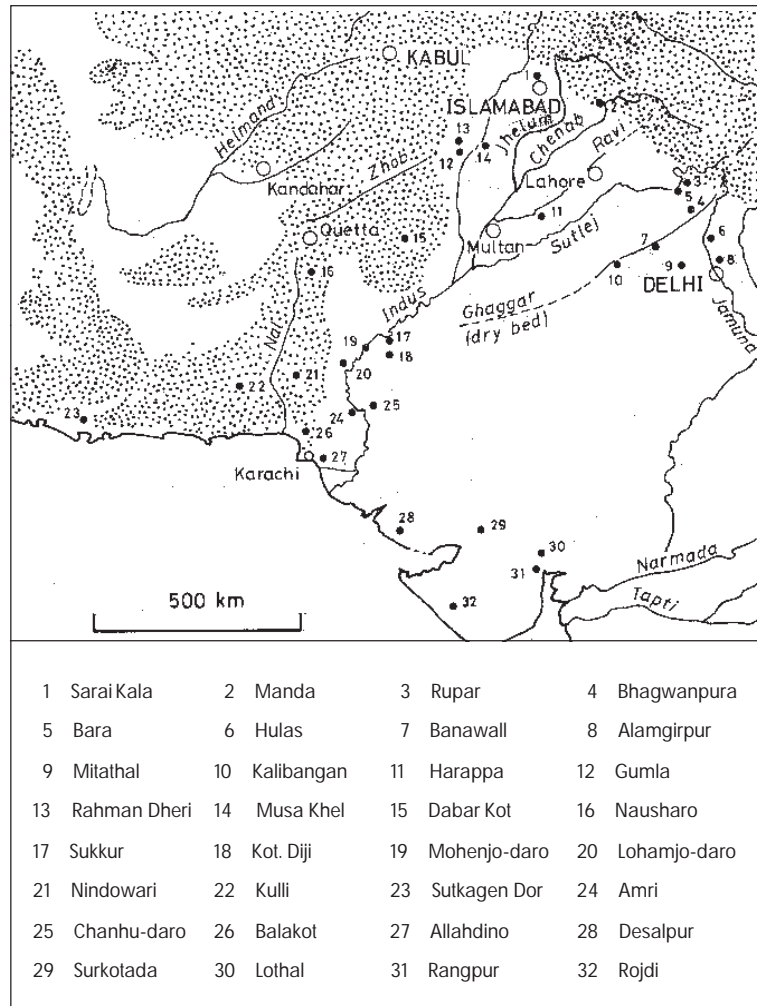
the west, through Mohenjodaro in the westnorthwest, Ropar in the north, Alamgir in the east, Sutkotri in the south to Lothal, Rangpur, Rojri and Dhaulavira in the southwest (Figures 5 and 7). The older Harappan sites are concentrated in the lower reaches of the Saraswati, while later Harappan settlements nestle in its upper reaches - in the Siwalik domain. There seems to have been upstream migration around 3,700 years BP, presumably prompted by a decline in the river discharge. Why was there a reduction in the river discharge? Perhaps the climate had worsened, as indicated by the lake waters turning saline around 3,700 years BP (borne out by overwhelming appearance of halphytes among the aquatic flora of the lakes). Or, perhaps the Saraswati had been robbed of its water.

### Ganga Stole Away Saraswati's Water

Tectonic movements overtook the northern part of the Indian subcontinent, and the Aravali started slowly rising. The evidence for the continuing rise or uplift of the Aravali Range is quite striking. The western flank delimited by faults is marked by very steep straight scarps. The gently west-flowing streams draining the very old mature terrain of Mewar either descend suddenly in

*Figure 6 Analyses of pollen buried with sediments in the Lunkaransar and Didwana lakes indicate — according to Gurdip Singh and his colleagues (1974) — that in the period 10,000 to 3,500 years BP Western Rajasthan used to have at least three times the rainfall that it has today.*

Figure 7 Major settlements of the Harappan period (A H Dani and B K Thapar).



**The Ganga had robbed the Saraswati of the major portion of its water through the agency of a branch of its tributary, the Chambal.**

waterfalls, or flow through deep gorges and ravines in the western flank of the range. These streams are characterized by entrenched meanders and incised channels, and show development of uplifted terraces on their banks before abruptly swerving across the active faults.

The Saraswati was forced to shift its course — progressively eastward. The Chautang channel (*Figure 1*) possibly represents the course abandoned by the eastward migrating Saraswati. Uplift of the Aravali domain accentuated the pace of erosion of the terrain. Consequently a branch of the Chambal River started



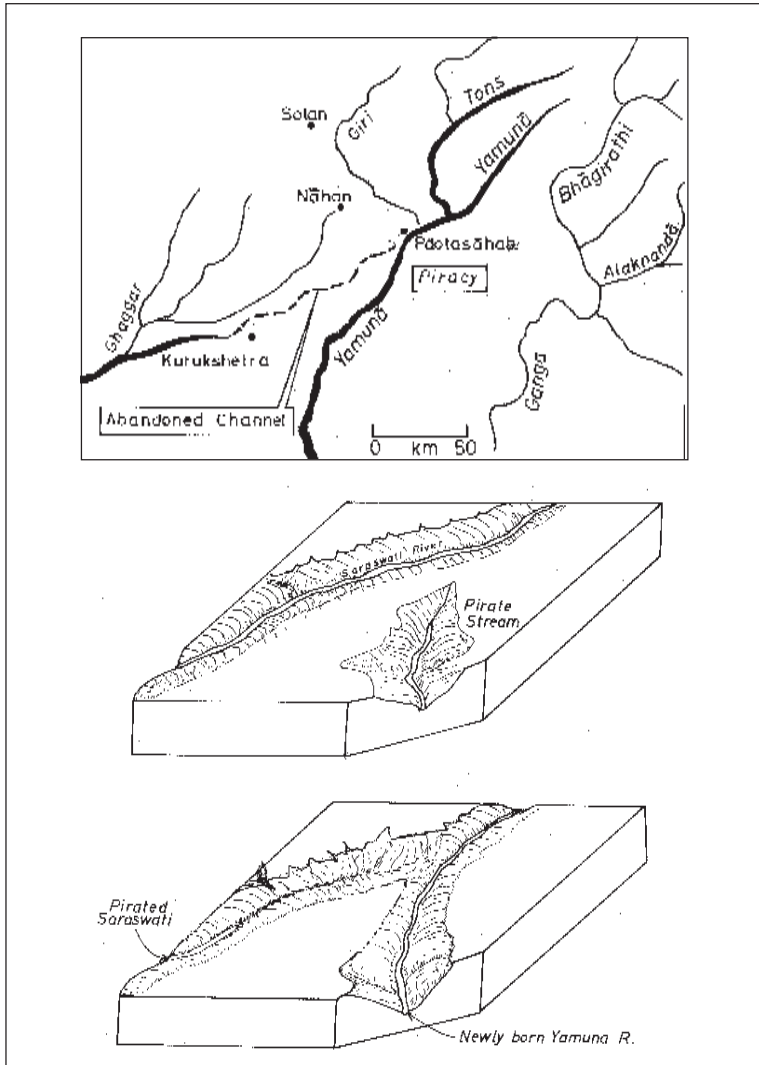


Figure 8 A south-flowing branch of the Chambal, (the southwestern tributary of the Ganga) cut its channel headwards and captured the water of the then south-west flowing Saraswati. The new channel, through which the diverted water flowed, was later named Yamuna. Map shows the drainage pattern after this river piracy — after the Saraswati was robbed of its water by the Ganga through the agency of its tributary.

cutting its course northwards by headward erosion. It cut the channel deeper than that of the Saraswati (*Figure 8*), and thus beheaded the Saraswati. During rains, the floodwater of the Saraswati rushed into this new channel (later to be called Yamuna) culminating in the capture of the Saraswati by the Chambal, the southwestern tributary of the Ganga. This was a case of river piracy, resulting from accelerated headward erosion, which in turn was prompted by tectonic uplift of the terrain. Thus the Ganga had robbed the Saraswati of the major portion of its water through the agency of a branch of its tributary, the Chambal (*Figure 8*).

Deprived of the snow-fed waters of the Yamuna and the Satluj, the Saraswati was reduced to a puny river, left with the streams rising in the Siwalik domain.

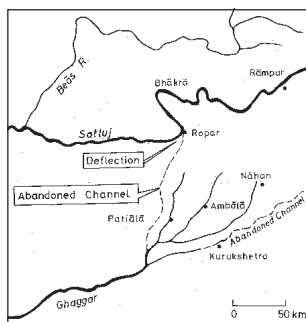


The reduced flow in the Saraswati, coupled with the onset of dry climatic conditions over western Rajasthan, forced the Harappans to migrate upstream and settle down in the foothills of the Siwalik domains. This must have happened about 3,700 years BP. The *Markandeya* and the *Varaha Puranas* tell us that the Saraswati was in decline during the Mahabharat time. Sage Manu states that the Saraswati vanished in the sand at Vinasan, near Sirsa. There is allusion to the disappearance of the river in *Van Parva* of the *Mahabharat*, and also in the *Siddhant Shiromani*.

### Great Betrayal

The Satluj joined the Sindhu, and the Saraswati was left high and dry, having being betrayed once again.

The Aravali continued to rise. The newly formed Yamuna was forced to migrate progressively eastward. Satellite imageries show that it has migrated 10 to 40 km (in different segments) since the time of Lord Krishna, who was born in a prison on the bank of the Yamuna. The Satluj likewise moved westward, abandoning its older channels successively. Dry channels such as Wah, Naiwal and Sarhind bear testimony to the progressive westward shifting of the Satluj. Finally it got deflected, possibly as a result of paroxysmal uplift of the Aravali domain and concomitant subsidence of the land to the west. This is obvious from the spectacular U-turn of the Satluj at Ropar (*Figure 9*). The Satluj joined the Sindhu, and the Saraswati was left high and dry. Saraswati was betrayed once again.



*Figure 9 Great betrayal. Later when the Aravali rose, and as the land to the west sank, the Satluj changed its course abruptly, making a sharp U-turn at Ropar.*

However, some water of this Himalayan river continued to flow into the Hakra-Nara channel until about 1245 AD, when there was a great migration of the desert people out of the region. The Satluj finally ceased to contribute water in 1593 AD, when it changed its course finally and decisively.

Deprived of the waters of the two snow-fed rivers (Yamuna and Satluj), the Saraswati was reduced to a puny river, left with the waters of the petty streams rising in the Siwalik domain - Wah, Ghaggar, Dangri, Markanda, Sarsuti etc. Only flood waters flowed down the large channel that was once the mighty Saraswati.

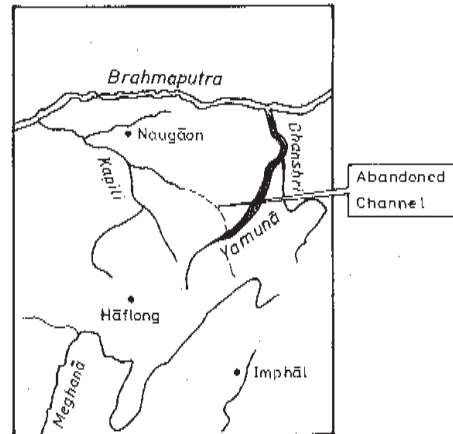
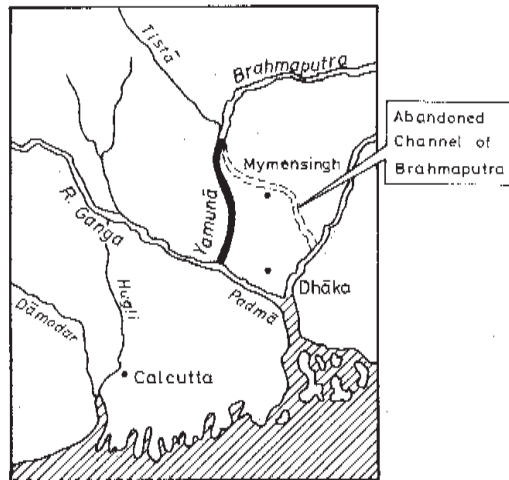
## Rivers Named Yamuna

The Saraswati of the Vedic period was beheaded and robbed of its water by a branch of the Chambal, a tributary of the Ganga. The channel through which the stolen water flowed is known as Yamuna.

Skirting the Meghalaya massif the Brahmaputra used to flow east through Mymensingh in Bangladesh to meet Meghana. Then the Barind terrain started rising between 1720 and 1830 A.D., and the Brahmaputra was attracted towards the Ganga. Abandoning its old course and the Meghana, the Brahmaputra joined the Ganga, west of Dhaka. The new pirate river is called Yamuna.

Between the Meghalaya and Mikir hills in Assam flows Kapili, merging with Brahmaputra southwest of Naugaon. A branch of the neighbouring Dhanshree captured its headwaters. The new channel is named Yamuna.

*Figure 10 In Assam and Bangladesh, as in Haryana - UP, the channel through which river piracy occurred, is named Yamuna.*



Western Rajasthan gradually turned into a parched land of moving sands.

It was not only the Satluj that was moving westwards. Indeed all the rivers of the Sindhu system — including the Asikni (Chenab), the Vipasa (Beas) and the Sindhu itself have been shifting perceptibly. The Sindhu migrated 160 km westwards in historical times. It appears that the uplift or rise and subsidence or sinking of the ground resulting from crustal movements causes changes

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in the courses of rivers, the beheading of streams, the piracy of their waters, and the disappearance of rivers, some even as great as the River Saraswati. This is the effect of the continuing tectonic subsidence of the belt adjoining the Pakistani mountain front.

The Saraswati is no more. But the anastomosing network of dry channels which lose themselves in the desert sands, tells us of the river that was great, and of the human history which was glorious. The network of canals across several states implies the return of the Saraswati to the land that was once very green and fertile.

### Suggested Reading

R D Oldham. On probable changes in the geography of the Panjab and its rivers, *J. Asiatic Soc. of Bengal*, 55:322-343. 1886.

C F Oldham. The Saraswati and the lost river of the Indian desert, *J. R. Asiatic Soc.*, 34:49-76. 1893.

S C Sharma. The description of rivers in the Rigveda, *The Geographical Observer*, 10:79-85. 1974.

G Singh, R D Joshi, S K Chopra A B Singh. Late Quaternary history of vegetation and climate of Rajasthan desert, India, *Philos. Trans. R. Soc. London*, 267B:467-501. 1974.

B Ghose, Amal Kar, A Husain. The lost courses of the Saraswati river in the great Indian deserts; new evidence from landsat imagery, *Geographical J.*, 145:446-451. 1979.

Yashpal, B Sahai, R K Sood, D P Agrawal. Remote sensing of the lost Saraswati river, *Proc. Indian Acad. Sci. Earth Planet. Sci.*, 89: 317-331. 1980.

Amal Kar, B Ghose. The Drishadvati river system of India: an assessment and new findings. *Geomorph. J.* . 150:221-229. 1984.

A K Singhvi, A Kar. Thar Desert in Rajasthan. Geological Society of India, Bangalore. 191. 1992.

V N Misra. Geoarchaeology of Thar Desert, Northwest India, in: S Wadia et al, (Eds) Quaternary Environments and Geoarchaeology of India. Geological Society of India, Bangalore. 210-230. 1995.

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Hardy on Ramanujam Theorems ... "They defeated me completely, I had never seen anything in the least like them before. A single look at them is enough to show that they could only be written down by a mathematician of the highest class. They must be true because, if they were not no one would have had the imagination to invent them".

