

# Excavation of the legendary city of Dvaraka in the Arabian Sea

Dr.S.R.Rao

*Emeritus Scientist, National Institute of Oceanography, Dona Paula, Goa, India*

## Maritime activity in the Harappan Period

### Lothal Dock :

The earliest archaeological evidence for maritime activity in India is provided by the tidal dock built by the Harappans at the head of the Gulf of Cambay on Gujarat coast in 2300 B.C. (Fig.1). The Gulf of Cambay being a macrotidal bay, the ships could sail up Bhogawo and

Sabarmati rivers at high tide and reach the Lothal port where they were sluiced through a channel into the vast basin of the dock. Extensive overseas trade of Lothal is indicated by the seals and sealings further supported by knickknacks such as the terracotta models of African Gorilla and Mummy. That the brick lined basin was designed to serve as a dock (Rao, 1973, 70 and 125; 1979, 134) is confirmed by the presence of stone anchors. Alternate uses of the basin as an

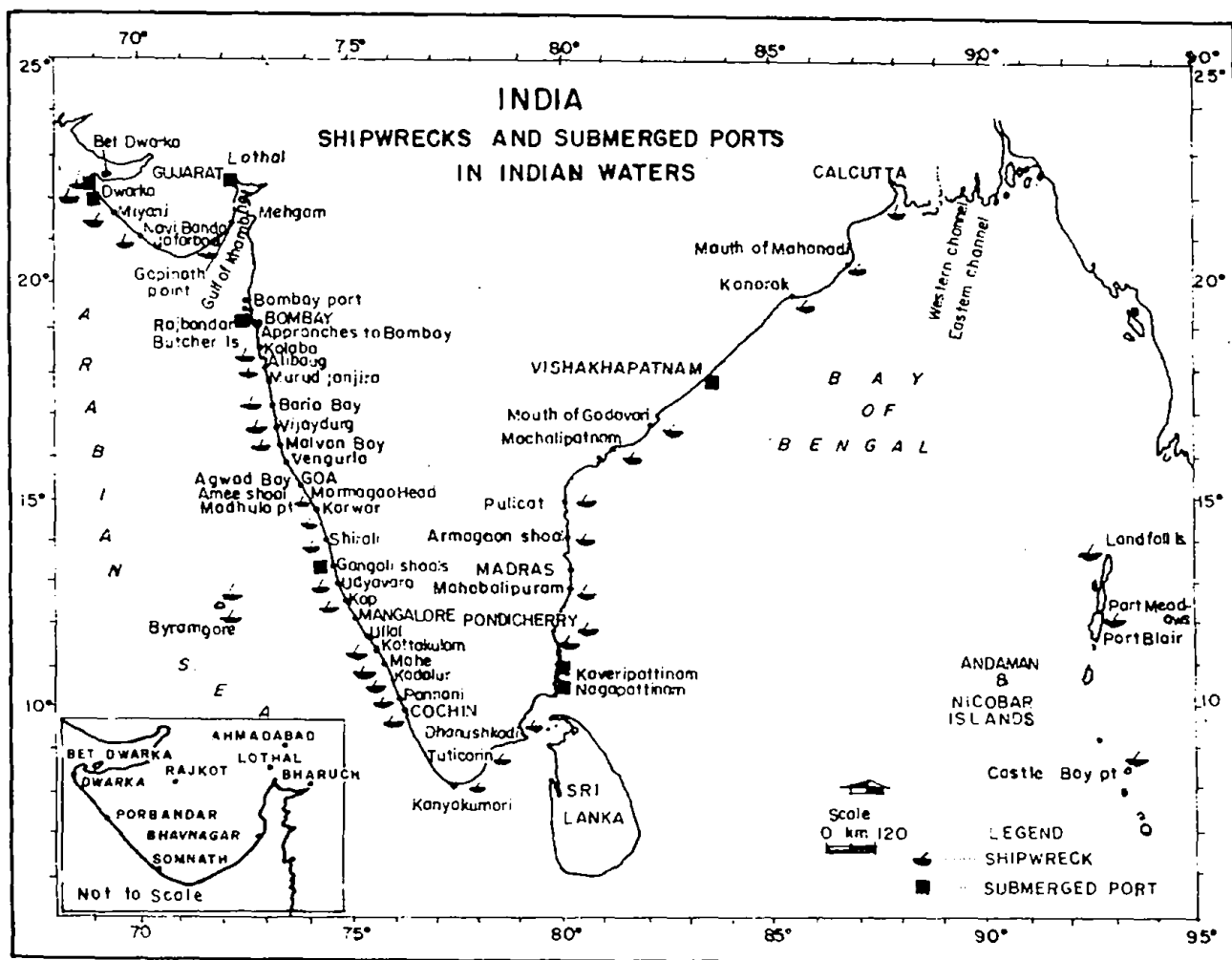


Fig. 1 Shipwrecks and Submerged Ports in Indian waters

irrigation tank or as a reservoir (Leshnik 1970, 911-22) is now finally dismissed by the findings of the NIO scientist Rajiv Nigam who collected samples from the floor of the dock. His study has revealed a fairly well preserved assemblage of foraminifera which do not show any sign of wear and tear. The assemblage has been considered by him as *in situ*. "The majority of foraminifera species in the study material are benthonic and typical to nearshore warm water environment. However the occurrence of a few specimens of planktonic foraminifera which thrive in open environment having at least moderate depth is of great significance. Their presence in the material from the present study of the site indicates existence of high tidal range during Harappan times" (Nigam 1987 : 20-21). As regards the date of the foraminifera of Lothal dock it is necessary to note that they come from samples taken from the floor of the basin which was sealed by a thick layer of Late Harappan habitation debris containing vast quantities of painted pottery and terracottas characteristic of Period B of Lothal dated 1900-1600 B.C. It is therefore certain that the foraminifera belong to Period A of Lothal dated 2350-1900 B.C. (Rao 1979 : 125-26). The navigational skill of the Harappans based on a knowledge of tides, winds and currents is discussed by Panikkar and Srinivasan (1971 : 36-50). The total benthic fauna from Lothal dock indicates normal marine to hypersaline lagoon conditions. The presence of large number of gypsum crystals also suggests hypersaline conditions. Nigam has concluded on the basis of all the evidence gathered by him that the rectangular structure was a dockyard connected through open marine environment with high tidal range. The connection was probably cut off due to shoaling of the Gulf of Cambay as a result of the Holocene sea level rise, which finally led to evaporation of marine water locked inside the rectangular body.

The Occurrence of Indus seals, weights and beads in Oman, Bahrain and Mesopotamia and ivory objects in Ugarit (Syria) suggests far flung trade. An important commodity traded in is copper. Lothal is famous for its pure copper. The lexical tests from Elba/Tell Mardik in Syria dated earlier than the Early Dynastic IIIb texts from Lagos mention the import of pure copper (tin) bronze tin and Dilmun tin as coming from Dilmun (Bahrain?). During the reign of Gudea of Lagos tin was imported from Meluhha which is identified with Indo-Pakistan coastal region (Caspers 1985 : 288). The Indian tin deposits of Rajasthan and Gujarat may have been exploited by Meluhites (Thapar 1982 : 4-13) and purified at Lothal for indigenous use and export also. Krispjin is of the view that trade in arsenic-copper preceded trade in pure copper and tin from which pure bronze could be produced. While copper from Mohenjo-daro and Oman has arsenic, Lothal copper ingot and two thousand artifacts do not contain any arsenic (Rao 1985 )

The Indus civilization contributed more to oceanic seacraft than any of the protourban civilizations of the Middle East (Tosi 1986 : 206-107). During the Isin-Larsa period (corresponding to 1900-1600 B.C.) trade declined but did not die. A seal with Indus script occurring in Bahrain (Rao : 1986 : 377) and a 'seal of west Asian origin' found in the mid-second millennium B.C. levels of Somnath (Dhavalikar 1984) suggest trade contracts, but precious little is known about the goods exchanged, the infrastructure of the ports and the type of ships built in India. Least of all, the destination and origin of goods are recorded any where. For reconstructing the maritime history of the second millennium B.C. archaeological evidence is necessary.

Between the end of the Harappa Civilization in 1900 B.C. and the beginning

of the 6th century B.C. there is no archaeological evidence corroborating what the epics and puranas glorify as the golden age. The Painted Grey Ware (PGW) Culture of Hastinapur is too insipid to represent the urban civilization of the Mahabharata Age. If, however, the preceding Ochre-Coloured Pottery (OCP) culture at the same site is taken into account and a large-scale excavation in its lowest level is undertaken it may reveal a more developed urban culture of the second millennium B.C. At Mathura another site of Mahabharata Age even the PGW is missing and no early settlement of the second millennium B.C. could be found. Another prosperous city mentioned in the *Mahabharata* is Dvaraka said to have been founded by Sri Krishna but subsequently inundated and submerged by the sea. The *Musala Parva* of the *Mahabharata* and *Harivamsa* an Appendix to the epic, refer to the submergence of Dvaraka by the sea. Three sites namely, Mula Dwarka on the southwest coast of Saurashtra, Girinagara in Junagadh district and Dwarka in Okhamandal are popularly known as Krishna's Dvaraka. For a proper identification of any one of them as the legendary Dvaraka, there should be relics of a second or third millennium B.C. at the port town, for, the Mahabharata War is variously dated between 1424 B.C. (Pusalkar 1955 : 56) and 3102 B.C. The consensus date of Mahabharata War is 1500 B.C.

### Search for the legendary city of Dvaraka

Before undertaking any onshore or offshore excavation at an ancient port town which could be identified as Krishna's Dvaraka there should be unassailable evidence of a protohistoric settlement of the second or third millennium B.C. The first attempt to search for the epic town was made by Hirananda Sastry who excavated Mul Dwarka in the thirties of this century, but he could not find any relics of a

settlement earlier than 1st century A.D. At Bet Dwarka too there was no evidence datable before 3rd century B.C. Junagadh could not have been Dvaraka of Mahabharata age because it is not a sea port and the site itself is of 3rd century B.C.

Most texts refer to Dvaraka of Sri Krishna as situated in or close to the sea deserving the appellation *Varidurga*, a 'fortress in water' given by the author of the *Harivamsa* (Vishnu Parva 57.5). The *Skanda Purana* another ancient text mentions the location of Dvaraka as hugging to the west coast where the river Gomati joins the sea. Dwarka in Okhamandal Jamnagar District (Fig.2) has been

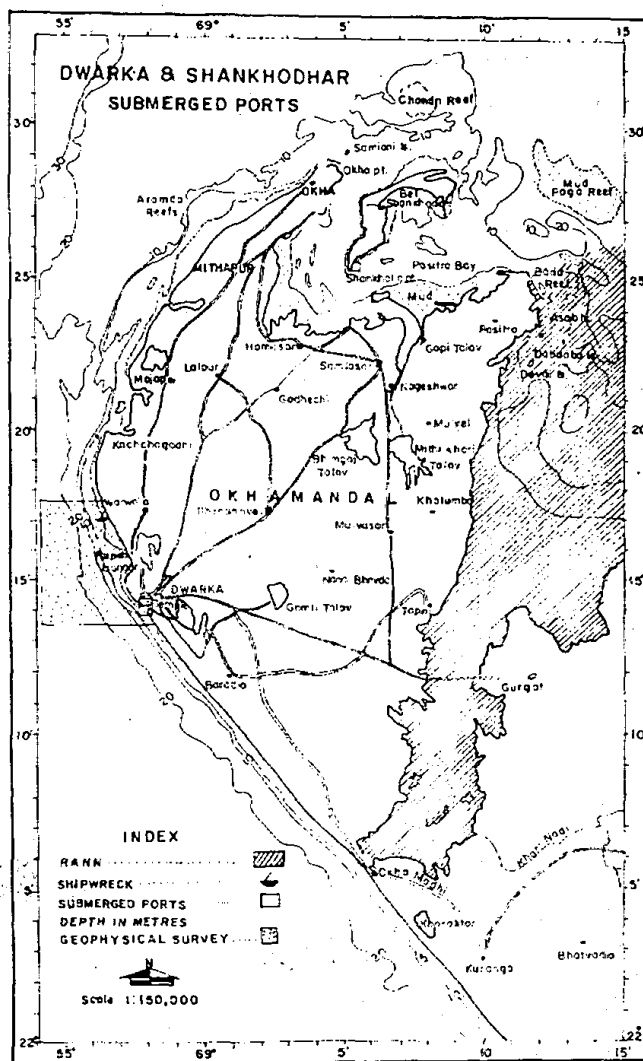


Fig. 2 Dwarka & Shankhodhar; Submerged Ports

regarded as Krishna's Dvaraka by great saints like Adi Sankara, Ramānuja, Madhawa, Mira and Ramdas. Millions of devotees pay homage to Lord Krishna in the magnificent temple of Dwarkadhish overlooking the Arabian Sea. The temple was built in the 13th century A.D. An assembly hall and a seven storeyed tower rising to a height of 43 m were added in the 15th century (Fig.3). The earliest epigraphical record referring to Dvaraka is a copperplate grant of 574 A.D. by the Garulaka king Simhaditya who refers to his father as the 'Dvarakadhipati' cast in the mould of 'Sri Krishna (EI Vol XI 11-12, 18). The identification of Dwarka in Jamnagar district as Krishna's Dwarka by the 6th century A.D. is borne out by this record. In the case of Mul Dwarka and Junagadh there is no inscriptional reference to them as Dvaraka, nor any

archaeological remains of 2nd millennium B.C. are available.

### Onshore Excavations at Dwarka (1963)

Credit must be given to Jayantilal Thakkar a local medical practitioner who took keen interest in collecting pottery from Dwarka whenever someone dug a foundation trench for building a house. His collection included the Red Polished Ware of 1st-5th century A.D. and two painted sherds of an earlier period. The first attempt to decide the antiquity of Dwarka was made in 1963 by the archaeologists of the Deccan College, Pune who dug a trench not far from the temple of Dwarkadhish. The excavators Z.D. Ansari and M.S. Mate came across rolled potsherds which showed "the effect of water action, having been tossed about in the sea and lying buried in

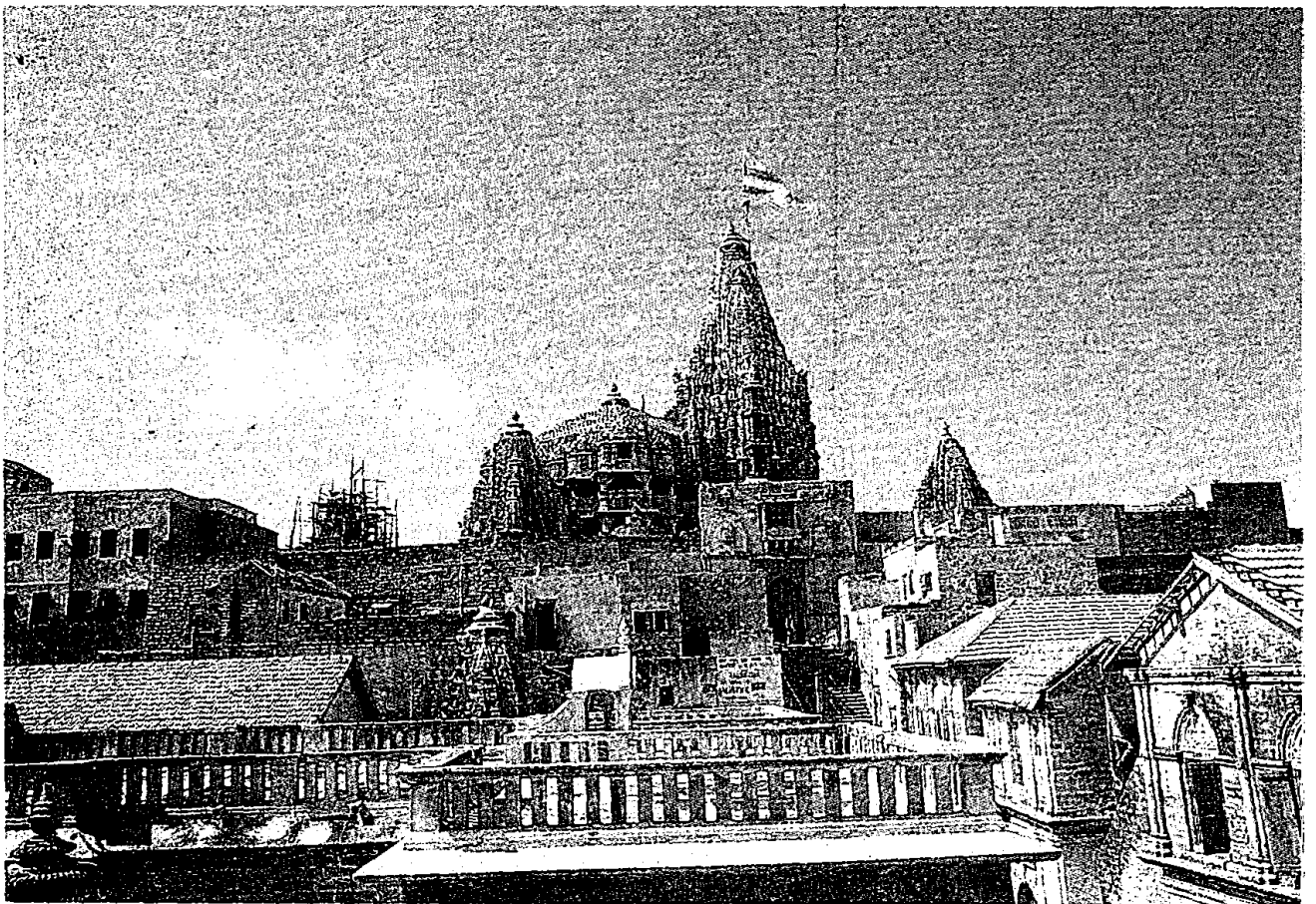


Fig. 3 Dwarkadhish Temple Complex on the banks of Gomati river, Dwarka.

the sand for 2000 years". According to them the proportion of rolled pottery increased in earlier levels. Some sherds had no doubt escaped the damage completely even though recovered from a depth of 9 m. They noticed that the first Dwarka lay buried under nearly 6 m of sand obviously because of the encroachment of the sea. Even the second Dwarka was covered by the sea burying it under 2 m of sand. They concluded that from the evidence of excavation, "one can definitely say that this is the Dvaraka mentioned in the Mahabharata, the Dvarakamahatmya of Skanda Purana and Ghata Jataka. In particular one can say that this is the Dvaraka described in such a great detail as a sacred tirtha (holy place) by the Hari-vamsa; probably it came into existence after the second submergence in the sea of two earlier Dvarakas because it gives very minute description of so many temples and this could have been possible only by a writer who had probably visited Dvaraka and seen the temples. But the writer was quite sure that the Dvaraka he was describing was twice submerged into the sea and therefore the earlier Dvaraka belonged to Sri Krishna. Of course of this we have no positive evidence excepting the fact that it is possible to say that the earliest Dvaraka was founded atleast in the 1st-2nd century B.C.-A.D." (Ansari and Mate 1966 : 13-17)". This observation is self-contradictory because the references in the *Hari-vamsa* and *Ghata Jataka* quoted by the excavators are earlier than the 2nd-4th century B.C. V.V. Mirashi assigns *Hari-vamsa* to the 2nd century B.C. and says "may be earlier but not later". The *Ghata Jataka*, an independent source referring to Dvaraka is not later than the 3rd century B.C. It mentions that Vasudeva and his nine brothers who battled and triumphed over many kingdoms settled down at Dvaraka on the one side of which was water and on the other a hill. From these reliable texts it is obvious that Krishna's

Dvaraká must have existed long before the 3rd century B.C. and the date 1st century B.C. - A.D. assigned by Sankalia to the first Dvaraka was incorrect. The second century BC inscription of Heliodorus on the Garuda pillar put up by him in front of the Vishnu temple at Besnagar in Madhya Pradesh in honour of the Sunga King Kasiputra Bhagabhadra describes Vasudeva as *devadeva* "God of Gods". Heliodorus, the Greek Ambassador became a Bhagavata when Vishnu-Krishna cult was known as Bhagavata cult. Sri Krishna must have occupied the position of God of Gods long before the 2nd century B.C. at Dvaraka, which was founded by him. The circumstances of his birth, his actions and end indicate that Krishna was a human being and his extraordinary qualities of leadership and intense love for those in distress endeared him to one and all. He could re-establish *dharma* after overcoming all evil forces. It is for this achievement that the people in gratitude appear to have raised him to the status of a God. The *Chandogya Upanishad* refers to one Krishna Devakiputra who is identified with Krishna of the *Mahabharata*.

### Excavation in 1979-80

A two-storeyed modern building which was a source of danger and hid the view of the 15th century temple of Dwarkadhish (DWK) had to be demolished in 1979 by the author to implement the conservation plan of the Archaeological Survey of India. The clearance operation revealed the heavily moulded plinth and delicately carved walls of a Vishnu temple assignable to the 9th century A.D. (Fig.4-5) lying buried in the sandy deposit over which the modern building stood. Further excavation revealed two more temples. The earlier one was assignable to the 1st century B.C. / A.D. (Fig.6). Deeper digging yielded evidence of destruction of a protohistoric settlement of mid second millennium B.C. Layers 10A and 11 in

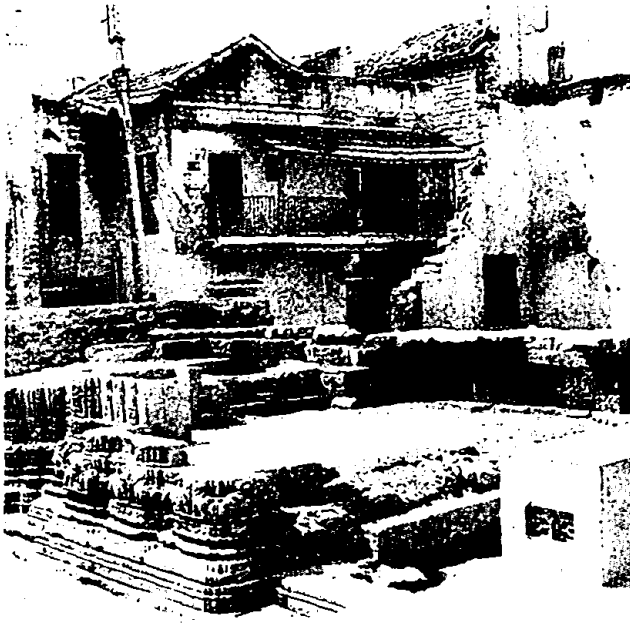


Fig. 4 Temple of Vishnu exposed under a modern building after it was demolished, Dwarka

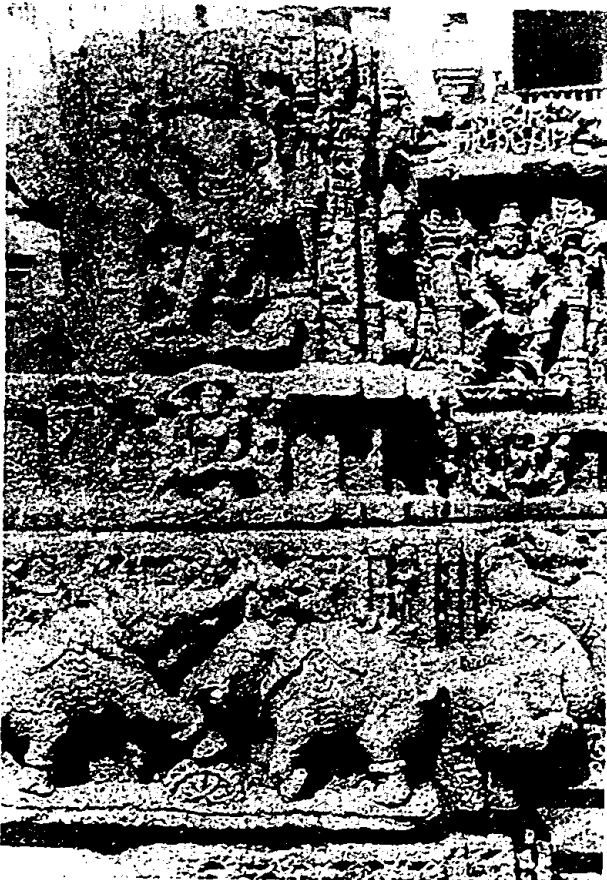


Fig. 5 Sculptures on the plinth and walls of Vishnu Temple, Dwarka



Fig. 6 Foundation and plinth of temples I to III exposed in excavation in Dwarkadhish Temple Complex.

Trench DWK 3 dug in the forecourt of Dwarkadhish temple yielded a distinct pottery known as the Lustrous Red Ware of 15th century B.C. (Fig. 7). On ceramic and numismatic evidence as many as eight settlements could be distinguished at Dvaraka.

First Dwarka	1400 BC	Lustrous Red Ware
Second Dwarka	900-500 BC ?	Painted Ware
Third Dwarka	2nd century BC	Temple I
Fourth Dwarka	2nd century AD	Temple II
Fifth Dwarka	12th century AD	After the destruction of Temple III of 9th century
Sixth Dwarka	12th-13th century AD	Temple IV
Seventh Dwarka	13th-15th century AD	Dwarkadhish Temple
Eighth Dwarka	Post 16th century AD	Modern Town

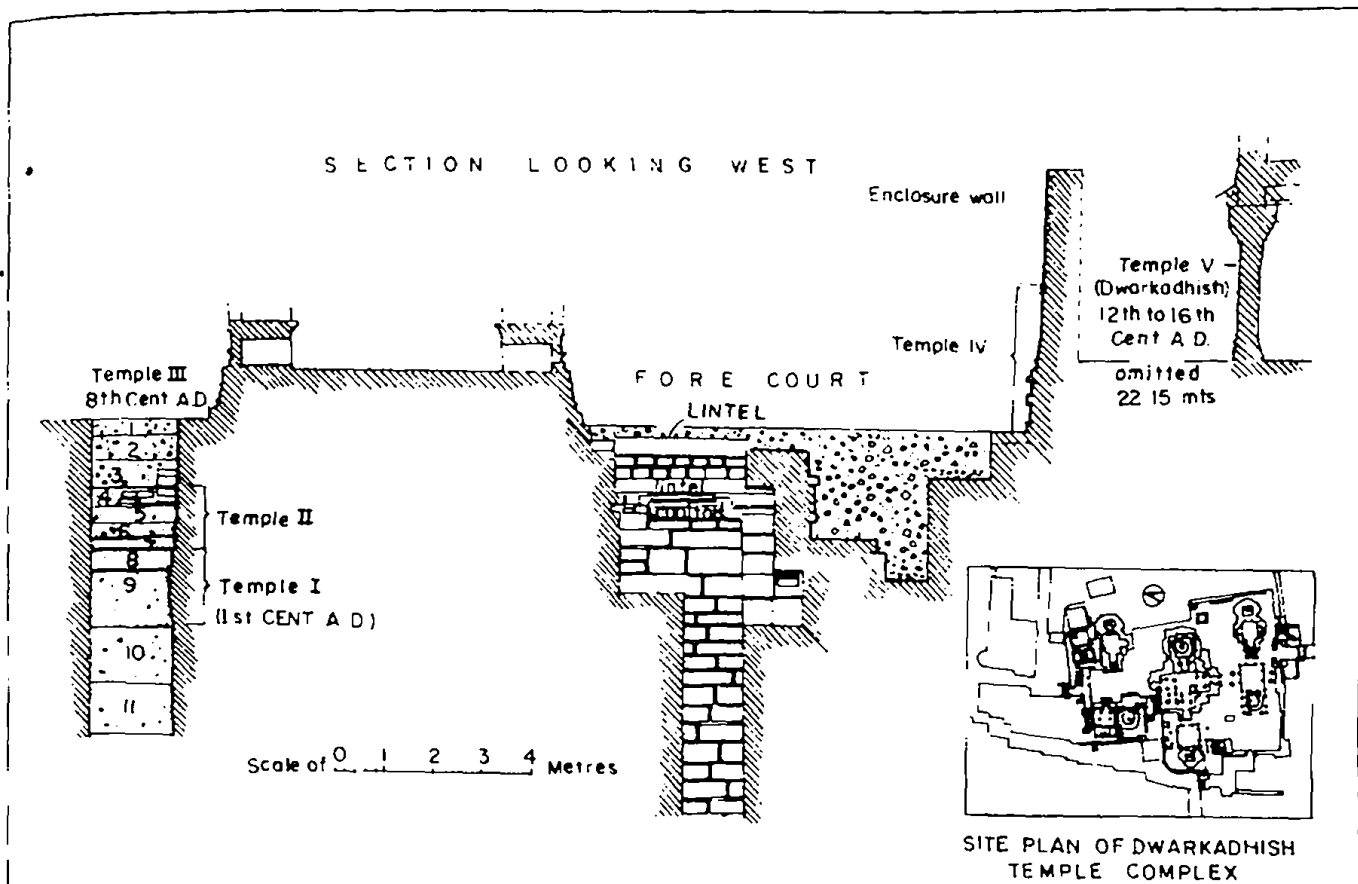


Fig. 7 Excavation at Dwarka 1979 ; District - Jamnagar. (Gujarat)

### Definition of the Problem

The onshore archaeological evidence for the submergence of a protohistoric settlement at Dwarka, though very meagre, had raised hopes of finding remains of a large port town in the sea itself. Unless a considerable portion of the submerged town was traced and its plan and date were made known, it was difficult to assert the existence of Dvaraka of Mahabharata Age and to reconstruct the economic and social conditions of the post-Harappan phase. Keeping this objective in view a modest Project for Marine Archaeological Studies was submitted to the Indian National Science Academy (INSA) in 1981. A seed money was promptly given for initiating steps to carry out the underwater investigation in the Arabian Sea off Dwarka. The results obtained from 1981 to 1983 were encouraging, but further research was held

up as the INSA Project came to an end. However in view of the importance of marine archaeology both for reconstructing maritime history and for generating data of educational and scientific value the Department of Science and Technology of the Government of India sanctioned a new Project for 3 years in 1984 which was later extended by further 3 years. Another objective of the Project was to locate in situ structures of the ancient city submerged in the sea on the basis of which it should be possible to arrive at a eustatic curve for fluctuations in sea level during the last 4000 years. Some study on the sea level fluctuation of early Holocene had been made by Nair and Hashimi, but more accurate information based on archaeological investigation was necessary. By undertaking offshore excavation scientific data relating to the nature and rate of sedimen-



tation and the effect of environment on wood and metals over long periods could also be made available.

In the first instance the island of Bet Dwarka also known as Sankhodhara which lies 30 km north of Dwarka had to be explored because the mention of Dvaraka as a *Varidurga* in ancient texts suggested that Dvaraka may be an island and this island was one of Krishna's pleasure resorts. The sea skirting the island yields chank shell and of pearls of good quality. Chank shell which was a substitute for copper and bronze was used for making ornaments, inlays, gamesmen, vessels, weights and seals. In the course of an onshore survey of the island conducted in 1981 and 1982 a rubble wall built of dressed and undressed blocks of miliolites (Fig.8) came to light at the foot of the

rocky cliff on the eastern shore. The wall runs over a length of more than 500m but it is heavily damaged at many places (Fig.9) partly by the sea and partly by the later settlers. The date of the construction was indicated by the Lustrous Red Ware found in the sections. From the intertidal zone and cliff section sturdy sherds of Late Harappan Red Ware and Chalcolithic black-and-red ware were collected. The pottery assemblage suggested that a protohistoric settlement which existed here has been destroyed by the sea and a seaward search may yield more convincing evidence of the submergence of port-installations, if any, in the sheltered bay.

The Bathymetry and topographic features of the Gulf of Kutch have been studied by oceanographers (Hashimi, Nair, and Kidwai 1981 : 1). The study based on



Fig. 8 Rubble wall in the cliff section of site BDK I in Shankhodhara (Bet Dwarka).





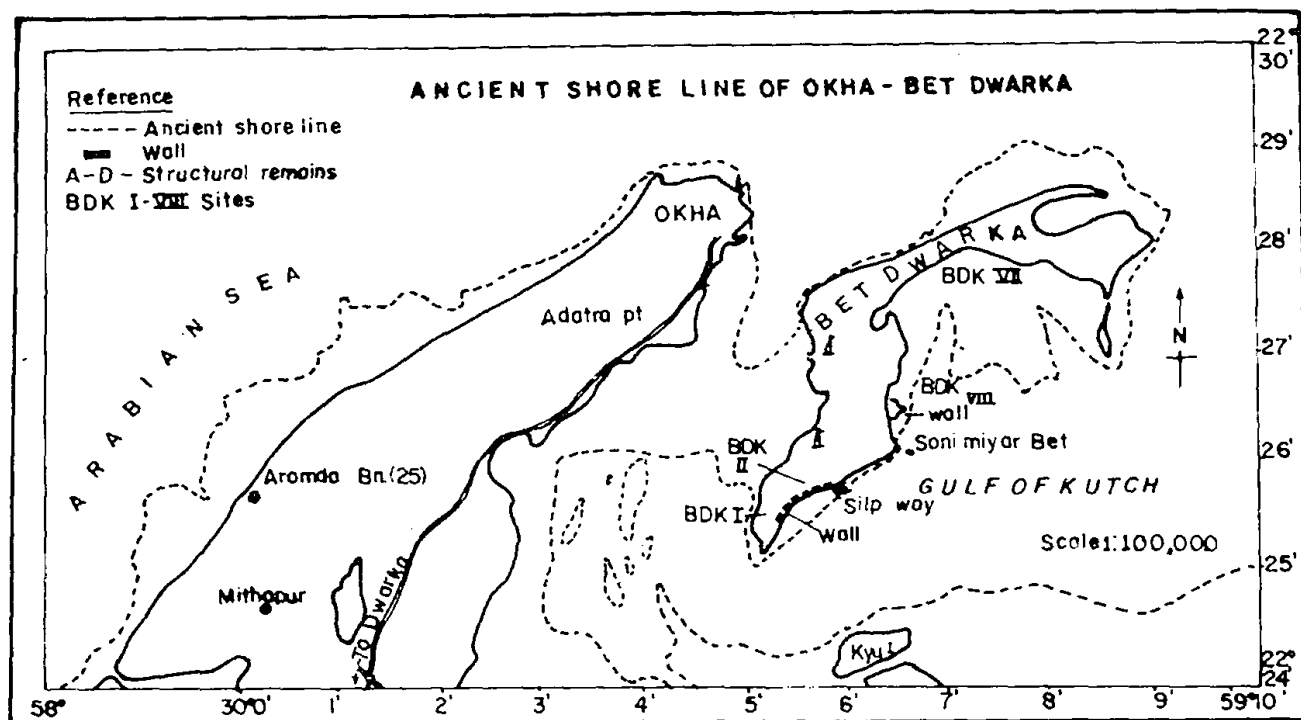


Fig. 10 Ancient shore line of Okha - Bet Dwarka

So far as the Dwarka coast is concerned the area between the northern bank of Gomati creek in the south and Rupen creek in the north is cut into a sandy gently seaward sloping outwash plain, which is truncated at the shore line. The severity of erosion, the lack of sediment due to tidal barrier and the storm events are to a great extent responsible for destroying the successive settlements made at the headland of Dwarka. Pathak has suggested that the spit like formation at a depth of 20 m and about 3 km off the existing shoreline shown in the Admiralty Chart of 1848 should be explored from the point of archaeological remains (Pathak 1988 : 61).

### First Marine Archaeological Expedition, 1983

The Marine Archaeology Unit explored seaward of the southern shore of Bet Dwarka island to trace submerged structures, if any. In all, seven cruises were undertaken in April, 1983. The Expedition party consisted of Dr.S.R.Rao (Principal Investigator of the Project),

Dr.B.U.Nayak, Head of the Ocean Engineering Division in NIO, Sri.P.Gudigar, Junior Research Fellow and Sri.V.M.Date, Photographer. A preliminary survey of the intertidal zone and 200m seaward of the beach in the southern sector of the eastern shore and further north upto Sonia Mar (Fig. 10) yielded protohistoric pottery and artifacts of Chank-shell. The crenulated bay near the Pir is well sheltered by cliffs against wind providing a safe anchorage for sea-going vessels. The rocky promontaries seem to have served in the past as natural breakwaters. Some boulders dumped on them can still be seen. The main purpose of the first expedition was to trace the continuity of the habitation area seaward of the rubble wall in the site designated BDK I-II. A number of cross walls which are partly visible at regular intervals of 2 m have been washed away.

A portion of a wall of stone blocks is in situ in the wave-cut bench in the intertidal zone opposite BDK I. The associated pottery consists of a bowl of

Lustrous Red Ware, a blunt carinated bowl of inferior Late Harappan fabric and a few fragments of the dish-on-stand. On the wavecut bench which extends 220 to 250 m seaward an array of boulders, each measuring on an average 1 x 0.6 x 0.5 m, lies almost in a straight line at a distance of about 180 m from BDK I. According to B.U. Nayak, Co-Investigator of the Marine Archaeology Project the massiveness of the stones rules out any possibility of their being transported by waves and currents. They also do not appear to be derived from the disintegration of the local outcrops. They are most likely to have been in situ and formed part of the submerged structures. Their prismatic shape and alignment suggest that they form building blocks of a wall like structure extending over a length of 20 m. Seaward of the line, lies a heap of rubble of the same size as that of rubble used in the construction of two structures namely, Str 1 and Str 2 in the cliff. The smaller fraction rubble extending all along and lying almost parallel to the shore-line seems to be the result of onshore-offshore movement of water due to the action of tides and waves. The wavecut bench in the intertidal zone is full of rubble, shingles and pebbles with small pockets of sand and silt. In trial trenches dug at selected locations seaward of the wavecut bench to ascertain the nature of sediment (Fig. 9) the overburden is 0.5 to 1.5 m and consists of silt and sand. Probing with iron rods indicated rock outcrops below the sediment layer. In some other locations the underlayer was hard enough to prevent further penetration of probe after about 1 m penetration indicating the presence of a compact layer. Excavation with an airjet yielded a few worked chank shells and two chert blades indicating perhaps, a habitation deposit below the overburden. In highest high water the in situ wall on the wavecut bench is submerged in 3.6 m water depth. When this wall was built in the protohistoric period, say about 3400 years ago the

spring tide must have been 1 to 1.5 m below the wall. It is therefore reasonable to postulate a net rise of 4.6 to 5 m in the sea level after the wall in IZ was built. Although the First Expedition confirmed the submergence of anciently built structures, it was necessary to ascertain how far the protohistoric township in Bet Dwarka extended seaward as well as landward. The survival of chert blade and perforated jar of Harappan period with the Late Harappan pottery demanded an explanation. The budget constraint and non-cooperative sea did not permit extended operation. In fact the offshore survey of Dwarka had to be abandoned as the trawler could not reach Dwarka from Bet even after 3 days in the choppy sea.

### **Second Marine Archaeological Expedition, 1984**

The First Marine Archaeological Expedition had no doubt confirmed that an ancient township fortified by a gravity wall on the one hand and a toe wall on the other was submerged by the Sea. A mid second millennium B.C. date for the structures was postulated on the basis of the wave-rolled pottery of the Late Harappan period, the coppersmith's stone mould and the chert blades found in the excavation. The typical Late Harappan and post-Harappan pottery found in Bet Dwarka is analogous in type and fabric to the pottery of Somnath on the southern coast. One of the objectives of the Second Expedition undertaken in December, 1984 was to ascertain the seaward extension of the protohistoric settlement of BDK I and BDK II and another objective was to carry out preliminary offshore survey of Dwarka. Two airlifts of 10 cm diameter, one of stainless steel and the other of mild steel (MS) pipe were designed and fabricated with necessary accessories such as PVC flexible and rigid pipes and hose. An air-compressor was supplied by Orient Underwater Engineers Pvt. Ltd., New Delhi.

Their divers had to be trained in underwater photography. Two caissons of MS sheets and a drawing grid of MS angles with graduations marked on it were used to facilitate underwater excavation and plotting of structures and small finds. Dry and wet suits and other diving accessories were readily available. Two wooden cutters namely, Raghuvira and Fateh Savai as well as a dingy were engaged locally for diving, and transport of the expedition team and equipment. In addition to airlift which was used primarily for removing the overburden an airjet was also employed for excavating in seabed. Two caissons, each measuring 2 x 1.5 x 1 m, were assembled on board and lowered in the sea bed. The airlift in the caisson sucked sediment-mixed water from the trench in the sea bed and delivered it to the first tank on board, which was connected to the second

tank. The sediment was made to pass through a sieve and potsherds and other antiquities were collected, examined, cleaned and recorded. This operation was limited to the comparatively recent deposit. In the earlier deposits hand-fanning exposed antiquities mostly consisting of small potsherds. Before disturbing any in situ structures to small finds they were plotted on the slate by draftsmen-divers.

Visibility was very poor and tidal currents were strong in Bet Dwarka waters. Hence no satisfactory underwater photograph of the technique of digging and documenting was possible. But photographs of high resolution could be taken in Dwarka waters whenever visibility was good upto 1 m distance. After removing manually all vegetation growing on structures each submerged building block was measured



Fig. 11 Diver probes a submerged structure of ancient Dwarka before removing vegetation

and plotted (Fig.11). Position-fixing was done in Bet Dwarka waters with reference to the base line at the foot of the structure in BDK I. In Dwarka waters position fixing was done with a sextant by taking the towers (*sikharas*) of Dwarkadhish and Samudranarayana Temples and the Light House as reference points.

In all fourteen cruises were made, three in Dwarka waters and eleven in Bet Dwarka waters. So far as underwater exploration of Dwarka was concerned the Expedition Party had to cruise daily between Rupen and Dwarka as there was no landing facility at Dwarka and the small boat (*hodi*) would overturn on outcrops near the shore. The necessity of a surf-landing craft was felt but again budget constraints did not permit hiring one.

### Bet Dwarka

In the course of exploration of the beach and intertidal zone of BDK II in Bet Dwarka large quantities of wave-rolled pottery and artifacts of chank shell were found. Three rock-cut slipways perhaps used for launching boats in the protohistoric and early historic period were discovered in the intertidal zone north of BDK II. Two trenches were sunk 500 m seaward of BDK II and the overburden at 0.5 m depth in the sea bed consisted of clayey sand and shells. It was observed that the base of the toe wall exposed in 1983 was again covered by sediments. As no artifacts were found 500 m seaward of BDK II, diving and underwater excavation had to be confined to locations 300 to 400 m seaward of BDK II (Fig. 12).

On 19th December, underwater excavation was continued at high tide in 5m water depth about 200 m seaward of BDK II. The overburden in Trench UW 2 was 0.3m thick and consisted of fine clay. Layer 2 at 0.8 m depth in sediment yielded

waverolled potsherds in a more compact clay thereby confirming the seaward extension of habitation area. In Trench UW 3 sunk 300 m seaward of BDK II potsherds and smaller fraction building blocks were found. Trench UW 4 sunk 500 m seaward of BDK I yielded very little habitation debris. Trenching was therefore confined to 400 m zone and samples were collected from 0.75 m depth in the seabed. A small trench namely TR 2 measuring 1 x 1 x 0.75 m yielded fine sand in layer 1 and brownish yellow sand in layer 2 at 0.5 m depth. The rock-cut slipways noticed north of BDK II were studied in detail by B.U. Nayak. He observes "Two rock-cut slipways extending from the beach into the intertidal zone are visible north of BDK II. The wavecut rock is mostly natural in feature but the slope of the slipway was created by artificial means by cutting the flanking rocks. Some weathering effect and denudation including erosion which are a natural phenomena in the intertidal zone are noticeable. The varying width of the two slipways seems to have been created for launching boats of different sizes used during the latter half of the second millennium B.C." The Late Harappan and post-Harappan ceramic wares including the black and red ware found here serve as a basis for determining the age of the first cutting of slipways which were later used in the first few centuries of the Christian era.

The Director, Space Application Centre Ahmedabad sent a team for filming of underwater archaeological exploration under the Supervision of Sri.Vishwanath. After shooting the film in Bet Dwarka the Expedition Team and SAC filming unit left the location in Bet Dwarka at 6.30 pm. At 7.15 pm the boat got grounded in a shoal. The sea was rough and the tidal range high. However, the divers extricated the boat before any damage could be done.

A trench laid in the cliff section of

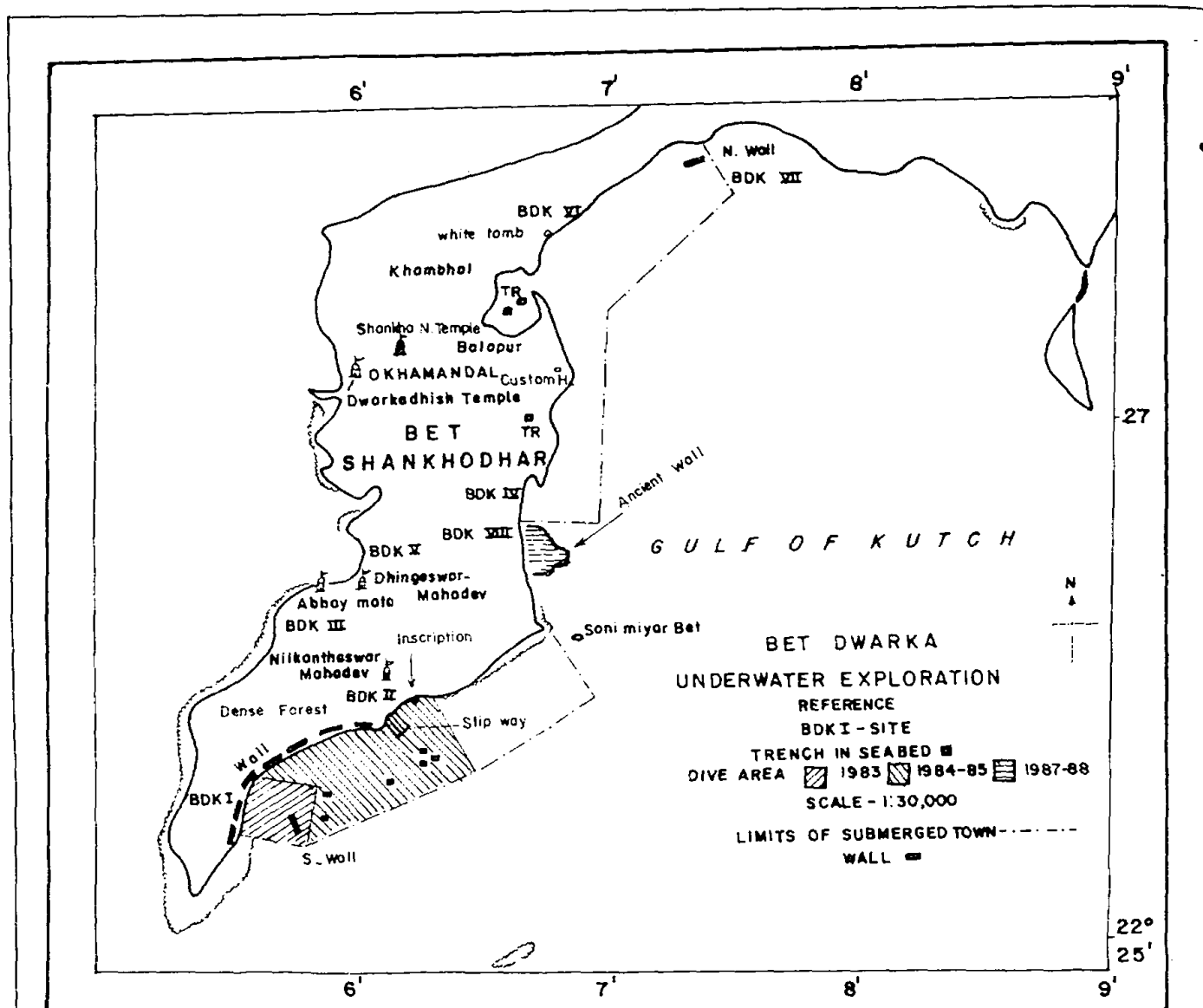


Fig. 12 Bet Dwarka Underwater Exploration

BDK I with a view to ascertain the cultural sequence revealed that the rubble wall running along the cliff had its foundation laid in layer 4, while the foundation of the abutting wall at the back was laid in layer 3. Hence the latter, built of smaller fraction rubble, is assigned to Period II (Early Historic) and the wall built in box technique to Period I (Protohistoric). This trench was connected to a small trial trench sunk in the intertidal zone (Fig. 9).

A trench UW 6 measuring 1 x 1 m was laid 400 m seaward of the rocky promontory projecting between BDK I and

BDK II. Airlifting was done in 3.50 m water depth at 1530 hours on 27th December within the caisson and sediment mixed water was pumped into a MS Tank on board. After removing the overburden a seal of chank shell was found in layer 2. The discovery of this Late Indus (Harappan) type seal along with a couple of rolled potsherds of protohistoric affinity is of great chronological importance. All the pottery from various trenches beginning from the cliff section down to seabed was carefully classified and the cultural affinities of Period I and II were determined.

## Dwarka

The main problem here was to identify the location of the submerged town in the Arabian sea off modern Dwarka. This involved a careful study of the geological and topographical features as well as the drainage system and the onshore structures such as the temple of Samudra Narayana (SN) where the sailors offer prayer to the Sea God. Similar temples are situated close to the ancient harbour Gogha near Bhavnagar. In view of the fact that ancient texts mention that Dwarka was situated at the mouth of the Gomati river where there is now a temple of Sea God, offshore survey was planned seaward of the temple (Fig.13). Less than one hundred years ago, large passenger boats entering the harbour at Dwarka could be anchored along the Gomati Ghat but the

construction of a wall in 1890 has narrowed its mouth. During the last 10 years the mouth of the Gomati remains blocked over a major part of the year by the sand bar in this high energy zone.

Initially, the survey vessel was anchored 200 m west of SN and diving was done along the baseline connecting DWK and SN temple and loose stones buried in sediment were reported while probing. Diver Bhandodkar photographed the underwater structural remains built of dressed sandstone blocks of prismatic shape which measure on an average 1.5 x 1 x 0.3 m to 0.5 m. Two courses became visible after clearing vegetation on the structures and the third course could be faintly seen. In some pockets between the outcrops and structures pottery was found. Diving, survey

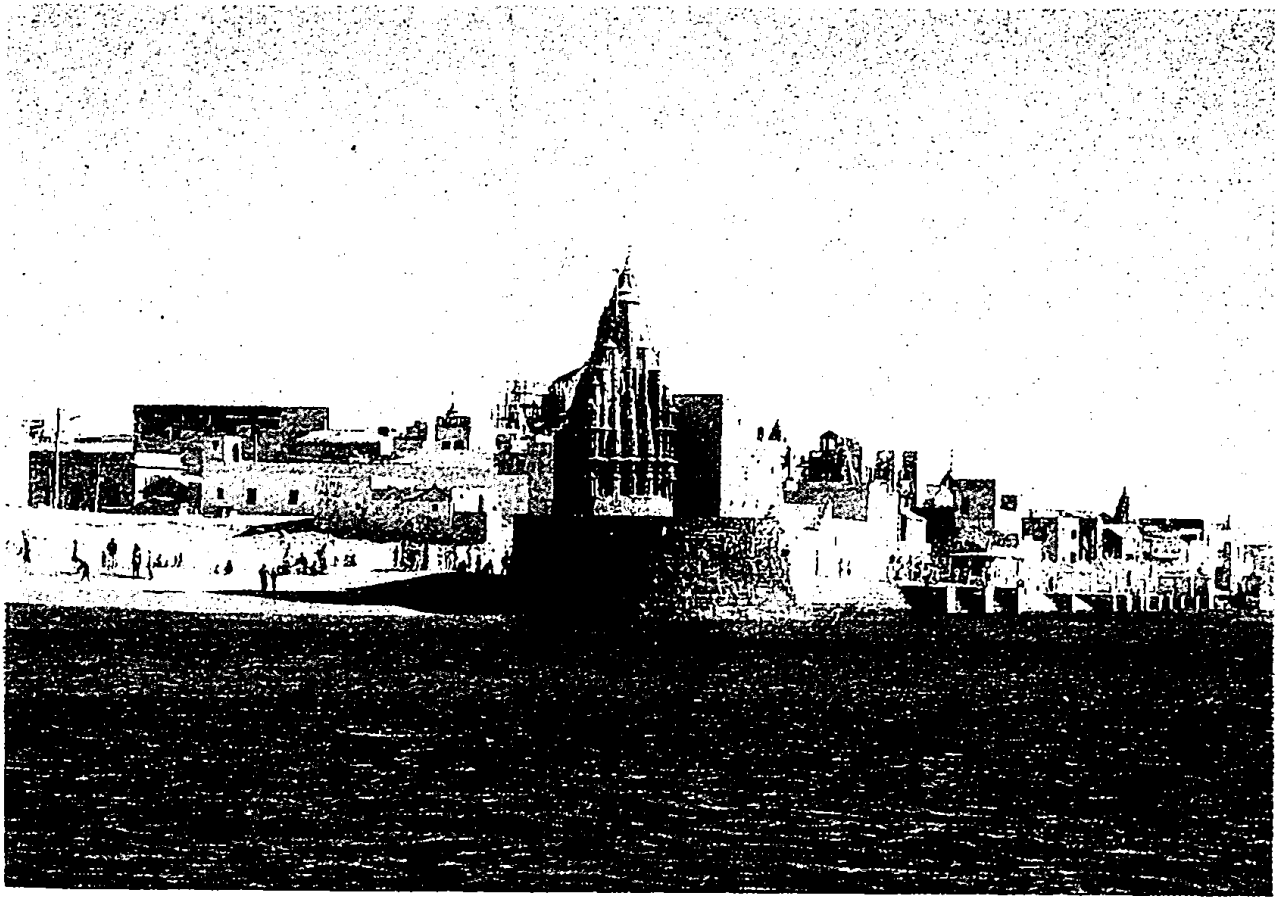


Fig. 13 Temple of Sea God (Samudranarayana) overlooking the Arabian Sea at the Confluence of Gomati river, Dwarka



operations and structures could be photographed as visibility was good between 11 and 14 hours.

### Survey Method

A swimline technique was adopted in searching for submerged buildings and artifacts beyond 200 m seaward of Samudranarayana Temple. The jackstay was not used as the divers had to swim sometimes against the current. A buoy was dropped to mark the starting point of the swimline in 3 to 4 m water depth. Divers carried and fixed buoys at the end of swimlines. The land transits are very accurate along Dwarka coast and there are backfeatures which can be sighted. Hence there was no difficulty in relocating the position of buoys marked on charts. For underwater survey the trilateration method

was used. Buoys were placed wherever significant structural members or anchors were found and their positions were fixed with the aid of the sextant. For plotting all the scattered blocks the site was gridded by a graduated steel drawing grid. The grid was fixed in a predetermined orientation. In the first instance the location of small objects was marked with reference to the baseline on the shore extending on either side of Samudranarayana. Photographing individual stone blocks was rendered difficult as the visibility was very poor and the current was strong.

Except on a single day turbidity due to swell and current made photography impossible. An in situ structure, 14 stray building blocks of stone and two 3-holed anchors were hauled with chain-pulley and



Fig. 14 Perforated stone anchors (Period I) Dwarka

brought to surface. Triangular 3-holed stone anchors weighing 100 to 150 kg are among the important finds of the Second Expedition (Fig.14). Two square fluke holes at the bottom of the anchor were meant for fixing wooden stakes. In the third hole called 'rope hole' which is usually round another wooden post was fixed and a rope was tied for lowering or hauling the anchor. Similar 3-holed anchors of Late Bronze Age are found at Ugarit in Syria and Kition in Cyprus (Frost 1985 : 400 ff). A structure of which three courses were in situ at location 1 seemed to be a protection wall of some kind. In the course of exploration one more structure in location 4 was recovered. The size of stones used in construction varied from 1 x 0.75 m to 1.25 m x 0.5 m with an average thickness of 0.4m.

It is necessary to refer to an incident that took place on the 26th December. A local Customs Officer and a Police Sub-Inspector came in a motor boat and entered the research vessel *Raghuvira* and interrogated the crew and Expedition Team as they were misinformed that smuggled gold thrown in the sea was being hauled. They had to return disappointed when they found that scientific research was all that was going on.

## Discussion

The onshore excavation in the forecourt of Dwarkadhish Temple in 1979-80 had yielded reliable evidence of destruction of the first protohistoric town in the 15th or 14th century B.C. Perhaps a second town settlement also suffered the same fate in the 10th century B.C. Furthermore it was observed that Temples I and II of the 1st century B.C. - 2nd century A.D. were totally ruined and the Vishnu Temple (Temple III) of 9th century A.D. (Fig. 7) was built on the foundations of earlier temples. Temple III also suffered damage perhaps due to sea level fluctuations or due to subsidence or both. Offshore

survey revealed two in situ structures, but the purpose of their construction could not be ascertained immediately. They could be remnants of a wharf, breakwater or jetty or a protection wall. In any case, they indicated submergence of the port-installations or public buildings of the ancient city. The evidence collected thus far confirmed that an ancient settlement was not only destroyed by the sea but also submerged. But unless the extent of the submerged township and its date were known it was too premature to assert that a city of the protohistoric period existed here. On the other hand, the pottery, seal and massive fortification walls and slipways of Bet Dwarka suggested that a large port town existed in the island in the 15th century B.C.

## Period I (Protohistoric)

The urban character of the protohistoric settlement in Bet Dwarka island and its importance as a port are two noteworthy features which came to light in the Second Expedition. The box-like construction of the gravity wall of rubble in the cliff section of BDK I-II confirmed that the protohistoric port-town was fortified landward. Initially it was thought that the town was 500 m long as can be made out from small patches of the fort wall. After a long time the site was reoccupied and buildings abutting the earlier wall were erected. If the rock-cut slipways (Fig. 12) are also taken into account the port-town of Bet Dwarka must have been 800 m in length. In circa 1400 B.C. almost the entire township was destroyed as can be judged from the heaps of wavesorted building blocks lying in the intertidal zone. The toe wall of massive building blocks built on the wavecut bench about 200 m seaward of the landward wall in the cliff section served as an anti-erosion wall. At present it lies submerged in 3.6 m depth at high tide. The spring tide must have been atleast 1.5 m below the toe wall at the time of its construction.

It is therefore reasonable to conclude that there is a net rise of 5 m in sea level during the last 3400 years, but it could be more if remnants of buildings in lower terraces could be traced.

The very fact that the protohistoric settlement in the island of Bet Dwarka was a fortified town with a toe wall on the water front and a landward gravity wall at the foot of the terraced hillock suggested an urban settlement with certain specialised industries such as shell-working, pearl-diving and perhaps metal-working also. The stone mould of a smith (Fig.15) found in the intertidal zone compares favourably with similar moulds found at Lothal, Mohenjo-daro and other Harappan towns and used for casting copper chisels and spearheads. The iron nails and stake found in the intertidal zone can be assigned to Period I in view of the technology adopted for fabricating them. The slipway indicates that boat building was an important industry. As the

sheltered bays provided good anchorages the inhabitants must have been expert navigators too. The seal and pottery found in the excavation give a mid-second millennium B.C. date for Period I.

## Period II

A large early historic settlement came into existence in Bet Dwarka in the 1st century B.C. - A.D. as indicated by the Red Polished Ware and other artifacts found in stratified deposits. The rubble walls of Period II abutting those of Period I were built by the new settlers. These structures differ in construction and material from the walls of Period I. Smaller fraction rubble, perhaps collected from the rubble-filling in the box-like constructions of Period I has been used in Period II. The robbers trenches yield both early historic and protohistoric pottery. The early historic town of Period II extended not only on the eastern and southern shores but also to the central parts of the island. The protohistoric town

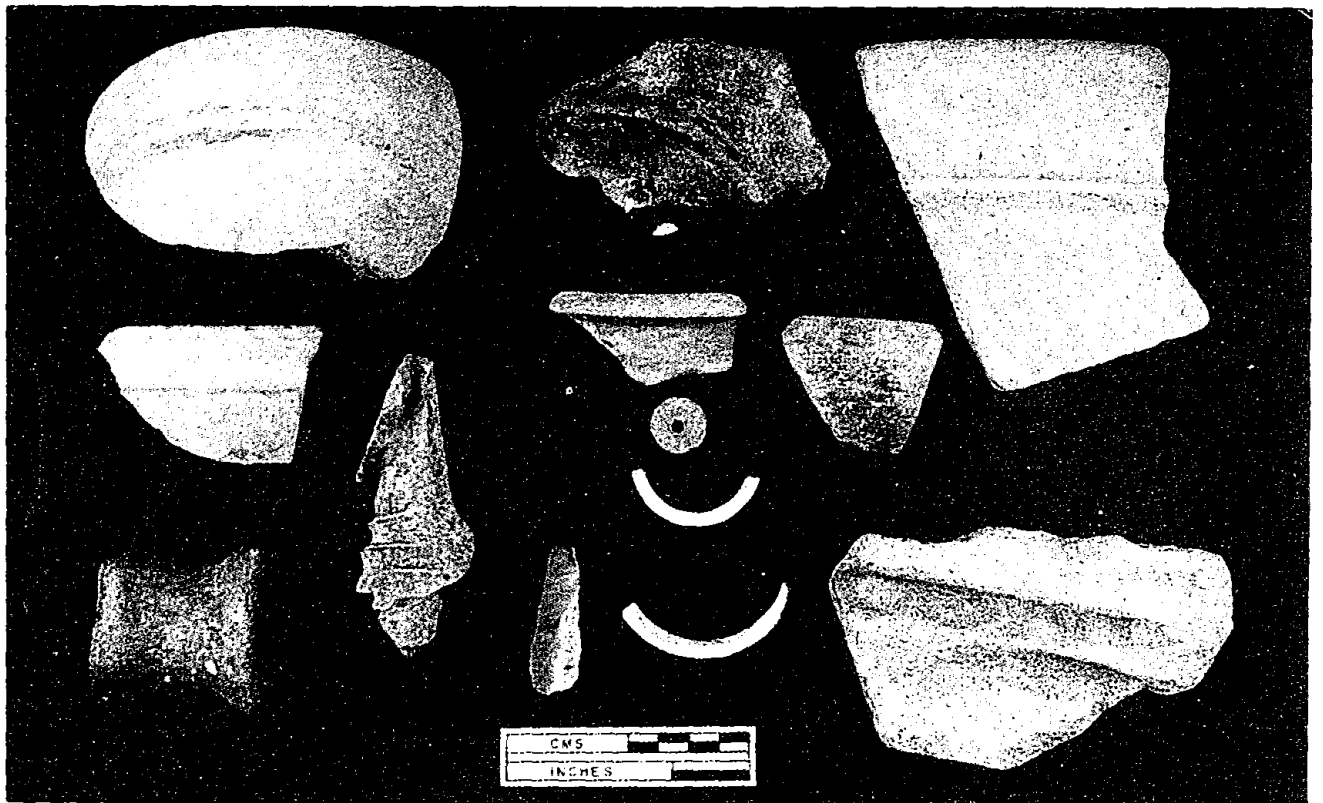


Fig. 15 Coppersmith's stone mould, chert blade and other artifacts (Period I), Bet Dwarka



Fig. 16 Late Harappan site in Balapur Bay, Bet Dwarka (Shankhodhara).

of Period I has been traced from the Pir at the southern end of the eastern shore upto the foot of the cliff opposite Nilankantha Mahadeva Temple. (Fig.12)

At the end of the Second Expedition the upper part of an earthen bowl in Red Ware inscribed in Late Indus script was found in the intertidal zone of BDK I-II. This find came in handy for cross dating. A reliable evidence for dating the ancient port of Dwarka is the three-holed triangular anchor. Similar ones were used in the 14th-12th century B.C. in Syria and Cyprus. The necessity of enlarging the survey area was obvious from the encouraging evidence of submerged structures in Bet Dwarka and Dwarka waters.

### Third Expedition, 1985

In all 10 cruises were made to survey underwater archaeological remains

off Bet Dwarka. A comparative study of the shore line maps of 1880 (Revenue Map) and the latest Hydrographic Survey map (1985) shows that the coastal indentations of 1880 have since been smoothed out by the action of waves and currents and there is a small bay formation taking place between the southern promontary (Custom House) and the northern promontary (Darga Pir) near Balapur (Fig.16). At spring tide the High Water line reaches the vegetation line on the beach. This part of the island was surveyed when Low Water was 0.99 exposing the mud flats as much as 2 km seaward. The Balapur Bay provides a good shelter to country crafts and must have been a safe anchorage with a boat building centre as is the case even now. The cliff section of the northern promontary here designated as BDK VI was surveyed for ascertaining the cultural assemblage and age of the habitation site.

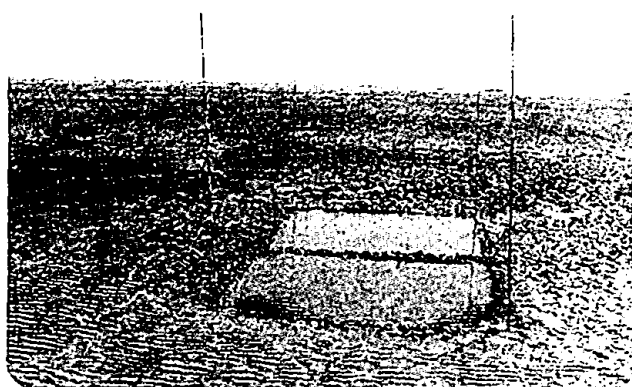


Fig. 17 Excavation in the mud-flats of Balapur Bay, Bet Dwarka (Shankhodhara). Highest high water is indicated by graduated rods

Perforated cylindrical jars, flanged dish and dish-on-stand are some of the Harappan types in sturdy Red Ware which seem to have survived in the Late Harappan (16th-15th century B.C). The upper horizon of one metre thick habitation deposit in the promontary yielded a sherd of the Lustrous Red Ware bowl. Thereafter the site was deserted until it was reoccupied at the beginning of the Christian era. The protohistoric deposit in BDK VI is 1 to 1.5 m thick while the Early Historic and Medieval deposits account for 1 to 2m each. At the foot of the mound a small trial pit was sunk in the mud flats of the intertidal zone (Fig.17) but the limited time available during low tide and the high water table prevented excavating more than 0.5m deep. Within the limited dig, the remains of a shell-worker's house, pottery and rejected columella of chank shell were found. As the duration of exposure of the mud flats in the intertidal zone is very short several problems will have to be faced in excavating even a couple of metres deep. If a coffer dam is built and the site is excavated deeper it will yield antiquities of the protohistoric period which lie buried in clayey sediment. The mud flats are dangerous to walk upon when exposed in low tide and the water depth being 2 to 3 m in high tide, diving is difficult and photography almost impossible.

Seventeen cruises were made between 28th November and 14th December, 1985 to explore submerged structures of Dwaraka seaward of SN. After removing vegetation and overburden the buried structures were photographed and plotted. Three dimensional measurements of anchors and other artifacts were taken in situ. Visibility was good and clear pictures of structures could be taken on the 28th and 29th November, but subsequently owing to heavy swell the photographer and diver could not gain stability and the pictures were blurred. Later diver R.P. Singh excavated within the caisson. The airjet was pressed into service for uncovering buried structures. Two arms of a structure marked B could be traced between buoys 16 and 13. Structure C which lies about 500 m seaward of SN has one of its arms between buoys 17 and 19. Others seem to be buried in the sediment. Some dressed stones displaced from

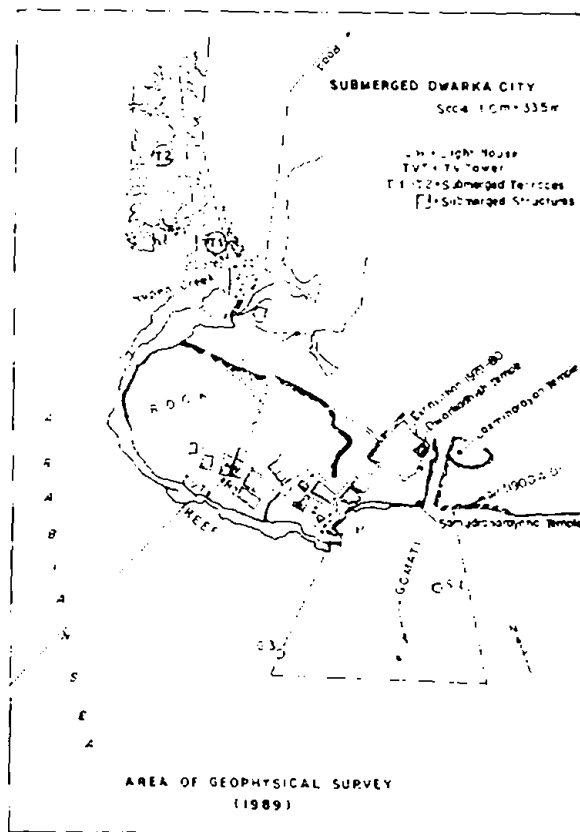


Fig. 18 Geophysical Survey and underwater exploration in Dwarka-Rupen.



structures were also encountered near buoy 15. Heavy swell and wind prevented further exploration and underwater documentation.

Among massive architectural members found in the sea bed a stone pillar, a beam and a crescentic moonstone (*candrasila*) normally used as a footstep leading to a temple are noteworthy. Large building blocks of walls measure 3 x 0.75 x 0.3m. and those of the superstructure are 1.5 x 0.8 x 0.2 m.

#### Fourth Marine Archaeological expedition, April 1986.

This was a very small expedition of ten days duration undertaken primarily in Dwarka waters for preparing survey plans of stray building blocks encountered in 4 to 6m depth. It coincided with the programme of the COMET Project of the Department of Science and Technology for producing a video film which could be telecast on Doordarshan.

#### Fifth Expedition, May 1986

Besides searching for structural remains of the legendary city upto 1.5 km seaward of SN an attempt was made to explore the Dwarka-Rupen area (Lat 22°14' 30"N, Long. 68°58'E). Although the duration of underwater search was limited to 30 days from November 27, 1986 the results were extremely encouraging. A well-equipped steel hulled research vessel *Vedhavati* was available and the sea was calm for the major part of the expedition. Good HP compressors, a derrick and other accessories were readily available. It became necessary to dig a number of trenches in the seabed for collecting samples. Holocene transgression and regression of the sea had also to be studied with reference to more number of in situ structures in the sea bed. Swells and currents prevented the divers from taking clear photographs and plotting mi-

nor antiquities. In all 14 trenches were dug near the buried structures in sea bed to ascertain the nature and rate of sedimentation. The bathymetry of the sea floor within the exposed area was studied and it was found that from SN to buoys 32-35 (Fig 9), the slope was gradual but beyond buoy 35 upto buoy 40 it was steep. The computed levels are given in Table I. The position of all buoys, structures and anchors was plotted on the survey plan. The most important find of the Expedition is a massive stone wall and bastion for the defence of the city or for its protection against erosion by sea. The nature of construction itself throws light on the measures taken for building in the water-logged areas. The bastion (Str 4) and Wall (Str 1) near buoys 33 and 35 on the right bank of a channel, perhaps the ancient course of the river Gomati, were built on a dry boulder foundation over the rocky bench which suggests that the builders took measures to reclaim water logged areas. A reference to reclamation is alluded to in ancient texts. Four courses of dressed blocks were traced in the bastion near buoy 35 (Fig.20) and in plan it was originally a circle. The stones are too heavy to be moved by waves and currents. Further west of the bastion (Str 4) two other buildings were laid bare near buoy 32. A 3-holed stone anchor (Fig.21) was also found.

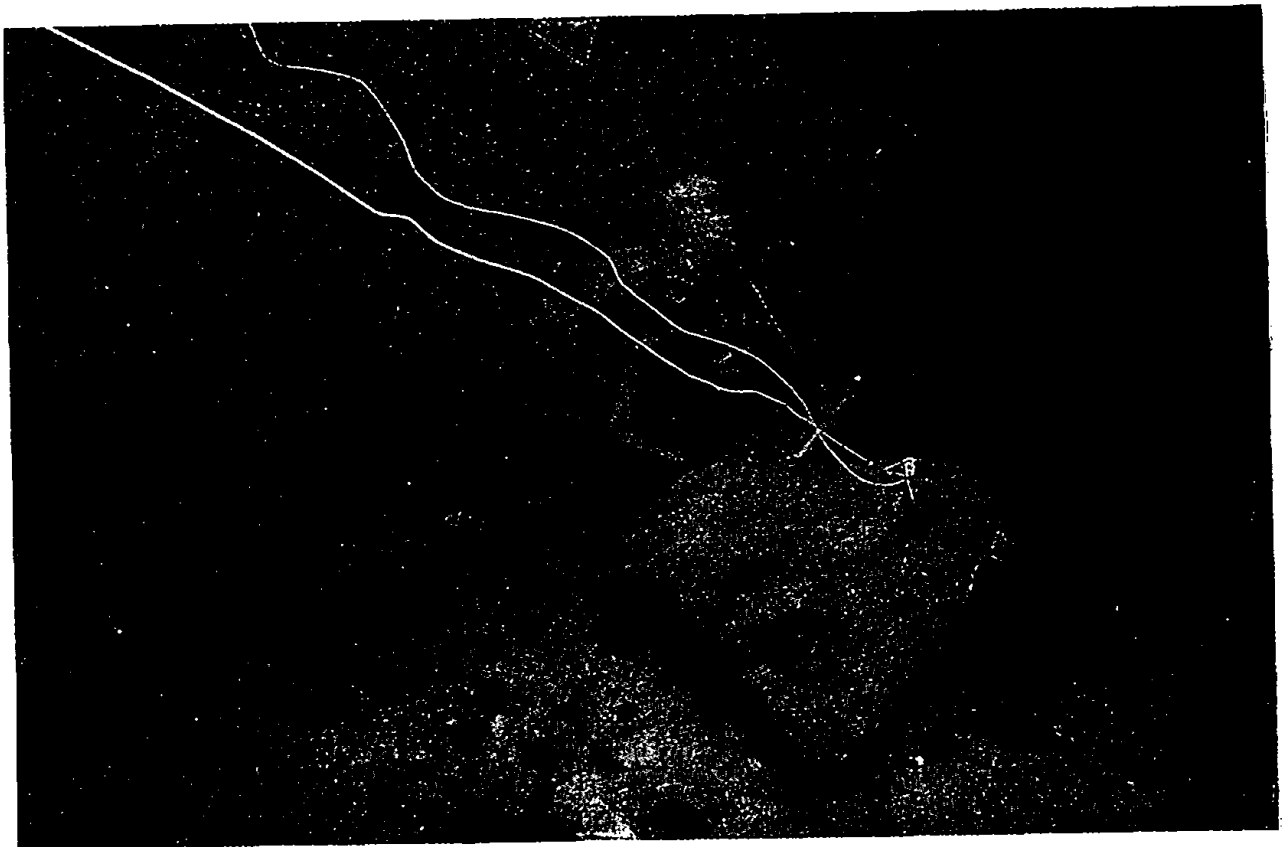
Although currents and waves came in the way of digging in sea bed for stratigraphic evidence, controlled digging helped in collecting samples layer by layer in 1 x 1 m trenches close to buried structures. A larger area was covered in Trench 6 and gridded into four squares A1-A2 and B1-B2 in the centre of which is the bastion. Near buoy 33 layers 1 through 3 consisted of sand, shingle and coarse coral sand respectively. Natural rock was seen below layer 3. In trench 10, however, there was a deposit of fine sand in layer 4 from which a chert blade was





Fig. 20 The diver plots a bastion of the protection wall of ancient Dwarka

Fig. 21 The diver measures a three-holed anchor used in 14th-15th century B.C., Dwarka



recovered. An iron anchor was found in layer 2 of the channel trench<sup>4</sup>.

The structures 1,3 and 4 near buoys 28, 33 and 35 respectively are found in situ at 6.14 to 5.56 m depth below MSL (see Table I for computed levels). They are assigned to Period I, the associated finds being five 3-holed triangular stone anchors and rolled sherds of black-and-red ware and Lustrous Red Ware (LRW) comparable to those of Prabhas III (Dhavalikar 1984 : *op cit*) and Rangpur III (Rao 1973 : 45-6, 100). The middle date for Prabhas III where LRW occurs is 1400 B.C. The structures of Period II and Dwarka waters are in situ at 2.81 m below MSL and the associated Red Polished Ware is dated 1st-5th Century A.D. in Amreli and other sites and 1st century A.D./B.C. -4th century A.D. in the onshore excavation in Dwarkadhish Temple Complex. More reliable is however the Red ware associated with RPW which is common to DWK 3 and offshore trenches in Dwarka waters. The structures of Period II are built of smaller size dressed stones while those of Period I are of much larger size. Iron anchors had come into use in Period II but not in Period I although iron nails and stakes were known in Period I at Bet Dwarka.

The conservation of wooden objects and two iron anchors found in Dwarka water has been done in NIO Laboratory under the guidance of V.C. Sharma scientist of National Laboratory for Conservation of Cultural Property, Lucknow (in this Volume). X-ray powder spectography revealed Magnetite, Haematite and Sulphur in the metal composition of the heavily corroded iron anchor.

An important achievement of the Fifth Expedition was the training of the archaeologist Gudigar in diving. Dr. Gangadharam, Geochemist from the National Museum, Kaula Lumpur underwent an in-

troductory course of training in marine archaeology.

### **Sixth Expedition: December 1986- January 1987**

During the Sixth Expedition offshore survey of Dwarka was confined to tracing of the submerged channel of Gomati. To the south of the DWK-SN base line some structures were discovered and an important feature of town-planning came to light. There are two protection walls, each with an entrance gateway flanked by circular bastions. The walls flanking the inner gateway run in North-South direction near another bastion traced at buoy 35 (Fig.19). A number of 3-holed triangular and prismatic anchors were found lying in sea bed. The walls are numbered Structures 1 through 3. Three trenches were dug near the walls and bastions so as to ascertain the stratigraphic position of buildings. A striking feature of construction is that the walls (Fig.22) and bastions (Fig.23) are built on dry boulder platforms raised on rocky benches especially where wave action must have been felt. The presence of a number of displaced architectural members within the enclosure walls suggests that important buildings, perhaps warehouses and the like, were situated here. Massive stone bases of flagposts and pillars (Fig.24) found near the outer fortification may indicate some sort of a warning system during cyclones. The soundings taken clearly indicate that the left bank of the submerged channel of Gomati extended more than 1 km seaward of SN.

From stratigraphic and ceramic evidence it is fairly clear that the township of the Early Historical Period (II) was confined to the 200-500 m zone seaward of SN while the protohistoric city of Period I extend upto 1km seaward, if not more. The antiquities especially iron anchors, copper and brass objects found in the present expedition belong to Period II and the

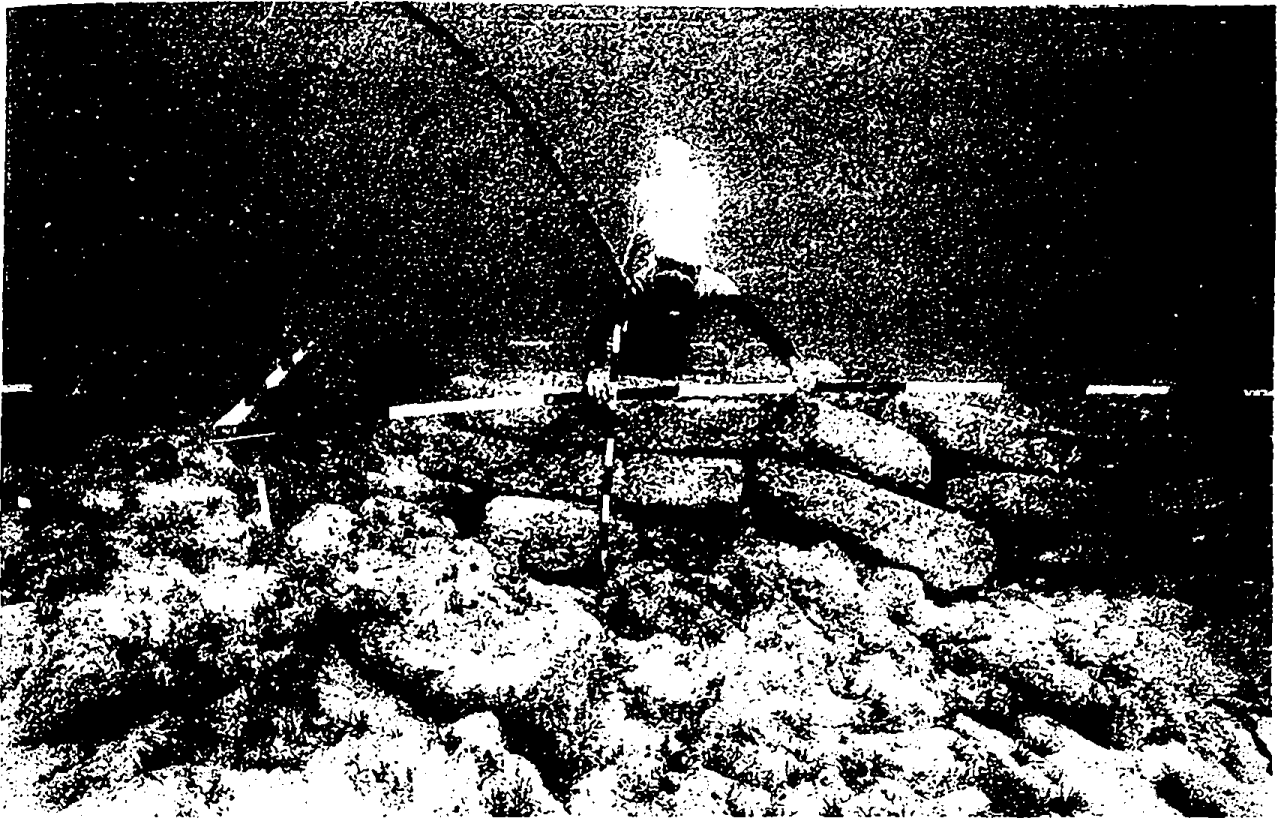


Fig. 22 Submerged Protection wall of stone built on dry boulder foundation in reclamation area of ancient Dwarka

Fig. 23 Bastion built on dry rubble foundation in ancient Dwarka.

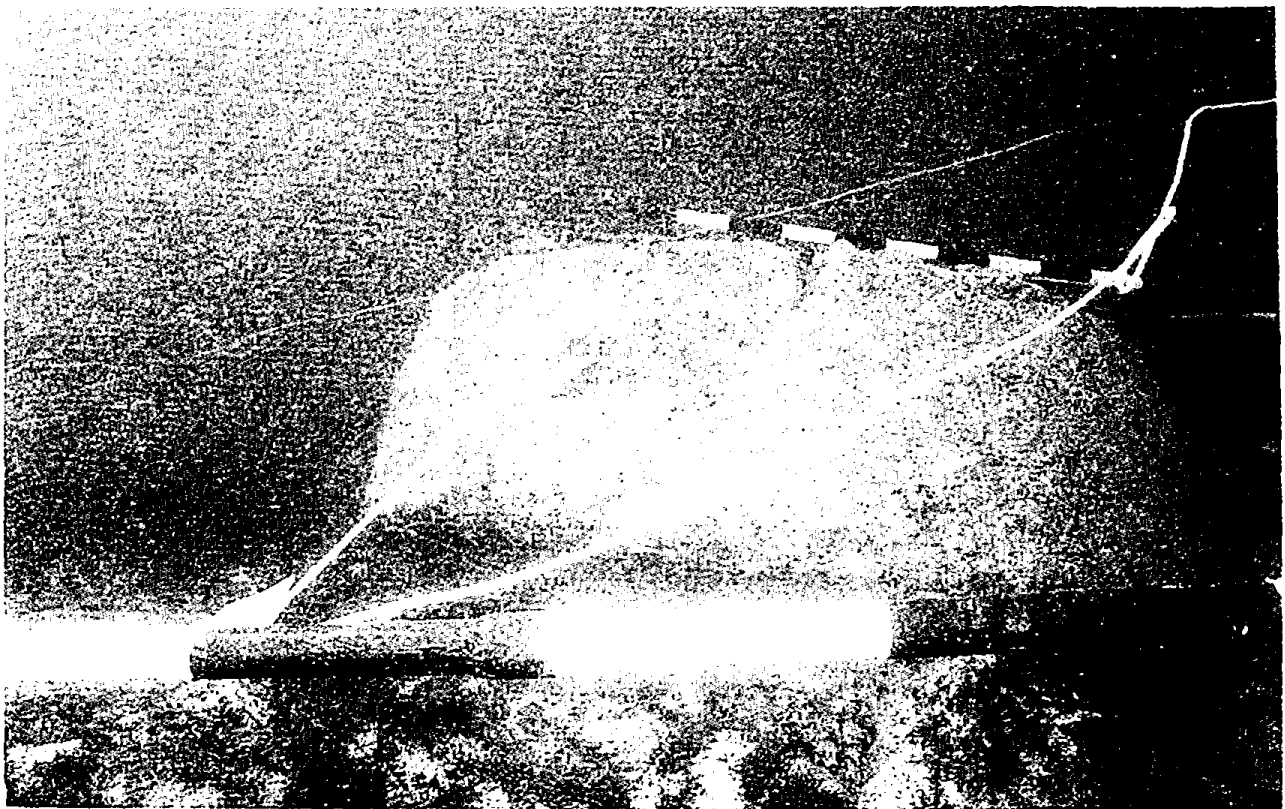




Fig. 24 The diver measures a pillar of a submerged structure of ancient Dwarka.

3-holed stone anchors as well as the Black-and-Red Ware are assignable to Period I. The paucity of ceramic wares in the explored zone is due to the fact that the river flow has carried away the lighter material and might have deposited it in the sea where it may lie buried deep in sediment.

As many as 50 anchors have been found in the sea near the bastions, walls and in the channel. If the number and size of anchors are any indication of the size of the port and the volume of its overseas trade it can be said that Dwarka was the largest port of the mid-second millenium B.C. on the Indian coast and the arms of its trade extended to Bahrain and perhaps to Syria and Cyprus also. The fragmentary marble statue in which only two feet of a deity or a human being are visible may belong to early Medieval Period (Fig.25). The brass objects (Fig.26), iron anchor (Fig.27), copper lota and some

wooden members of a boat (Fig.28) belong to Period II which may be provisionally dated 1st century B.C. The Thermoluminescence date for the pottery of Period I of Bet Dwarka is 3520 years BP and for Period II 2000-1800 years BP. These dates

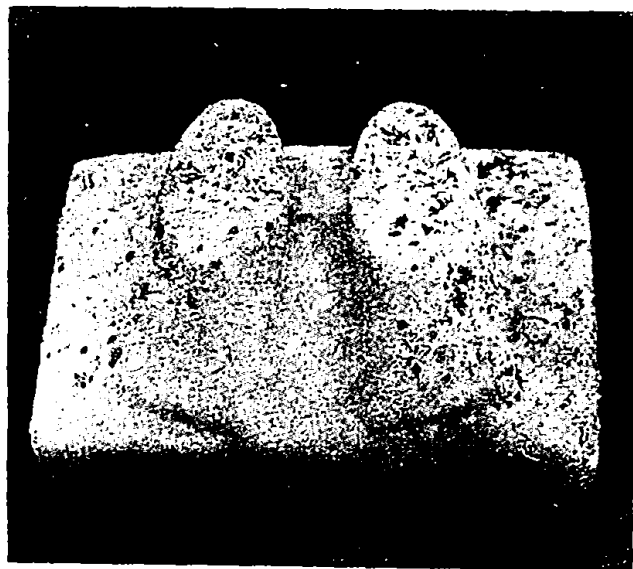


Fig. 25 Lower part of a marble statue of Period II, Dwarka.

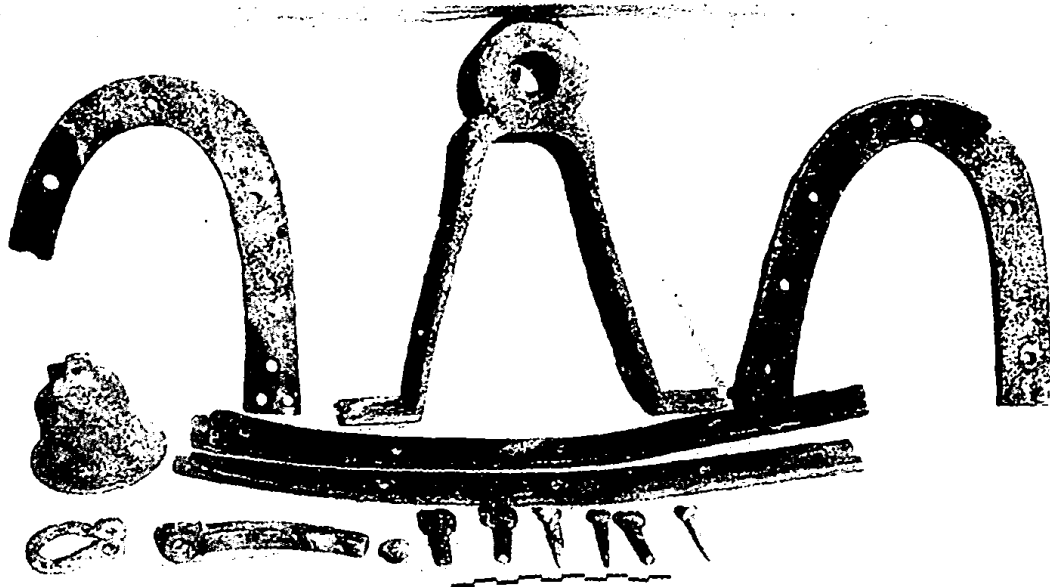


Fig. 26 Copper bell and other metal objects of Period II, Dwarka.

arrived at by Singhvi corroborate the date of archaeological finds. LRW is dated 1500-1200 B.C. in the Excavation at Somnath (Prabhas).

A few architectural members and 3-holed stone anchors were found on the supposed left bank of the submerged channel of Gomati. Further exploration had to be abandoned as the sea became very choppy.

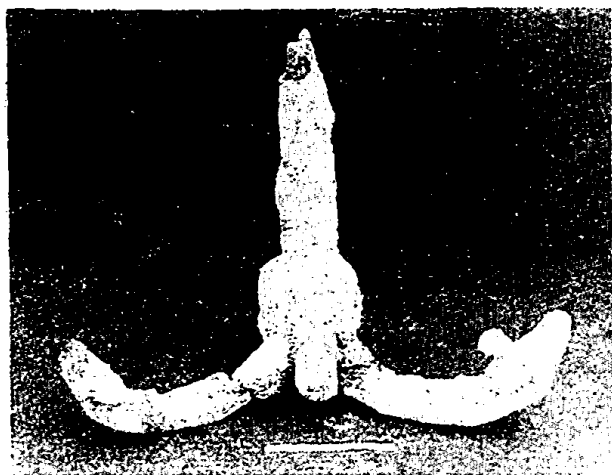


Fig. 27 Iron anchor of Period II, Dwarka

### Seventh Expedition 1988-89

After having discovered the gateways and inner and outer walls of protection on the right bank of Gomati it was necessary to search for corresponding structures on the bank opposite. If *in situ* structures were to be found, it was thought, they would indicate the left bank and the width of the submerged channel could be calculated. The soundings would give the gradient of the flow channel and the samples may throw light on the nature of fluvatile deposit. Whether the inner and outer walls flanked by bastions were meant for protection against storm waves or enemies had to be ascertained. In this connection the reference in *Harivamsa*, (*Bhavishya parva*) to the attacks on Dvaraka by Salva king of Saubha and the steps taken to defend the city are important. Before Dvaraka was founded by Sri Krishna there was an earlier town known as Kusasthali which was also destroyed by the sea.

One of the recommendations of the Second Monitoring Committee of the Marine Archaeology Project was to collect

data for arriving at a high resolution curve of sea level fluctuation and to know the nature and rate of sedimentation. The extent of coastal erosion during the last 4000 years was also to be ascertained if possible. Lastly more extensive seaward exploration to trace the farthest limits of ancient Dvaraka was necessary but this involved geophysical survey of 50 sq km. In the absence of necessary echosounder, profiler and side scan sonar the Expedition Team carried out manual survey of an area of 1.25 x 0.5 km seaward of SN and diving was limited to 17 m depth. The reference point for westward survey was buoy 35 where the inner fort wall and bastions are in situ. During the present field season a rectangular structure (Period I) was discovered on the left bank at buoys 68,69 and 70 opposite the bastion at buoy 35. The width of the river at this point is

about 170m. The Section A-F (Fig.19) across the Gomati channel gives the stratigraphic position of structures of Period I and Period II, but further west, seaward of SN a structure and four stone anchors were laid bare by removing the overburden. Here the Gomati channel is wider than what was presumed to be the case. It increased from 100m near SN to 700 m over a distance of 1.5km. Perhaps it was wider near SN before the stone wall was built in 1890 A.D. The gradient of the channel bed increased from -4.87m at buoy 35 to -7.44m at buoy 50 (Table I). Farther seaward the gradient increased from -7.44m to 11m at 1.5 km west of SN. But the width and gradient of the channel need to be confirmed by geophysical survey. On the left bank also walls and bastions are found to have been built on dry boulder foundation on the bed rock. The overall

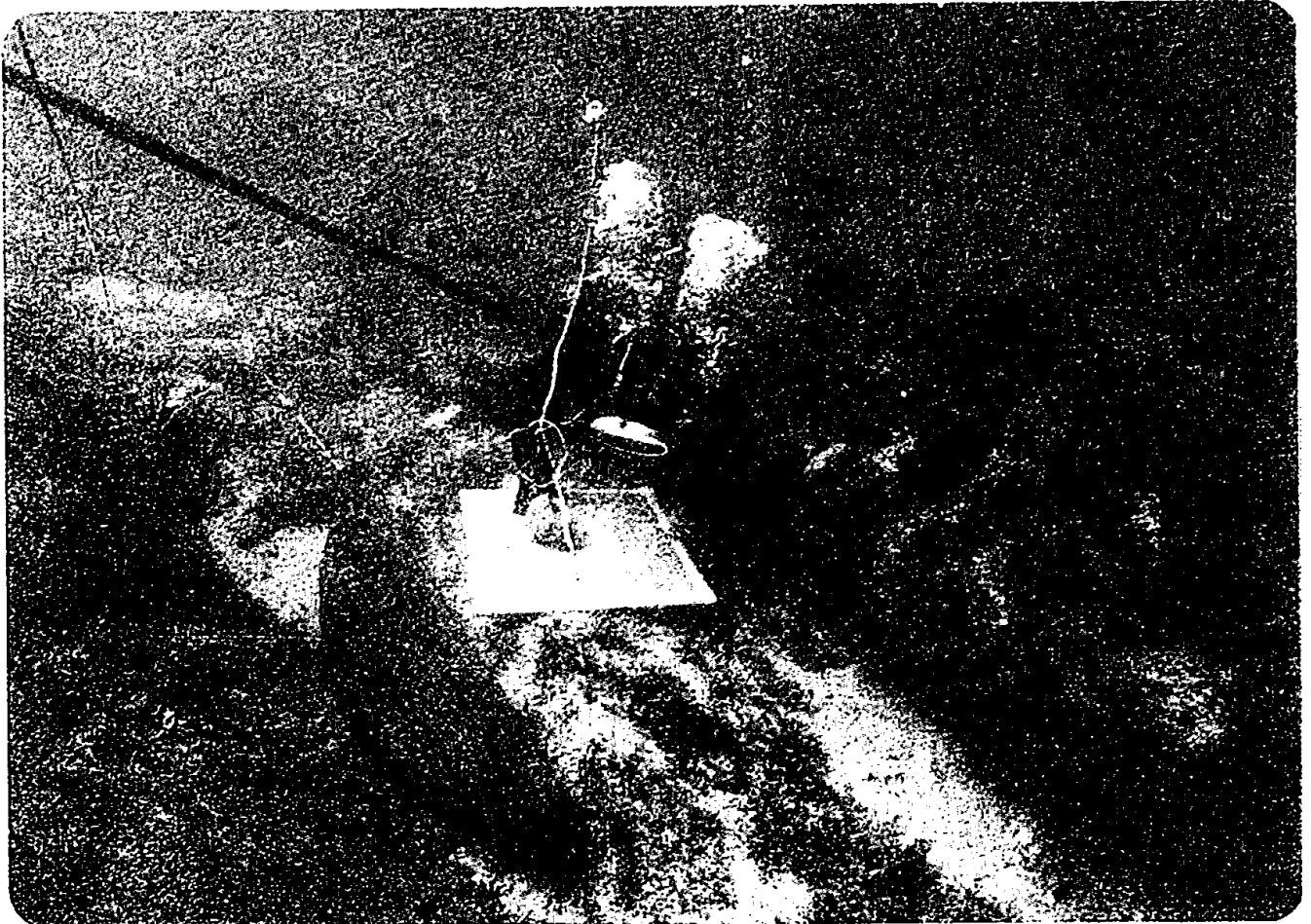


Fig. 28 Wood from a shipwreck of Period II, Dwarka



picture of the building activity within the limited area explored is indicated by marker buoys where structural remains (Str 1 to 6) have been traced. It is now obvious from the structural remains that the port city of Dvaraka built in 1500 B.C. had double protection walls. One gateway in each enclosure has been identified. Four courses of bastions and walls built of large dressed sandstone blocks measuring on an average 2.6 x 1.3 x 0.4 m have been exposed by airlifting.

The difficulty experienced in tracing structures overgrown with vegetation was enhanced by the dumping of sand excavated in Gomati channel into the sea by the irrigation department of Gujarat State in 1988. The structure documented in the fourth and fifth expeditions were covered by sediment by the shovelling action of the sea. There were several structures within the two enclosures constructed from smaller fraction building blocks. As they could not withstand the destructive action of waves and currents, they are destroyed and heaps of rubble are seen in Dwarka and Bet Dwarka waters. Except in the case of two large buildings

which must have been warehouses or some other port installations it is difficult to ascertain the purpose of other buildings which are in utter ruin.

Pathak and others have referred to a spit about 3 km northwest of Dwarka shown in the Admiralty Chart of 1848 (Pathak 1988: 59-62). Wing Commander I.S. Buttar has suggested survey of "a submerged hill, a white sandy beach and dilapidated buildings visible during his aerial survey of the sea near Dwarka" (personal communication). An attempt was made to trace the outer limits of the ancient city of Dvaraka beyond the Light House towards Rupen bandar, but except for a few loose dressed sandstone blocks no substantial structure came to light. The Expedition in December, 1989 will undertake geophysical survey of area 10 x 5 km in the northwest direction seaward of Light House. The Project is expected to reveal anomalies and features which shall be manually examined by divers who will also collect samples. Position-fixing will be done with Mini Ranger III, since the position fixing by sextant may not be accurate. Geophysical survey at close



Fig. 29 Rubble wall in BDK VIII exposed in lowest tide in central sector of ancient Shankhodhara (Bet Dwarka)



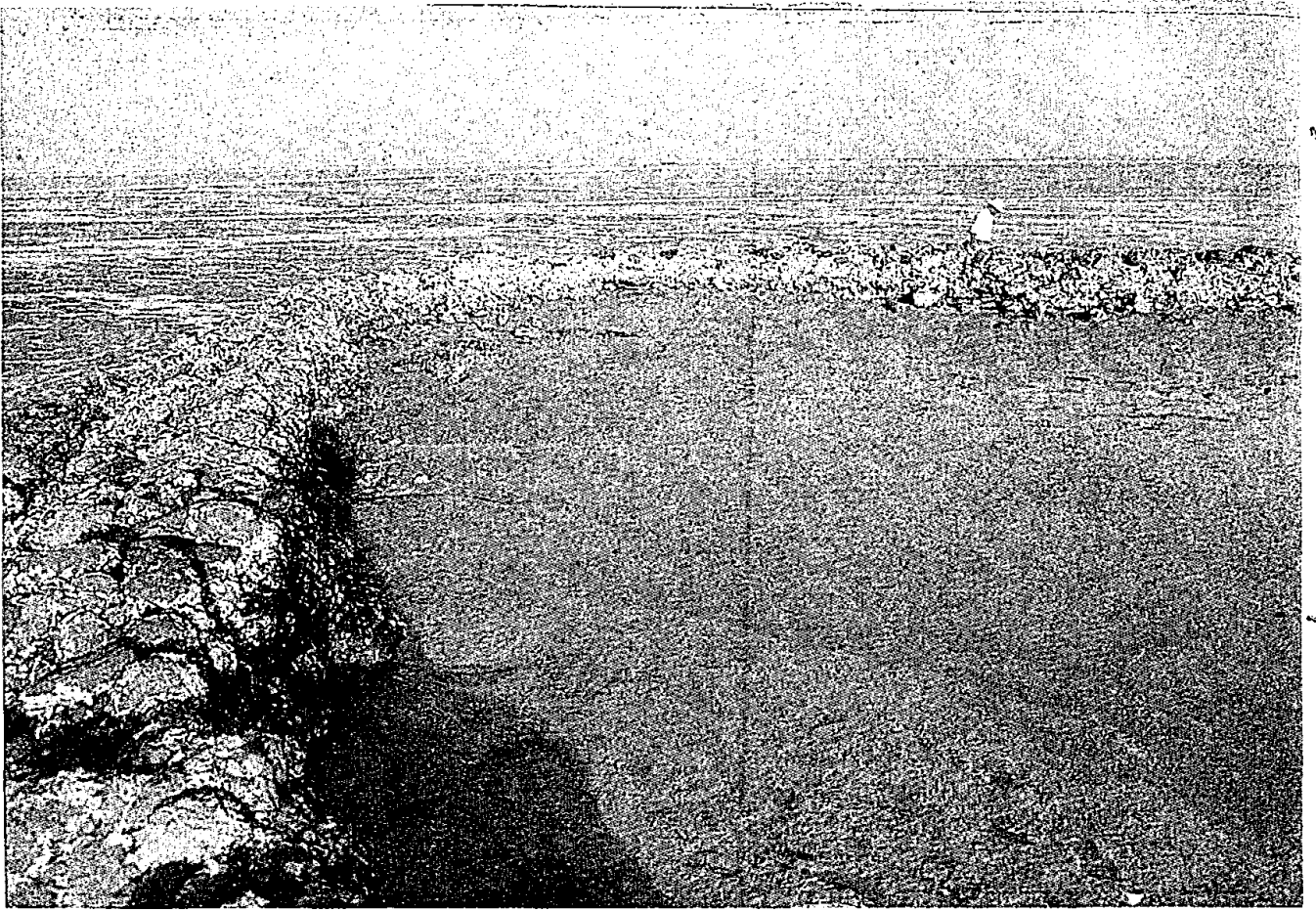


Fig. 30 Rubble wall exposed in lowest tide BDK VIII

range for high resolution is, no doubt, very expensive, but this has to be undertaken to decide once and for all whether Dwaraka city extended beyond 1.5 km seaward and if so whether its relics could be earlier than 1500 B.C.

### Bet Dwarka

In the course of survey of the intertidal zone between BDK II and BDK VI in January 1989 a massive rubble wall (Pls. Fig.29-31) was discovered. It is an irregular hexagon 558.3 m in perimeter, the extant height being 1.5m. Its maximum width is 2m. A small trench 1 x 1.2m (Fig.32) was dug on the southern face of its northern arm and 9 courses of masonry were found in tact. This wall has an inner core of rubble filling while the outer shells are of wedge-shaped stones some of which are dressed. At high tide

the wall lies submerged under a column of 1.5 to 2m above the topmost course. Originally two arms of the massive structure extended upto the cliff at the foot

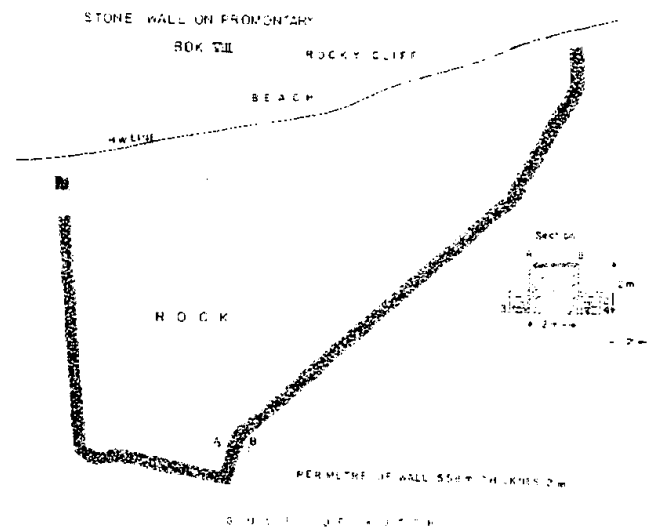


Fig. 31 Rubble wall in BDK VIII - plan and section



Fig. 32 Section of a trench exposing lower part of rubble wall in BDK VIII

of which a small beach formation appears. Whether a gap of 19.20m in the eastern arm was intentional for entry from the beach or whether it was caused by the sea is not clear. One thing is certain namely this structure built on a rocky promontory acted as a protection wall and provided a good anchorage.

### Antiquities

Two highly significant antiquities found in the Second Marine Archaeological Expedition are a rectangular seal and an inscribed earthen vessel. The seal of chank shell is 20 x 18 mm. in plan and has a perforated button on the back for holding a ring. A three-headed animal motif representing a short-horned bull, a unicorn and a goat is engraved on it (Fig.33). The seal and motif suggest Indus origin but the art style bespeaks of

Bahrain art. The exaggerated eye of the animals and the outline drawing of the bull are characteristic of animal figures on the round seals of Bahrain. It may be noted here that a round Bahrain type seal carved with two jumping gazelles flanking a dragon was found at the Harappan port of Lothal in Gujarat. Recently a square Indus seal with unicorn motif was found by the Indian Archaeological Expedition to Bahrain. A few Bahrain type seals from Oman and Failaka are also inscribed in Indus script thus establishing close trade and cultural relations between South Arabia and India in the 3rd and 2nd millennium B.C. (Rao 1986:376-82, Dani, 1985: 383-887). Three-headed animal figures are engraved on Indus seals of Mohenjo-daro, but the art style of the Bet Dwarka seal and the Late Harappan pottery from the intertidal zone of the



Fig. 33 Late Indus type seal with a 3-headed animal motif representing bull, unicorn and goat, Bet Dwarka island suggest a mid-second millenium B.C. date. This evidence is corroborated by an inscription in post-Indus characters on a votive jar from Bet Dwarka.

Different interpretations are given by different scholars to explain the composite animal figure on Indus seals. It appears that the short-horned bull, the goat and the unicorn were revered by different clans or groups of people and engraved as symbols of their faith. Though the seal itself was used for a commercial purpose, it has a religious context (Rao 1979, 191-218). The three - holed stone anchors of Dwarka are of three types namely triangular, prismatic and elliptical (Fig.34).

**Inscription from Bet Dwarka (Fig.35-36)**

There are seven distinctly inscribed

characters above the shoulder of this wide-mouthed jar which has a low flange on the shoulder and a perforation also. The letters, one cm in height, are separated from one another. Out of seven letters, six are identical with the late Harappan characters. The fourth character from left is a combination of two signs, one of which is a Late Harappan sign for *ga*, and the other a non-Harappan sign resembling the Brahmi sign for *cha*. The inscription runs from left to right as in Brahmi inscriptions. All the signs, except the compound sign, bear close resemblance to the Semitic (Phoenician) letters on the one hand and Late Harappan on the other (Rao 1982, Fig.8). At least five out of seven characters are traceable in the Megalithic inscriptions of Sanur and three are analogous to Brahmi

STONE ANCHORS OF DWARKA

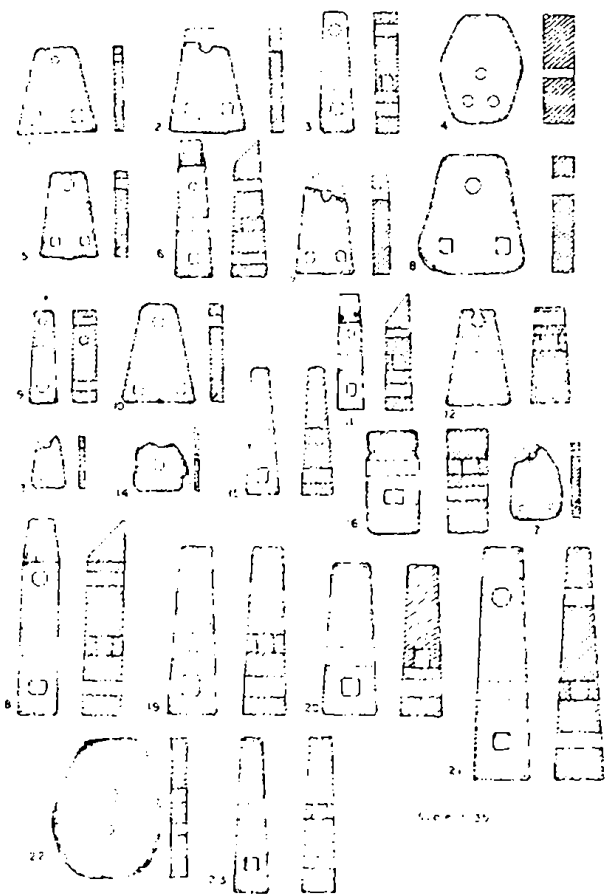


Fig. 34 Three-holed stone anchors, Dwarka

characters. The characters can be evaluated on the basis of the phonetic value of a known contemporary script, namely the Semitic Script.

The first character in Bet Dwarka inscription is comparable to the sign for *m* in the South Arabian Iron Age inscription and it occurs on the post-Harappan Daimabad pot. The same character is evolved into Brahmi sign for *ma*, the intermediate stages being indicated by the Rangpur and Megalithic graffiti of Sanur (Rao 1982; Fig.2). The second and third characters in the Bet Dwarka Inscription are identical with the sign for *h* in Semitic (Canaanite) inscriptions and the Late Harappan and Harappan signs, the

phonetic value being the same as in Semitic writing. The repetition of the character in the Bet Dwarka inscription shows the continuance of the Harappan tradition. It occurs in Daimabad and Megalithic graffiti also. Another feature that deserves attention is the fact that the second and third characters in the inscription under consideration face left as in the ivory rod inscriptions of Mohenjo-daro. They are written facing right in Bet Dwarka and this is the normal way of writing it on Indus Seals. The fourth character consists of two characters resembling those in Brahmi for *ga* and *cha*. The first sign here is identical with the sign for *ga* in Semitic and Indus writing, for, neither had palatals in their phonetic system. Since it occurs in Bet Dwarka and Brahmi inscriptions, it represents the intermediate stage when new signs, especially for cerebrals and palatals, were introduced. Thus the compound character is to be read *gacha* (*gachcha*) which is a homophone of *Kachcha*. Interchange of *k* and *g* was common in Indus inscription eg. *Baka* and *Baga*.

The fifth character is identical with the sign for *sh* in Semitic Shafatbal, Asdrubal and Canaanite inscriptions and Indus seals and graffiti. Though it looks



Fig. 35 Inscribed votive jar, Bet Dwarka

S.NO.	2500-1900 B.C. HARAPPAN SIGNS (BASIC)	1900-1500 B.C. LATE HARAPPAN SIGNS (BASIC)	1500-1000 B.C. NORTH SEMITIC SOUTH	PHONETIC VALUE	1300-BETDWK B.C.	1400-800 B.C MEGALITHIC SANDR ETC.	3rd CENT B.C. ASOKAN BRAHMI GIRNAR
1				h			ba
2				g			ga
3				d			dh a
4				h			ja
5				w			va
6				h			
7				th			tha
8				k			ka
9				n			na
10				s			sa
11				(say)			
12				p			pa
13				r			ra
14				s			sa
15				t			ta
16				s			sa
17				h			ha
18				m			ma
19				a			a
20				r			ra
21				s			sa
22				s			cha
23				z			
24				y			ya

Fig. 36 Chart showing alphabetic signs of Indus, semitic and Brahmi scripts compared with those in BDK inscription

more like *gha* than *ya* in Brahmi script, its phonetic value is *sh* in Semitic and Indus scripts. The sixth character looking like the Brahmi alphabet *ja* is exactly like the basic sign for *h* in Semitic and Indus script. The last sign is comparable to the semitic sign for *pa*. With two strokes on top as in the Indus script it reads *pa*. The whole inscription can therefore be

*readma-ha-ha-ga-cha-sha-ha-pa=ma hagachcha-shah-pa or mahakaccha shah pa* e "Sea (or Sea God) king (or Ruler) protect".

If the last three characters resembling Brahmi signs, are read *yajama* or *ghajama* and not *yajasa* the inscription makes no sense, while the phonetic value

of the identical signs in Semitic gives the reading *shah-pa* meaning 'Ruler protect (or protector)'.

From the reading based on Semitic-Indus phonetic value of seven signs it becomes obvious that the language of the inscription is Indo-European and not Semitic. This is also true of Indus seal-inscriptions.

The term *mahakachcha* is used in the *Mahabharata* in the sense of 'a high Cedrena Toona having vast shore, the sea (Monier Williams). It is also used according to Lexicographer Amarasimha in the sense of 'Sea, Sea God, Varuna' etc. The inscription and its contents are most appropriate when we take into account its provenance, development of the script, language and tradition. Offerings used to be made to Varuna Devata in Dvaraka, which included Bet Dvaraka (as both were connected by land) where a temple dedicated to him is situated. In *Rigveda* and *Mahabharata* there are references to offerings made and prayers offered to Sea God Varuna. (Rao 1989 in press). From Harappan times onward down to medieval time votive jars bearing inscriptions making a reference to the deity to which offerings were made have been found. On palaeographical grounds and ceramic evidence the votive vessel belongs to the post-Harappan period. Taking into account that the Lustrous Red Ware and chalcolithic Black and Red ware were in use in Bet Dwarka, the inscription under reference is assignable to the 15th-14th century B.C. Its significance lies in corroborating the evidence from Rangpur, Prabhas (Somnath) and Daimabad besides Mohenjo-daro and Lothal about the evolution for the Indus script and its use in simplified form in the Vedic and Epic periods. It also points to the fact that the Brahmi script was derived from the Late Harappan script with some additional signs for cerebrals and palatals which the Late

Harappan script did not have. The new signs that we notice in the earliest Brahmi script for palatals and cerebrals might have been taken from Aramaic but the bulk of the consonantal signs in the Late Harappan script were adopted by the Brahmi script.

In this connection, K.V.Soundara Rajan's view may be noted. He says in a personal communication "I should congratulate the team at the outset on this very important and perhaps first ever stage of a breakthrough in the understanding of the devolutionary stages of the Harappan script problem ...

The direction of writing of the legend is by itself significant. Six of the letters as you have said are analogous to the Semitic and what you call the Late Harappan script of Lothal. You however think that it is post-Harappan, why? you have mentioned in the last paragraph about two peculiarities of the script, the facing of the letter *ha* and its repetition leading to the lengthening of this letter as *hā*. But have you seemingly avoided saying as also that both these peculiarities are to be seen in the Brahmi character for the first time only in the earliest state of the Tamil-Brahmi cavern records. If this could be accepted without detriment to the known characteristics of the Harappan script usage in the mature and Late stages, we may have for the first time (i) an ethnolinguistic slant for the script language as well. Can the legend be read as *mahakayajasha* (seemingly to mean as belonging to one born of *Mahakaya*). You know in some of the instances of early stages of Brahmi the possessive *sa* is written as *sha* ... In this connection the examination as to how far late in the Chalcolithic one can place the jar container would be interesting. I have always held that pre-Asokan writing should exist and this discovery of yours is indeed a very valuable link."



As regards Soundara Rajan's suggestion of a maritime introduction to Megalithic culture, the author has nothing to say. His second suggestion about ethno-linguistic slant for the script language is not clear. Anyway he has accepted the link between Indus and Brahmi scripts. So far as the date is concerned the inscription is of 14th-15th century B.C. because of the Lustrous Red, Back-and-Red and Kassitte Wares associated with it. The uninscribed sherd of identical fabric and type from Nageswar also falls in that chronological bracket. Soundara Rajan has suggested reading *ma-hakayajasha*, but the 3rd character is also *ha* like the second *ha* and hence cannot be read *ka*. The fourth sign cannot be dropped before reading *ya*. It reads in all probability *gaca*. The sign for *sh* in Ahiram and Bet Dwarka inscriptions is the same, while the sign for *ya* in the Tamil - Cave Brahmi is slightly different. It is analogous to *sha* in Ahiram and Late Harappan inscription (Rao 1982: Fig 8) and to some extent similar to sign for *ha* in Semitic and Late Harappan *p* with 2 strokes on top. If one has to stretch imagination it is more like *ma*. If Brahmi phonetic value is given to all characters of Bet Dwarka by distantly comparing with Brahmi characters the reading would be *ma-ja-ja-gacha-gha-ja-ma*. On the other hand the phonetic value based on the similarity of Bet Dwarka with Indus and Semitic characters the reading would be *ma-ha-ha-g-cha-sha-ha-pa*. The Brahmi characters and Brahmi direction of writing suggest that B.D. is the forerunner of Brahmi script providing an important link with the simplified linear script of 24 signs in the Late Harappan writing.

### Coastal erosion and rate of sedimentation

Pathak, Kotnala, Prabhakaran and Sivakholundu (Pathak et al 1988: 58-62) have concluded that dearth of sediment and the tidal barrier coupled with storm

events have resulted in heavy erosion—about 550 m in 130 years in Dwarka and 3m per year at Bet Dwarka. But my study of the coastal belt of Dwarka from 1948 to 1989 has not indicated anything more than 8m where SN stands thus accounting for a 0.2 m regression per year. The gradient of river bed beyond 400m seaward increases by 12m thereby lessening the rate of erosion. The presence of a massive wall and bastion on the left bank 400m seaward of SN where triangular anchors are found confirms that it "served as a protection to the bank against erosion due to strong flows in the Gomati Channel". "The large corals, gastropods and rock fragments in the sediment sample of layer 1 in the trench at buoy 64 at 5m MSL suggest a surf zone". On the right bank also there are walls and bastions. The protohistoric walls gave protection to other port installations against small waves. The structures served as a good anchorage also. The sample consisting of fine grained sand from layer 3 at 1.5 m depth in sediment at -19m MSL, about 1750 m seaward of SN, indicates that the effect of waves and currents was very limited. This was the point where Gomati might have met the open sea which needs confirmation. On the other hand the sample consisting serpulid tube (worm) from layer 2 at buoy 67 in 60 cm sediment depth suggests surf action. Here the water depth is 4.5 m only. From these details it can be inferred that the erosion rate is about 450m in 3000 years. Since the area excavated in sea bed is extremely limited, the above inference needs to be verified with samples from greater depths and atleast 3km seaward where a spit is reported by Pathak and others. Even if the carbonate sample is dated, the fluctuation in the rate of sediment cannot be known owing to the flow in the Gomati Channel. Nair has however suggested that the movement of the river itself over 3500 years should be determined. According to him "the soil sample comprising of



predominantly shell material suggests that the surf zone was around an island with fringing reefs".

### Sea Level Fluctuation

There is considerable difference of opinion among oceanographers regarding the mode of sea level rise during the Holocene. Fairbridge's (1961:99-185) curve of eustatic rise has pronounced variations. Emiliani and others proposed a rapid rise (1975:1083-1090) Morner (1976:123-151) and Bowen (1978) have demonstrated that because of the differing tectonic histories no universal eustatic curve is possible. But the data made available by Nair and Hashimi as a result of their studies of the western continental margin is considered useful for eustatic study of the Gujarat coast. They have come to the conclusion that 'the post-glacial rise of sea level on the western continental margin of India was rapid' (Nair and Hashimi, 1988, 83-86). "The possibility of shallow water conditions in the past is indicated by the presence of calcareous sandstones at a depth of 60m, which on the basis of petrographic and faunal studies have been found to have originated in the intertidal zone. The radiocarbon dates for these were 9000 to 11000 years BP" (Hashimi, Nair and Kidwai 1978: 1-7). Whether the rise in sea level was uniformly rapid during the last 10,000 years is not clear from their investigation nor are the fluctuations if any in the form of one or more transgressions followed by regressions in Dwarka - Bet Dwarka region during the last 5000 years indicated. It was therefore found necessary to supplement the data furnished by Nair and others with archaeological data to arrive at an eustatic curve for the period 5000 years BP.

The primary archaeological evidence for an eustatic curve comes from the in situ structures at three stations within a

distance of 0.3 to 1 km seaward of SN temple at Dwarka where two periods of occupation are distinguishable. Period I is datable to 1500 B.C. - 1400 B.C. and Period II to 100 B.C./A.D. - 500A.D. At Station 1 on the right bank of Gomati channel there are structures of both Period I and Period II (Fig 9). The top of structure 4 which is a bastion at buoy 35 is 4.87 m below charted datum of Okha. (COR). Four dressed courses of stone masonry account for further 1 m height to which must be added atleast 0.5 to 1m height of boulder platform on which the bastion stands. Thus the working level of Period I structure is computed at  $4.87 + 1.5 = 6.37\text{m}$  below Okha/Dwarka MSL. Since the structures must have been built 1.5m above the then HWL the sea level in 1500 B.C. can be said to be 7.87 m below present MSL. Further seaward at Station 2 on the right bank is a bastion at buoy 59. The top of the bastion is 7.44 m below present MSL. If the heights of the bastion and platform are counted together the ancient working level can be computed at 9.94m below MSL. If the structure stood at 1 to 1.5m above th then HWL the average sea level in 1500 B.C. may be said to be 10 to 11m below present MSL. The possibility of the structures having sunk under their own weight or due to tectonic activity is remote because they stand on boulder platform built on solid rock. The walls with bastions served as protection walls against erosion at least during the life time of the port of Period I at Dwarka. The structures at Bet Dwarka were built on terraces. The toe wall on the wave-cut bench of BDK I is 1.5 m below present MSL while the upper rubble wall (dated 3520 BP) is 1.5m above MSL. The wall in BDK VI opposite iron pillar is also about 1.5m below MSL of the protohistoric habitation deposit in mud flats of BDK VI, where the tidal range is 3.5 to 4m. The lowest working level is about 5m below MSL but only excavation in mud flats can give the true picture.

As regards Period II, structures are in situ at 5m below MSL and the ancient sea level in the 1st-2nd century A.D. must have been 5+1m=6m below present MSL

Transgressions and regressions in the Holocene can be postulated in the Gulf of Kutch resulting in the submergence of coastal Harappan sites in Saurashtra and Kutch. The regression in the beginning of the 2nd millennium BC must have brought back the population that had left after the first transgression. This is clearly reflected in the epic which says that Kusasthali was founded by a Yadava ancestor of Sri Krishna and that it was destroyed. After its destruction Dwaraka was built when the sea yielded 12 yojanas of land. The second transgression, which submerged Dwarka and Bet Dwarka of Mahabharata period (1500B.C).

TABLE I

Buoy No	T1	HI	T2	TIME	DEP TH	COR DEPTH	MSL
35	816	1.26	1343	2.78	1120	5.00	4.87
43	816	1.26	1343	2.78	1230	5.20	4.64
42	1030	0.91	1631	2.74	1110	4.50	5.58
45	1030	0.91	1631	2.74	1110	4.50	5.58
40	522	3.32	1201	0.75	1045	5.00	6.07
39	522	3.32	1201	0.75	1138	5.00	6.27
34	603	3.13	1256	0.67	930	5.50	4.64
45	654	2.94	14000	0.54	1055	5.00	5.55
46	1400	0.54	2124	3.12	1600	4.50	5.56
47	800	2.79	1501	0.36	1050	5.00	5.10
48	800	2.79	1501	0.36	1145	5.50	6.10
46	1501	0.36	2224	3.35	1505	4.50	6.18
49	911	2.72	1558	0.16	1005	4.00	3.43
51	1018	2.76	1650	-0.04	1415	6.00	5.61
50	1018	2.76	1650	-0.04	1415	5.00	6.13
41	639	1.33	1211	2.99	945	6.00	5.72
42	639	1.33	1211	2.99	945	6.00	5.72
36	1211	2.99	1826	-0.28	1220	5.00	4.05
53	1303	3.11	1913	-0.26	1430	7.00	6.37
55	405	3.79	1026	0.27	930	5.00	6.39
54	10266	0.27	1654	3.09	1035	5.00	6.77
56	1654	3.09	2333	0.89	1505	4.50	3.83
58	533	2.27	1222	0.31	930	4.00	4.62
57	1222	0.31	1939	3.04	1530	5.40	6.06
59	1331	0.40	2100	3.13	1450	6.00	7.44

seems to be of longer duration and greater intensity, as indicated by the absence of sites of 1000-300 B.C. on the coastal belt of Okha-Dwaraka. The sea receded once again and townships sprang up on the coast in the 3rd century B.C. The submerged Buddhist settlement in the

Elephanta island off Bombay is an indication of the rise in the sea level or subsidence of land. Similar transgression is noticeable at Kaveripatnam, Kalingapatnam and Nagapatnam on the east coast. A tentative sea level curve is suggested here (Fig. 37) with a proviso that for reaching definite conclusions about the rate of sea level rise more work is necessary. Some remains of an ancient settlement almost 10km seaward should be explored before postulating the rate or rise in sea level. The sea level curves suggested by Fairbridge and others for western hemisphere may not be applicable to the Indian coast. However archeological data and findings of oceanographers can be correlated if a joint programme of eustatic studies is undertaken. The cause of fluctuation over short periods is yet to be ascertained. Negi and Tiwari have made temperature analysis of long term temperature variations and sea level fluctuations during past 10,000 years. According to them Walsh spectra and maximum entropy spectral analysis of climate series reveal statistically significant periodicities around 3000, 2000, 1500, 1150 and 550 years. They correspond to periods in geomagnetic intensity variations observed in sedimentary cores and tree-ring records. Interestingly all these palaeoclimatic and geological periodicities match with well-known

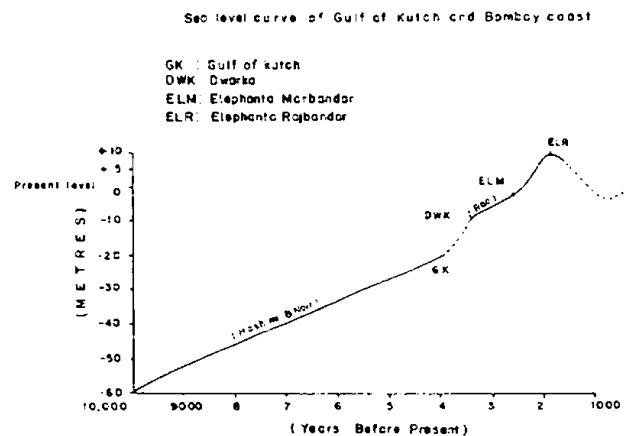


Fig. 37 Sea level curve of Gujarat - Bombay coast

harmonics of planetary cycles (548 and 1150 years). There are small changes which are analysed by them. These changes are related to cosmic radiations, sea level changes and astronomical cycles. The periodic planetary conjunction has an effect on sea level rise (Negi and Tiwari: in Press). Since astronomy had made good progress during the Mahabharata period it is highly probable that a planetary conjunction around 1500 BC and the disastrous effect of sea level rise could be predicted. In fact the *Mahabharata* says that Sri Krishna warned Arjuna of the impending calamity resulting in the submergence of Dwarka (Rao 1985b:39)

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- Abbreviation =EI= Epigraphia Indica