

Evolution of the Western Coastline of India and the Probable Location of Dwārakā of Kṛṣṇa: Geological Perspectives

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Abstract: A description of Dwārakā and its environs, its growth and final destruction as narrated in the ancient classics of *Mahābhāratha*, *Hari-vamśa*, *Skānda Purāṇa* and *Viṣṇu Purāṇa* is presented and it is shown that the Dwārakā built by Kṛṣṇa could not be the Dwārakā located at the western tip of Saurashtra. Geological evidence shows (1) that the coastline of India is a rifted margin with present day Saurashtra, Kachchh, Pacham, Wāgir, Bela and other isolated masses occurring as islands off the rifted western margin; (2) the greater part of Saurashtra formed an island of explosive volcanic activity not directly connected with the Deccan trap of the mainland; (3) the existence of the Cambay basin, a long linear sedimentary basin, more than 500 km long with an average width of 50 km and maximum depth of 7 km linked the basin with the Gulfs of Cambay and Kachchh maintaining marine connection from early Cretaceous to late Pleistocene and early Holocene (5000 years ago); (4) filling up of the basin with enormous amount of alluvium brought by the rivers Saraswati, Luni, Sabarmati and others – are presented as evidences lending support to the view that the present day Dwārakā, isolated and far removed from Mathura could not be the original Dwārakā (Ur-Dwārakā) of Kṛṣṇa. Ur-Dwārakā was nearer to Mathura and could be reached via Pushkara (near Ajmer) and Mt. Abu and in all probability was located on the eastern margin of the Cambay basin. The city either was drowned or washed away by the sea around 1400 BC. West coast of Gujarat lies at the junction of the African, Asian and Indian plates and is riddled with many active faults and has been an active seismic zone. Authors make a strong plea for a multidisciplinary study by a group consisting of oceanographers, geologists, geophysicists, sedimentologists, engineers and meteorologists to make an intensive study of the region and elucidate the history of development of this terrain and incidentally solve the problem of the location of Ur-Dwārakā.

Keywords: Western coastline of India, Indian pre-history, Cambay basin, Impact model, Dwārakā.

INTRODUCTION

In the recent past, there has been renewed interest in the archaeology of the west coast of Gujarat. This has been mainly driven by the desire to know more about the ancient town of Dwārakā, the capital city of Kṛṣṇa. Here we denote this as original Dwārakā (Ur-D for short) to differentiate it from the present day city of the same name Dwaraka (69°E, 22.25°N) in Saurashtra. Marine archaeologists, investigating this region seem to have accepted Ur-D to be same as or at least very close to Dwārakā (Gaur et al. 2004). This belief initially based on the opinion expressed by Sankalia (1966) has been later supported by S.R. Rao (1995). While archaeological investigations have exposed a township offshore Dwaraka, dated to second millennium BC, its connection with Ur-D remains unproven. Kṛṣṇa and associated historical and

geographical traditions have come down to us through the texts of *Mahābhārata* (MB), *Harivamśa* (HV), *Skānda Purāṇa* (SP) and a few other *Purāṇas*. Hence, it is important to investigate these texts critically to verify whether Ur-D could be identified with Dwārakā or not. Even if one may not be able to pinpoint where Ur-D was, it may be possible to conclude where it was not. Notwithstanding the fact, that Kṛṣṇa and his legends have been among the factors moulding the cultural foundations of the country, neither the history nor the geography of his period have been clearly understood.

Recently Iyengar (2003a, b; 2005 *in press*) investigated the issue of the historicity of Kṛṣṇa based on celestial observations mentioned in MB, HV, SP, *Viṣṇu Purāṇa* (VP) and *Bhāgavata Purāṇa* (BP). It was found that the observations are broadly consistent with a date around

1500-1400 BC. While this figure may be further debated, one could proceed with this as a working hypothesis for deciphering geographical descriptions in the ancient texts. The issue of where Ur-D was located remains an important topic. A standard reference on ancient place names by B.C. Law (1954) indicates that at one time Ur-D was thought to be near Girnar region, before being identified with Dwārakā. Kosambi (1965) based on internal evidence available in MB has argued that Ur-D could not have been at Dwārakā. Munshi (1943) after taking into consideration available evidences concluded that there are objections to the present day Dwārakā being identified with Ur-D. Among the famous place names that appear in the texts, Kurukṣetra and Mathurā are perhaps the least controversial. Starting from Vedic times through Itihāsa, Purāṇa and the historical period, location of Kurukṣetra and Mathurā has remained unquestioned. The same cannot be said about Prabhāsa and Ur-D, two other towns of importance in Kṛṣṇa-lore. It is interesting to note that the natural relief, rivers and lakes mentioned in the texts match reasonably well with the geography of Kurukṣetra and Mathurā (Growse, 1872). Thus, for Ur-D and Prabhāsa also, the preserved textual descriptions of geographical features and an evaluation of the new geological information in the development of coastline of Gujarat should prove to be consistent with observations. With these points in mind an attempt is made in the present paper to investigate further the above Sanskrit texts with a view to identify Ur-D. In all the cases, the more relevant Sanskrit texts are presented with brief translations. The collected material is discussed from a geological perspective to draw meaningful inferences.

Mahābhārata (MB)

MB refers to Ur-D in many places, but not necessarily in a consistent manner. This may perhaps be attributed to the layered formation of the text at different periods. In the very first book called *ādi-parva* reference is made to the last days of Yādavas near the salt sea and the visit of Arjuna to help the people to vacate the town of Ur-D (Ch.22.2,26). In *sabhā-parva*, Kṛṣṇa during his conversation with Yudhishthira says:

vayam caiva mahārajā jarāsandha-bhayāt tada
mathurām samparityajya gatā dvāravatīm prati ||

[Mahārajā! Due to fear of Jarāsandha, we discarded Mathurā and emigrated to Dvāravatī |

(Ch.13.65)

The alternate name of Ur-D being called Dwārakā is

seen in Chapter 42 of this *parva*. A link among Ur-D, Prabhāsa and River Sarasvati appears in the third book *vana-parva*. Pāṇḍavas, in their exile are advised to visit holy places. The description of the places presents a geographical background of the region in which Ur-D was located. This starts in Chapter 80 with a description of Lake Puṣkara (26.5°N, 74.6°E), Narmadā, Carmanvati, Mt. Arbuda, Prabhāsa, confluence of Sarasvati joining the sea and Dvāravatī roughly in that order.

tato gaccheta dharmajño himavatsutam arbudam |
ṛṣṭhivyām yatra vaicchidram pūrvamāśit yudhiṣṭhira ||
tato gaccheta dharmajño prabhāsam loka-viśrutam |
yatra sannihito nityam svayam eva hutāśanah ||
tato gatvā sarasvatyāḥ sāgarasya ca saṅgame
tato dvāravatīm gacchet niyato niyatās 'anah |
piṇḍārake narah snātvā labhet bahu-suvarṇakam ||

[Then, one should go to Mt. Arbuda, where in the ground a fissure existed. Then one should go to the famous Prabhāsa, where fire is ever self-existent. Then having visited the confluence of river Sarasvati and the ocean, one should go to Dvāravatī and next to Piṇḍāraka]

(Ch. 80. 74, 77, 79, 82)

The above places are mentioned in a sequential order. The confluence of a river with the sea is mentioned once again without any specific place (v 85). After another 30 verses Viṇāśana, where Sarasvati flows underneath the desert is mentioned. Chapter 86 provides another description with many differences but with same place names. This time, Agastya's hermitage is mentioned which is not traditionally associated with Mt. Abu. The text in this chapter describes holy places in *Saurashtra* (86.15-22) like Prabhāsa, Piṇḍāraka and Mt. Ujjayanta. This hill is not Mt. Abu, but probably a hill of the same name in present day Saurashtra. The Dvāravatī mentioned in this chapter is not only different from Ur-D of Chapter 80, but also negates its identification with present day Dwaraka, which is far away from Mt. Ujjayanta.

In *sānti-parvan* (Ch. 326.81-84) Visnu proclaims his (future) incarnation on earth as Kṛṣṇa at Mathurā and his founding of Dwārakā at *Kuśa-sthalī*. Such a description does not help in fixing Ur-D, but it hints at *Kuśa-sthalī* being the name of a broad region.

In *āśvamedhika-parvan*, Arjuna is said to follow the sacrificial horse all over India, including the southern parts. During his travel along the western countries, Arjuna arrives at Prabhāsa from south, before reaching Dvāravatī (Ch.84.10-53). This would indicate that Ur-D was roughly

north of Prabhāsa. In *mausala-parvan* (Ch.8.40-47) flooding of Ur-D by sea, and Arjuna's efforts to escort the people out of the place is described. The route taken by Arjuna was through forests, mountains and streams to reach Pañçanada, only to be attacked by the Ābhīras. There is no mention of crossing the sea or of islands on the way. Thus, it may not be wrong to conclude that Ur-D was connected with other parts of the country through land route. In the 17th book, Pandavas are said to visit the western parts of the country to see Ur-D being submerged (*pari-plutam*) in the sea (Ch.10.42-43).

Hari-vamśa (HV)

HV is an appendix to MB and is traditionally taken to be between Itihāsa (history) and Purāṇa (legend) and a primary source for the early life of Kṛṣṇa, later described in other Purāṇas with additional legends. Reference to Ur-D occurs in all the three books of HV, sometimes without any specific relation with the main theme of the books.

Hari-vamśa speaks of migrations of people from east to west giving the impression that it was a common tradition.

In chapter 55 of the second book, Garuḍa the mythical eagle and vehicle of Viṣṇu is introduced, to be searching for a site to locate the new city. He says, “I shall go to Kuśasthalī in Raivata. I shall survey the hill of Raivata and the region bounded by the hill and the sea (*sailodadhi-taṭāśrayām*). After selecting a site and clearing the bushes, I shall report to you.” Garuḍa is said to go west of Mathurā, for his search (II 55.1-11). Upon his return, he describes the site and the town as,

sāgarānūpa-vipulām prag udak-plava sitalām |
sarvatodadhi-madhyasthām abhedyām tridaśaiḥ api ||
raivatam ca giri-śreṣṭham kuru deva surālayam |
nāmnā dvāravatī jñeyā triṣu lokeṣu viśrutā |
yadi syāt samvṛtām bhūmim pradāsyati mahodadhiḥ |

Lord! Make Raivata the great hill as your abode. That place has many backwaters of the sea. It is cool due to the wind blown over water, from the front. It is in the center of water bodies, unbreakable even by gods. The town will be famous as Dwāravatī, if the ocean gives the land around.

(Ch.II 55. 103, 110-113)

Yadavas, travel west (56.19) in their exodus out of Mathurā. They reach the delta of a river near the seashore.

anūpam sindhu-rājasya prapetuh yadu-pungavāḥ |
dadarśa vipulam deśam sāgareṇopāśobhitam |
vāhanānām hitam caiva sikatā tāmra mṛtikām ||
sāgarānīla samvītam sāgarānību niṣevitam |
viṣayam sindhurājasya śobhitam puralakṣaṇaiḥ ||
tatra raivatako nama parvato nātidurataḥ |
mandarodārā śikharaḥ sarvato 'bhi virājate ||
tatraikalavya samvāso dronenādhyuṣitasciram |

Yādavas reached the delta of the king of rivers. They saw the vast region beautiful with the ocean nearby and with red soil mixed with copper coloured sand ideal for movement of vehicles. They saw the place endowed with the symbols of a city, blown with sea breeze. There, not far away in the Raivata hill, the peak Mandarodara shines from all around. There lives Ekalavya. Once Drona had also stayed in that place.

(Ch.II 56.22, 24-28)

In chapters 88, 89, the boat trip of Kṛṣṇa when Pāṇḍavās visited him is described. The trip included a visit to Piṇḍaraka. The descriptions indicate the sea was not very deep. In chapter 98, an aerial view of Ur-D is described as seen by Kṛṣṇa. In the east was Mt. Raivata. In the south was Mt. Latāveṣṭana. To the west and north were Sukakṣa and Veṇumān hills. River Mandākinī was flowing around Dvāravatī divided into fifty parts. The town was at a height with a trench all around. The nearby branch town was twice the size of Ur-D.

The broad picture one gets from HV is that Ur-D was roughly west of Mathura, but east of the sea shore in a land where salt was available in plenty. The city was a fort with four doors, encircled with water channels or rivulets. River Sarasvati does not find mention in HV, but Mandākinī was said to be flowing around Ur-D in fifty channels. This could be an allusion to the delta of a large river approaching the sea. The commonalities between MB and HV in locating Ur-D are clearly its western location from Mathura, near the seashore. Both the books hint at the nearness of Ur-D to Lake Puṣkara and Mt. Abu.

Skānda Purāṇa (SP)

Next to MB and HV, tradition assigns greater importance to Visnu Purāṇa and Bhagavata as far as the story of Kṛṣṇa is concerned. However, it is found that SP contains more number of geographical references connected with Kṛṣṇa's time, than any other Purāṇic text. SP is the largest among the eighteen Purāṇas. The seventh and last part of SP called *Prabhāsa-khaṇḍa* contains four books namely, *Prabhāsa-kṣetra-māhātmya* (PKM), *Vastrāpatha-kṣetra-māhātmya*, *Arbuda-khaṇḍa* and *Dvārakā-māhātmya*. These books

refer to Ur-D and Prabhāsa as holy places, but provide some more insight into ancient happenings. The PKM has been reviewed in detail (Iyengar, 2004) to understand the natural disasters described therein. It was found that the older tradition available in PKM does not identify Prabhāsa, with the present Somanath. In Chapter 9 of PKM, a query is raised as to why Kṛṣṇa chose Prabhāsa for his last days. In Chapter 10, the place, Bhallukā tīrtha, where he passed away is described as being a small region of the size of a cow-hide, which cannot be identified without knowledge of the scriptures. In Chapter 352, this place is called *Bhalla tīrtha*, where Kṛṣṇa was cremated on the twelfth day of the Bhādrapada month. Quite interestingly, it locates the place as:

*viśvam vahate tatra nṛyām adyāpi pārvati /
māghyām māghyām sameṣanti sarasvatyabdhī-
sangame*

*Pārvati! The solstice passes through that place even now.
In the month of Māgha every year, all the holy places
come together at the confluence of Sarasvati with the sea.
(Ch.10.22, 28)*

This statement would indicate that the latitude of Prabhāsa to be about 23.5°N, matching closely with present day Patan. Further Piṇḍāraka, which appears in association with Ur-D in several of the texts matches with Pindwara (24.8°N: 73.07°E) of Sirohi district in Rajasthan, not far from Mt. Abu.

Dvārakā-Māhātmya is supposedly about Ur-D, but there is little geographical information in this book. Ur-D is said to be in *Kuśa-sthalī* on the west coast located in Ānarta country (Ch.2.3-4). The text informs that many places were washed away by the sea (*papluvire ārnave* | Ch.14.1) and they are now washed by sea and covered by dust and water (*plāvitāni samudreṇa pāmsunāpyudakena ca* || Ch.16-44).

GEOLOGICAL PERSPECTIVES

We may now briefly examine what geology has to say about the physiographic conditions prevailing during the period recorded by Mahābhārata and other ancient texts. The postulated position of Ur-D as reviewed in the Sanskrit texts appears to conform with the broad geological history of the region.

The most striking part of the NW coast of India is the occurrence of Saurashtra as a craton not connected with the mainland but by an arm of the sea filled up of deltaic sediments. Kachchh also appears as an island together with the Great and Little Rann, which represent vast

inlets of salty water. Greater part of the Rann is a massive gulf which has recently emerged out of the sea (Merh, 2004). Other small land masses which make their appearance are all islands like Pachham, Khawada and Khadir. Further south, Bombay group of islands are to be considered as only submerged islands not exposed above sea level.

The second part whose significance has not been fully appreciated is the delineation of the Cambay Basin. It does not end at the latitude of Baroda but extends as a rift-basin into the heartland of Gujarat for a distance of over 500 km having an average width of 50 km and a maximum depth of 7 km. Figure 1 gives a picture of the basin in Central Gujarat.

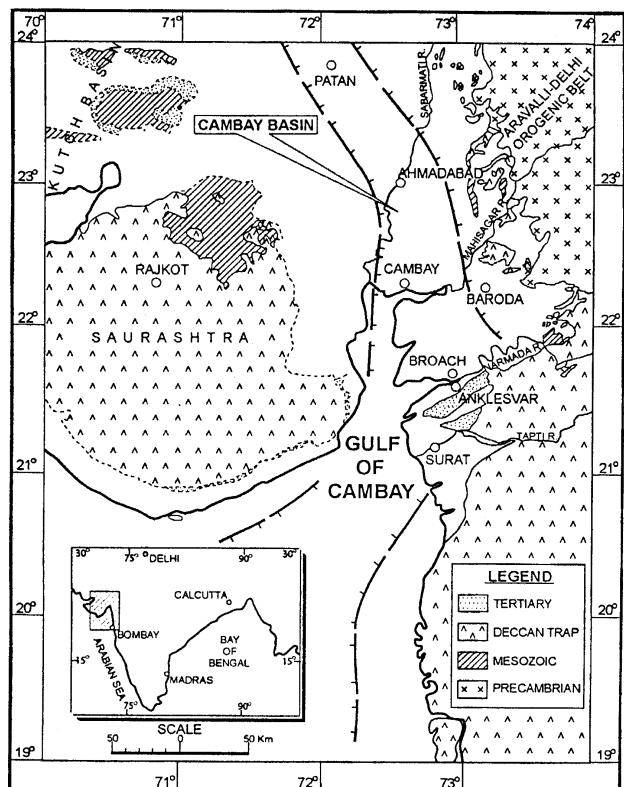


Fig.1. Geological sketch map of NW India showing effect of Cambay basin separating the peninsular islands of Saurashtra from the Gujarat mainland (after Choudhary, 2004).

Figure 2 emphasizes the islandic character of Saurashtra and Kachchh. Speaking of the Rann of Kachchh, Wadia has stated "A very little depression of this tract would be enough to convert Kathiawar (Saurashtra) and Kachchh into islands."

This famous Cambay petrolierous basin which was initiated in the lower Cretaceous was filled up with marine sediments of Eocene, Miocene and Pleistocene ages. What is important to note is that it remained as a channel way,

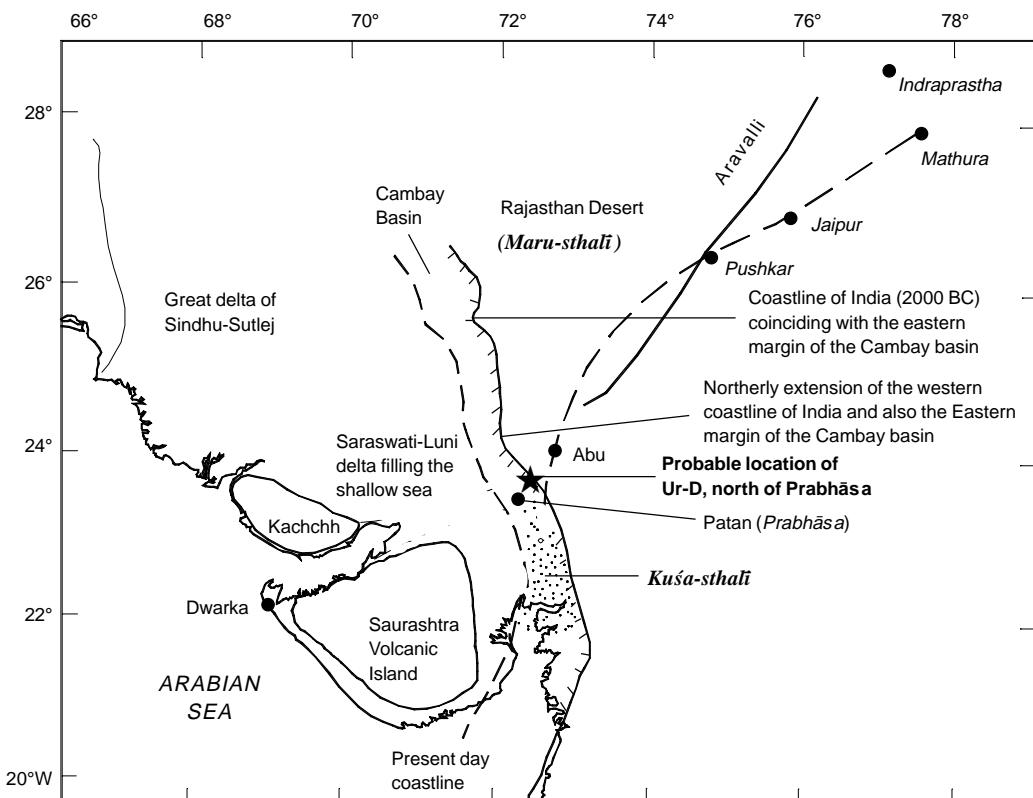


Fig.2. Sketch map showing extension of Cambay basin separating mainland Gujarat from Saurashtra and Kachchh which appear as islands completely detached. The west coast line of India does not get terminated at the Narmada rift but continues northwards forming probably the eastern arm of the Cambay basin, while the northern extension of the Cambay basin was filled up by sand (*Maru-sthālī*) the southern extension continued as a shallow sea grown with weed and grass (*Kuśa-sthālī*).

grown with marsh and *Kuśa* grass deserving the appellation *Kuśa-sthālī* (marshy land overgrown with weeds) in contrast with the ground northward appropriately termed *Maru-sthālī* (sandy desert). Growing aridity around 3000 BC desiccated most of the rivers like Saraswati, Luni, Mahi, Sabarmati which emptied into the basin. Even as late as 2000 BC however, there was water and rivers were navigable.

The northern extension of the Cambay basin falls in the greater part of the delta of Vedic Saraswati. We may presume a large part of the filling and creation of the delta is the contribution of Vedic Saraswati and its tributaries. The characteristic feature of the filling of the basin is its longitudinal character with sediments derived from the Himalaya where Saraswati had its source. Sedimentary facies shows gradation along the basin axis, in sequences ranging in age from Eocene to Pliocene, from a sandstone-shale-coal sequence in the north to siltstone-shale sequence in the southern Cambay basin to shale facies and finally carbonate facies in the Mumbai offshore basin (Choudhary, 2004, p.3).

The extension of Cambay into the heartland of Gujarat brought the sea to Mt. Abu and Patan in the second millennium BC (see Fig.2). It was here Krśna's Dwaraka was located in all probability on the eastern bank of the Cambay basin very near to Patan (23°52'N:72°1'E).

Krśna seems to have predicted the destruction of Ur-D soon after his death.

Dwārakām ca mayā tyaktām samudrah plāvayishyate
(*Visnu Purana II ch.37.36*)

Attention has to be drawn to the use of the word *plāvayishyate* which can mean that the city got washed away by high sea as in a tsunami. Incidentally it forms the first record of tsunami affecting India.

This postulated location of Ur-D as reviewed in the Sanskrit texts appears to conform with the broad geological history of the region as we know it today.

Saurashtra itself appears as an almost circular island with its radial drainage as a distinct land form (Fig.3). It does not show any similarity with the Deccan trap of the mainland and is surrounded by deep main faults on

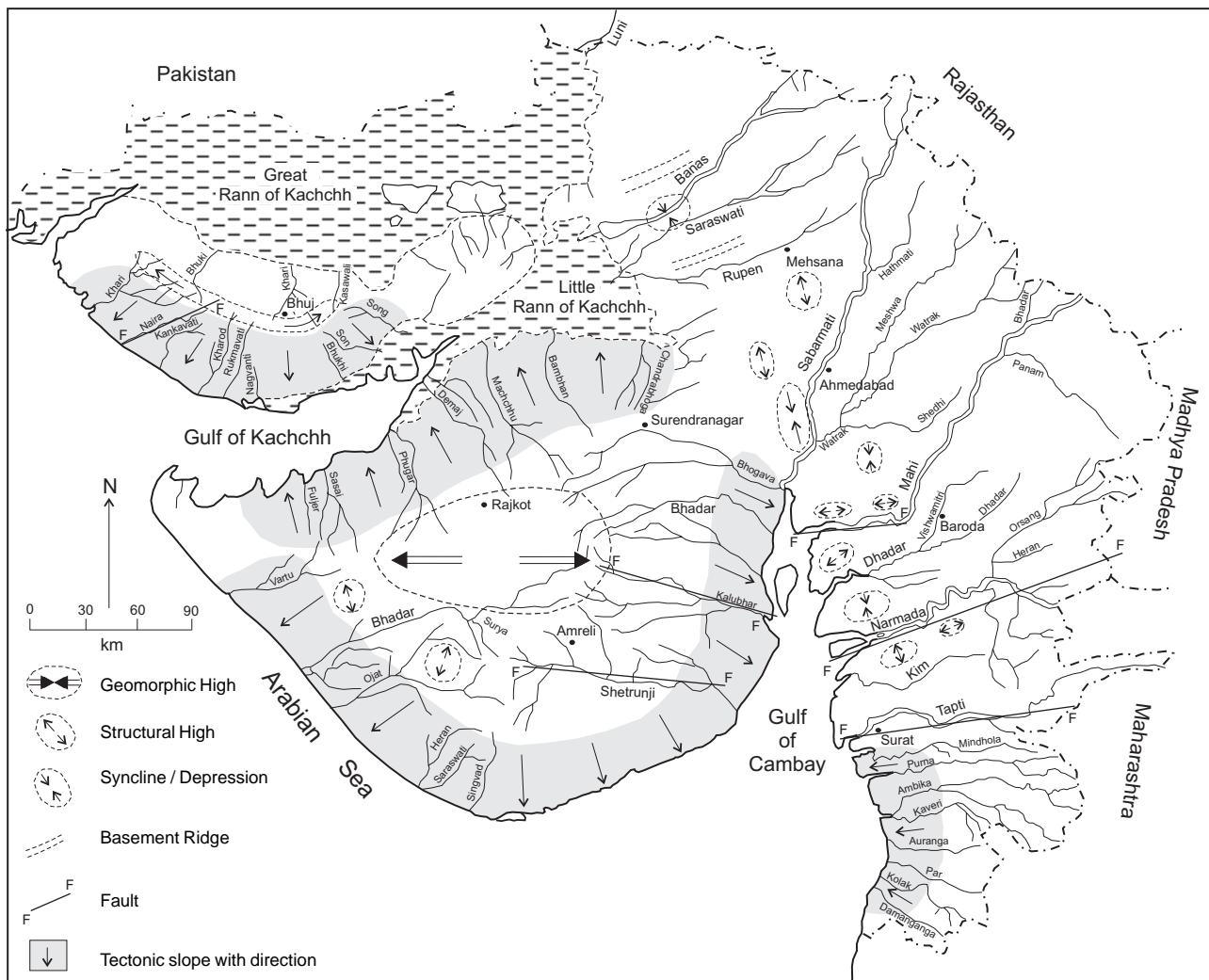


Fig.3. Drainage configuration of Gujarat and Saurashtra. Observe the radial drainage pattern marking it stand as a separate island unconnected with the mainland (Chamyal et al. 2003).

all sides. It is interesting to recall the observation made a long time ago by Wadia (1951) 'About twenty miles from the coast of Mekran the area deepens suddenly to a great hollow'. It is not clear whether any one has pursued this observation and followed it up to ascertain the cause. In all probability it might represent traces of a submerged caldera. No wonder it has been an epicentre of strong earthquakes.

Wadia (1957, p.45) makes reference to an earthquake of magnitude 6.7 with epicentre near the Mekran coast 160 miles northwest of Karachi that resulted in a violent tidal wave causing great damage all along the coast. Even Bombay seems to have been affected with $6\frac{1}{2}$ ft tidal wave and washed away a number of people. Large eruptions from a submarine mud volcano lead to the appearance of an island few miles off the coast. Eyewitness account

reports 'a huge sheet of flame and columns of smoke' as having been observed immediately after the earthquake (Pendse, 1948).

The same authority (p.47) has referred to the subsidence of (1819) the western border of the Rann of Cutch under the sea, accompanied by the elevation of a large tract of land (the *Allah Bund*) a most striking event recorded in India and was witnessed by the whole population.

It is interesting to recall that Siveright (1907), an officer of the public works department working in NW India, in the early part of 20th century had published his observations in the Geographical Journal. He has presented evidence for the Great Rann and the Little Rann being once navigable. His surmise is that during Alexander's time (325 BC), the coastline was almost lying parallel to 25°N latitude and Kachchh and several other landmasses of smaller size

appeared as islands. There are evidences to show that (Rao et al. 1996) during 2nd millennium BC the sea level would have been higher by about 4-6 m from the present level. This was the reason for Dholavira, Lothal and Kuntasi, now land locked, to have been ports in ancient times (Mathur, 2002).

CONCLUSIONS

Arising out of the exercise of enquiring into the historicity of Krṣṇa and the probable location of the capital city Dwārakā which he built, the study throws up several interesting geological aspects requiring further study:

1. Saurashtra, Kachchh and several other masses appear as islands off the west coast of India. It is the delta of Saraswati, Mahi and other rivers which has filled up the intervening land and created a connection with the mainland.
2. The study of the Cambay basin is important in understanding of the evolution of the west coast of India.
3. The west coast of Gujarat is a highly tectonically disturbed region with several E-W trending active faults demarcating blocks moving up and down

(Biswas, 1987; Chamyal and Maurya, 2002).

4. The region is seismically very active with several strong earthquakes affecting it, the latest being that of Bhuj.
5. The islands show evidence of differential uplift and subsidence.
6. The region is one of high heat-flow showing the existence of magma reservoir at shallow depths.
7. Prospects of occurrence of hydrocarbons in the rifts and adjoining regions is high. The region appears unexplored for its deep potential.
8. Volcanic breccia and plugs characterise the region. The existence of a long ultramafic body is inferred based on seismic tomography (Biswas, 2005).

The region therefore seems to offer the best ground for putting to test the impact model for the generation of rifts at the break-up of Gondwanaland.

A multi-disciplinary project would probably unravel the evolutionary history of this important region.

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