

NATIONAL SEMINAR ON “ WATER AND CULTURE”

June 25-27, 2007

Title: GLIMPSES OF BHAGIRATHAVIDYA– IRRIGATION ENGINEERING IN ANCIENT INDIA

Dr. Ravindranath Vaman Ramdas

A/601, Jasmine Towers,
Vasant Vihar, Pokharan Road No. 1,
Thane (W) – 400 610 , Maharashtra.
Tel – (022) 25459820

Accept this my praise, Ganga, Yamuna, Saraswati, Sutudri, Parusni, Marrudvrtha with Aksini and Vitasta, listen Avjikiya and Susoma” Rigveda, X, 75.5. (1)

Water as liquid, is indispensable to sustain life in all biological forms for drinking, for the metabolic functioning and cleansing of the body, for shelter and domestic animals and to prepare food and medicine. According to Chhandogya Upanishad “water is the essence of the earth and plants are the essence of water”. The personification of water in the form of rivers and the oceans is integral to Indian mythology (2).

Shri Kakasaheb Kalelkar used the terminology “Bhagirathavidya” for Irrigation Engineering in ancient India.(3)

It is along the banks of the rivers our civilization flourished and since the Vedic times we regarded this country as Motherland (Matrubhumi) and Holyland (Punyabhumi). The Nadi Sukta of the Rigveda and the Prithvi Sukta attest to the Divinity with which they were regarded and prayers are offered to them. Markandeya Purana says , “All the rivers are sacred, all flow towards the sea, all are like mothers to the world, all purge away sins”. The pilgrimage to the various tirthas is a unique aspect of our culture which is brought down to us for thousands of years. In his every day life a devout Hindu chants the following sloka before he invokes the presence of all the holy rivers in it.

Gange Cha Yamune Chaiva Godavari Saraswati

Narmade Sindhu Kaveri Jalesmin Sannidhim Kuru

William Willcocks aptly remarks, “ Following the genius of your country, your ancient writers, Vyas in the Mahabharata described the physical facts they were writing about in spiritual language but the facts were all the same. Every canal which went southward, whether it has become a river like Bhagirathi, or remained a canal like the Mathubhango, was originally a canal. They were lined out and dug parallel to each other. They were spaced apart. I remember quite well when I began to line out a scheme of canals for the irrigation of the country, I was astonished to find everywhere that a so-called ‘dead river’ on the map was just where a canal should be placed”. (4)

The Ishvakus and the Paurava-Bharatas were the two most illustrious royal dynasties of India during the Vedic period. Many early kings of the Ikshvaku dynasty are celebrated in both the Vedic literature and the Puranas. The most noted of these were Mandhatra, Purukutsa, Trasadasyu, Harischandra and Bhagiratha. Bhagiratha is not only mentioned as a famous king in the Ikshvaku genealogy found in the Puranas but also in the Jaiminiya Upanishad Brahmana. (5)

The story of the descent of the Ganga, the river of the immortals, to the earth is related in the ninth chapter of the Bhagwata Purana. The sons of Sagara had been turned into ashes in Hades (Patala) during an expedition for conquests. Beseched by Prince Bhagiratha the River of the immortals Ganga in the sky Viyat Ganga – Via Lactis agreed to come down to earth to revive them. To preserve the earth from inundation Siva who resides in Mount Kailas became the breakwater. The mighty floods however disappeared in his matted hair until at the further prayers of Bhagiratha Siva released Ganga when her pride had been sufficiently humbled to, to flow down the slopes of the Himalayas (6)

The earliest evidence of water conservation goes back to 3000 B. C. when Gabarbands were built in Baluchistan. The Harappans built tanks and wells, they were pioneers of well-digging technology. Wells were discovered in Harappan houses and they were also used for irrigation. During this period even in Rajasthan there was good rainfall. But the succeeding period (2000 B. C. to 500 B. C) is marked by increasing aridity, when cities vanished and all over the country there were rural farming cultures. After 1000 B. C. the climate became increasingly arid and many people had to resort to pastoral nomadism.

In the Chapter entitled 'The activities of the heads of Department' Kautilya says:

“ He should build irrigation systems with natural water sources or with water to be brought in from elsewhere. To others who are building these he should render aid with land, roads, trees and implements and also give aid to the building of holy places and parks. If one does not participate in the joint building of an irrigation work, his labourers and bullocks should be made to do his share of work. And he should share the expenses but will not receive any benefits of it. The ownership of the fish, ducks and green vegetables in the irrigation works should go to the king.” (7) A new class of odakayantrikas came into being during this period who maintained water networks. (8)

King Ashoka is associated with a remarkable feat of Mauryan Engineering in the field of irrigation. It was the construction of a reservoir called Sudarshana on the mountains of Raivataka and Urjayat near Girnar or Junagarh by artificially damming up of some of their streams. The irrigation was undertaken under Chandragupta and was improved by Ashoka who equipped the lake with wellprovided conduits drains and means to guard against foul matters. (9)

King Rudradaman has left the earliest Sanskrit inscription which records his martial exploits and his reconstruction of a great artificial lake at Girnar in Kathiawar which had been excavated under Chandragupta and improved in the time of Ashoka. This inscription is certainly amongst the earliest dated records of ancient India and proves that Rudradaman was reigning in 150 A. D. (10)

According to the Arthashastra the City Governor was responsible for the cleanliness of the streets and the prevention of fire. His duties also involved prevention or alleviation of such disasters as famine, flood and plague. Thus the last record we have of the Girnar dam is how it burst and how it was reconstructed by the local city Governor Chkrapalita, the son of the provincial governor Pranadatta is praised in the inscription commemorating the rebuilding of the dam in terms which are indeed panegyric but certain passages are quite unexpected and depict the city governor as a popular figure on the most friendly terms

with the citizens.. In any case these verses show the ideal set before the local official in the Gupta times and therefore very significant (11)

It is interesting to note how Rajendra Chola brought the water of the Ganges from where she flows in North India to the region of the Cholas. A glance at his Tiruvalangadu Plates amuses us when we realise he criticised even his own ancestor Bhagiratha for having obtained the stream from Siva through begging. That royal light of the solar race laughed at Bhagirath who had Ganga descent on earth by the intensity of his penance and decided to purify his part of the land by bringing the holy Ganga by the might of his arm to it. (South Indian Inscriptions, III, p. 400) Of course as a devotee he bows to Siva, but as a Kshatriya, he feels that imploring Siva even for Ganga was not a proper stance. By his own might and by overcoming the rulkers of the Gangetic plains, The Palas and the Gahdvalas, Rajendra brought the waters of the Ganges to Gangaikondacolapuram. The only tribute that he asked of the defeated hosts was Ganges water, brought by the vanquished princes. In large vessels loaded on troops of elephants, all the way from north to south.

Vijitais tadiyatatabhuminayakais
Salilam tadiyam atha pavanam param'

Nijanayakaya mathurantakaya tat
Samaninayat sapadi dandanayakah (S I I . III, p. 400) (12)

The discovery of a Gahadwal inscription in the temple of Siva at Gangaikondacolapuram, mentioning the Chola emperor as sovereign lord makes this event significant. The issuing of a special commemorative gold coin with the obverse and reverse identical to emphasise the esteem in which Ganga was held. Rajendra mentions the twelve mile long tank name Cola Ganga that he dug in his capital and used for holding the waters of the Ganga, as a (liquid pillar of victory) Gangajalamaya jayastambha: (13)

The Samaranganasutradhar of King Bhoja is worthy of attention. The word sutradhar literally means thread-bearer i. e. an architect who takes measurements by means of the plumbline Here is the pun on the word samara which means both the battlefield and a mortal human being destined to die. Thus the title as applied to Bhoja would signify, firstly that he was the architect of the fortunes on the battlefield i. e. who planned the strategy of battle leading to victory and secondly who was the architect of human dwellings i. e. civil architecture on an extensive scale.(14)

Ancient Indians were aware of the floating force of water, its weight and its relative power, the qualities which are chiefly used in hydraulic machines as is evident from the references in the Samarangana Sutradhar. (15)

When water flows with a force, it conveys things with it or pushes things coming in its way ; when water drops from a height or exerts an impact and when it is pushed from one direction, it reaches in all directions and these are properties of water that are used in water machines. When a thing floats in water it means that water lifts it up with a pressure equal to its own weight. When turbines and sprouts rotate, it means water reacts on the pipes while getting out at the open ends. (16)

Water can be stored, it can be supplied; it can be directed or compelled to react and in this way its force can be used in hydraulic machines. Such storage etc., has to be resorted to because the power of water is greater when stored, as it is situated at a higher level or as it is available in a larger quantity or as it is conveyed in a more water tight tube. (17)

Probably the largest of the Indian irrigation lakes until recent years was the lake at Bhojpur near Bhopal built in the middle of the 11th Century by Bhoja Parmara the King of Dhar. This too has vanished. The embankment was breached up by the Muslim invaders in the fifteenth century and has never been restored. But it is evident from available traces that the lake originally covered no less than 250 sq . miles(18)

Another monument due to the genius of King Bhoja was the Bhoja Sagar in which water was collected from the three enclosing slopes of mountains and stored into a reservoir by building an embankment on the fourth side. The fame of this wonderful lake resounded in popular memory throughout the medieval times and has been preserved up to our own times in the Hindi saying :“ Tala to Bhopala Tala Aur Sub Taalaiya” i. E. among the lakes the foremost is the one called Bhopal Tal or the lake built by King Bhoja, round which was planned the city of Bhopal, the others are mere ponds of water. (19)

Kalhana's Rajatarangini is replete with information on canals, irrigation channels, embankments, aqueducts, circular dykes, barrages, wells and water-wheels. According to the historian Aurel Stein, numerous channels from Dal and Anchar lakes that intersect suburbs of Srinagar and pass into the centre of the city bear testimony to the evidence from Rajatarangini. In fact according to him, "in the earliest traditions recorded by Kalhana, the construction of irrigation canals plays a significant part " Aurel Stein could identify quite a few of the canals which Kalhana claimed to have been built during the reigns of different kings. One of these canals is Sanmanikul, which is mentioned in the Rajatarangini by its ancient name, Suvarnamanikulya, and can be ascribed to antiquity. Another old canal that Stein could identify is called Nandi, whose name is perhaps connected with that of Nandaka village referred to in the context of Avantivarman's drainage operations.

Among the many works mentioned in the Rajatarangini, the more significant ones include the huge embankment called Guddasetu, built by Damodara II, controlling the waters of the Mahapadma (Wular lake), by a network of canals, and diversion of waters of the Vitasta and construction of series of water wheels for distribution of waters in different villages by Laladitya Muktapada of the Karkota dynasty. However the most important evidence of sophisticated waterworks in the Rajatarangini is about the irrigation work carried out by during the reign of Avantivarman of the Utpala dynasty by Suyya. Having drained off the waters of the Vitasta, he controlled it by constructing a stone dam clearing its bed. Suyya also displaced the confluence of the rivers Sindhu and Vitasta. And constructed stone embankments for seven yojans along the Vitasta for damming the Mahapadma lake. The construction of new beds for the river at points threatened by inundation breaches was among the measures designed to achieve the same object.. The change thus made at the confluence of the Vitasta and its important tributary the Sindhu can still clearly be traced. It shows the large scale and the systematic basis of Suyya's regulation. The result of the latter was a great increase in land available for cultivation and increased protection against disastrous floods, which in Kashmir have ever been the main cause of famine.(20)

Suyya made the different streams, with their waves which, like the quivering tongues of snakes, move about according to his will, just as a conquerer does with the snakes.

According to Kalhana Suyya supplemented these measures by equally important improvement in the system of irrigation which is indispensable for the cultivation of rice, the staple produce of Kashmir. The facilities thus secured for cultivation produced a remarkable reduction in the price of rice, the cost of a rice being alleged to have fallen from 200 Dinars to 36 Dinars in consequence. (21)

The system of irrigation designed by Suyya was designed in such a way that everyone was supplied with a fair share of water. Lalitaditya Muktapida is also credited with having supplied villages near Chakradhar now called Tskdhar with irrigation by constructing a series of arghatta (water wheels which raised the waters of the vitasta.. The arid plateau of Martand with its magnificent Martand temple, the flourishing township that surrounded it, and his capital Parihasapur (which now suffers water scarcity) had a system which ensured a perennial water supply.

Ganga's purity is such that almost everywhere her sanctity is claimed in some stream or pool in different places. Vijayakshetra, Nadikshetra and Varahakshetra in Kashmir are described as places hallowed by Vishnu, where the stream of Ganga bears the name Vitasta, and where the famous Mandapakshetra and Uttaramanasa are located. (22)

As descendants of Bhagiratha, who brought down the Ganga from the Heaven to the earth for the welfare of human being, it is our sacred duty to make Bhagiratha efforts to make the **Ganga Kaveri Link** Project a reality and prove ourselves to be worthy successors to Bhagiratha.

Notes.

1. S. D. Misra, Rivers of India, 1970, Rigveda, X, 75- 5.
2. D. N. Tiwari, "Protection of Environment , We and Mother Earth" in Vishwa Mangala Hetave, 2000-1, p.90
3. Kakasaheb Kalelkar, Lokamata, 1938.
4. Ramesh Dutta, Economic History of India under Early British Rule, p. 199.
5. P. L. Bhargava , King Bhagiratha and the River, Puranam –puranam, Vol. XIII, No. 1
6. R. S. Pandit, Kalhana's Rajatarangini: The Saga of the Kings of Kashmir. 2006, pp. 227-8.
7. M. K. Dhavalikar, Water Conservation Systems in Ancient India,
8. Ibid.
9. R. C . Majumdar, The Age of Imperial Unity, 1953, p. 87.
10. L. Basham, The Wonder That was India, 1954, p.. 192.
11. R. P. Kangle, Kautiliya Arthasashtra, 2. 20-24.
12. C.Sivaramamurti, Ganga, 1976, p. 89.
13. Ibid.
14. V. S. Agrawal – Samrangansutrardhar – 1966, p.xii
15. K. V. Vaze, Extract from a paper on Shilpa Sansar, 19th March 1955, p. 173.
16. Ibid p.193
17. K. V. Vaze, Ibid
18. L. Bhasham Op Cit., p.193
19. Agrawal and Sunita Narain, Dying Wisdom, 2005, p. 11
20. Ibid. p.98
21. Silpa Sansara, Feb. 1955 p. 133.
22. Kathasaritasagara, 39, 36 – 38