Marine Archaeological Explorations Off Dwarka, Northwest Coast of India

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Offshore excavation of Bet Dwarka (Shankhodhara) and Dwarka, which are said to have been submerged by the sea, has indicated remains of fortification walls and rock-cut slipways, meant for launching boats, submerged in the Gulf of Kutch near Bet Dwarka. A stone jetty and remains of a temple are found submerged seaward of the temple of Sea God near Dwarka. Two Bronze Age stone-anchors, an Indus type seal, an inscribed jar, a coppersmith's stone mould, iron and shell objects and post-Harappan pottery are among the datable finds from the excavation. On stratigraphic, ceramic and inscriptive evidence the submergence of Dwarka and Bet Dwarka seems to have taken place in the 14th century BC and the net rise in sea level since then is about 5 m.

A sunken ship or a submerged port acts as a chronological scale on the sea bed, and the nature and rate of subsequent accumulations can be ascertained with the help of datable archaeological finds such as coins, seals, inscriptions and pottery of distinct fabric and type found in the sediments. The transgression and regression of the sea due to climatic changes are more accurately determined by submerged or exposed archaeological finds in situ, for example, sea level fluctuations on Italian coast.1

The maritime history of India dates back to the Indus Valley Civilization and the earliest tidal dock of the world was built at Lothal during 2300 BC.2 Although India played a key role in the Indian Ocean trade very little is known about the adventures on the sea and the ships built. The objective of the present work is to reconstruct the history of maritime trade, ship-building and cultural migration in India and to furnish reliable archaeological evidence needed for dating the samples collected by oceanographers.

Information on shipwrecks in Indian waters (about 200) has been collected from different archives in India. Apart from the type of vessel, its ownership, cargo carried, the circumstances in which the ship had to be abandoned and the location of wreck, etc. are all recorded in archives.

A more important thrust area of marine archaeological investigation has been the survey of the submerged port city of Dwarka (NW coast, Gujarat State, Figs 1 and 2) of historical and Maharshtra fame, which is said to have been founded by Lord Sri Krishna on the ruins of an earlier settlement known as Kusathali after reclaiming from the sea. The onshore excavation in the forecourt of the temple of Dwarkadhish (13-15th century AD) at Dwarka during 1979-80 provided the much sought for archaeological evidence of a settlement of the second millennium BC. It was found that 3 temples built successively in the 1st century BC, 2nd and 9th century AD were destroyed by the sea. The foundation trench of the earliest temple was found cut into layer 10 of trench in Dwarkadhish complex which represented the protohistoric deposit. On ceramic evidence (Lustrous Red Ware) the earliest settlement could be dated to 15th century BC and the subsequent one to the 10th century BC. 14C dating of charcoal samples from layers in which the Lustrous Red Ware is found in Somnath (Prabhas) excavation, also suggests 1500-1200 BC. It is, therefore, of oceanographic interest to know whether the submergence of Dwarka is a fact and if so, the reasons thereof.

Study Area

The identification of the remains of a 15th century BC township destroyed by the sea in the Dwarkadhish temple complex overlooking the Arabian Sea, increased the possibility of finding the submerged remains of the city in the sea. The temple of the Sea God (Samudra Narayana or Varuna Devta) near the junction of the Gomti river with the sea marks the entrance to the ancient harbour of Dwarka (Fig. 2). It was therefore decided to explore seaward side of this temple. Before undertaking the expedition it was necessary to explore another potential site namely, the island of Bet Dwarka, also called Shankhodhara which, according to tradition, was the summer resort of Sri Krishna. Situated 2 km off Port Okha, the island answers to the description of Dwarka as Väridurga in ancient texts. It is this Dwarka which is referred to as Barak.
RAO: MARINE ARCHAEOLOGICAL EXPLORATIONS

Fig. 1—Shipwrecks and submerged ports along the Indian coast (Data from different archives)

Fig. 2—Dwarka showing the submerged port city area under investigation
Onshore exploration in 1982 brought to light a rubble wall in the cliff section of the southern shores (Fig. 3) and the protohistoric pottery found in the cliff section and intertidal zone suggested that remains of an ancient town might be found further seaward. Hence, diving operations were started in Bet Dwarka waters.

The sea floor in the Gulf of Kutch consists of numerous topographical irregularities like 10 m high pinnacles separated by flat-topped features. There are also a number of shoals, the more important ones being Ranwara and Lushington shoals. The depression at the mouth of the Gulf is a tidal or scour channel. An important feature of the southern shores of the Gulf is the presence of numerous islands at a depth of 20 m or less. The sediment here consists of silts and clays with patches of sand. Calcareous sandstone is found only between the mouth of the river and the centre of the Gulf.

The Gulf of Kutch (Fig. 4) is tide-dominated and the proportion of land-derived sediments in the Gulf is negligible as the region is arid with little runoff. The calcareous sandstones around 60 m depth seem to have originated in the intertidal zone and suggest shallow water conditions in the past; radiocarbon dates for these were 9000 to 11000 y Before Present. Taking the above data into account it is obvious that the interior of the Gulf of Kutch was almost a dry land or Rann 9000 y ago and the Bet Dwarka island must have been joined to the mainland towards Port Okha since massive rectangular building blocks were encountered here while dredging.

**Results**

**Bet Dwarka**

After fixing the base line along the cliff section in which structural remains of the early historic (1 to 7 century AD) and protohistoric (late 2nd millennium BC) periods were traceable 2 diving zones corresponding to 2 onshore sites BDK I and BDK II were marked by dropping marker buoys (Fig. 5).

Preliminary exploration in low tide near BDK I has yielded Red Ware bowl of Late Harappan period in the intertidal zone. At lowest low tide a massive wall of large building blocks of prismatic shape is found built on the wavecut bench. Two courses of the wall are in situ. The large building blocks are too massive to be moved by waves and currents and they are not derived from the disintegration of the local outcrops. Heaps of building blocks of large size, lying on the wavecut bench, clearly indicate that a large number of structures are destroyed and submerged by the sea. Smaller fraction building blocks of the same size and shape, as are used in the construction of the onshore wall, are found lying wave sorted. From the section of the wall, fragments of bowls and dishes of post-Harpa...
appan period (15-14th century BC) are also recovered. The wall on the wavecut bench which served as an anti-erosion wall is submerged under 3.6 m water depth. Originally the spring tide level must have been at least 1.5 m below the wall. The net rise of 5.1 m in sea level during the last 3300 y is suggested by the submerged in situ wall on the wavecut bench.

Underwater excavation was conducted by SCUBA diving at 5 to 6 m depth, 30-100 m seaward of the in situ wall. An airjet was pressed into service for loosening the sediment and collecting the antiquities.

The wavecut bench is full of shingle and pebbles with small pockets of sand and silt. Below the overburden of sand is a compact layer of clayey silt containing worked columnella and bangles of conch shell besides 2 chert blades, indicating Late Harappan occupation earlier than the wall on the wavecut bench. Among protohistoric antiquities found in the intertidal zone and the beach a coppersmith's stone mould (Fig. 6) and a few beads of fish bone and terracotta deserve mention. Similar stone moulds used for casting pins and chisels are found in Harappan sites.

Since probing beyond 500 m seaward off crenulated bays in BDK I and BDK II did not yield evidence of human settlement, subsequent underwater exploration was limited to locations 300 to 400 m seaward of BDK II. An airlift under low pressure was used for excavation within a caisson of 1 x 1 x 2 m to remove the overburden.

Probing with an iron rod revealed that layer 2 of P3 (Fig. 5) was hard and consisted of greyish clayey silt.

Fig. 6—Antiques from sea bed and intertidal zone (pottery, bead, chert blade, shell bangles and stone moulds (bottom right) for casting spearheads)
The antiquities recovered included conch bangles and rolled potsherds. A trial trench (UW 6) was sunk in seabed about 400 m seaward of a promontory between BDK I and BDK II in 3.5 m depth (Fig. 5) and the sediment from layer 2 yielded an Indus type rectangular seal of conch shell (18 x 20 mm) engraved in Bahrainian style with a three-headed animal representing a short-horned bull, a unicorn and a goat (Fig. 7). From a trench (TR 2) dug in the intertidal zone of BDK I a fragmentary vase of Kassite type and fabric was found in layer 2 at 0.75 m depth. Late Harappan and black-and-red wares were recovered in another trench (UW 4) 400 m seaward of BDK I. A very significant find from the intertidal zone is a part of a jar in sturdy red ware inscribed in post-Harappan script.

Three courses of a massive wall were exposed at low tide north of BDK VI in Balapur Bay (Fig. 4).

**Dwarka**

Between 21 and 26 Dec. 1984 offshore exploration within a range of 400 m seaward of the temple of Sea God, Samudra Narayana, which is a landmark in the ancient harbour of Dwarka was undertaken with a view to locating submerged port installations if any.

Two hundred metres southeast of Samudranarayan temple a submerged structure of large building blocks, measuring on an average 1 to 1.5 x 1 x 0.3 to 0.5 m, and laid in 2 or 3 courses was uncovered and photographed after removing the overburden of sand with the help of the airlift (Fig. 8). Further southeast of the structure some loose building blocks of prismatic shape were laid bare. Two arms of the structure running almost at right angle have also been traced.

Many divers were made between 28 Nov. and 14 Dec., 1985* to trace further seaward extension of the submerged structures in Dwarka waters. More than 100 building blocks varying in size from 2.6 x 1.3 x 0.4 to 0.65 x 0.05 to 0.15 m were exposed after removing the heavy overgrowth of vegetation and the sand deposit 1 to 1.5 m thick, with airjets and adopting the airlift technique.

Six dives were made in April, 1986* and structures extending up to 700 m seaward of Samudranarayan temple were traced. Drawings of 4 groups of structural remains have been prepared under water. The structure nearest to Samudranarayan temple is designated as inner structure and the farthest as the outermost. Of the two in between, one is the intermediate structure and the other is the outer structure.

Besides discovering and haulng several architectural members of a temple namely the moonstone (Chandrasila), beams and corner railing pillar, three perforated stone anchors weighing 100 to 150 kg were retrieved. Two 3 holed anchors (Fig. 9) were found near the submerged jetty 600 m seaward of Samudranarayan temple. The two square fluke holes at the base of the anchor were meant for fixing wooden stakes and in the third hole, which is round, a wooden post was fixed for tying the rope (Fig. 10). Similar 3 holed Bronze Age anchors are reported from Ugarit in Syria and Kition in Cyprus.

**Discussion**

The toe-wall built on the wavecut bench seaward of the protohistoric gravity wall in the cliff section of BDK I appears to have served the purpose of an anti-erosion wall and may indicate the seaward limit of the ancient town at its southern extremity. The northern limit of the town is marked by another anti-erosion wall of massive blocks, 3 to 4 courses of which become visible (Fig. 11) in lowest tide northeast of Balapur Bay (Fig. 4). Between these 2 extremities of the submerged town 4 km in length, there are 2 rock-cut slip-ways, 7 m in width, gently sloping seaward from the highwater line (Fig. 5). The floor of the slipways meant for launching boats is produced by artificial means by cutting the rock flanking the floor. Some weathering effect and denudation which are natural in the intertidal zone are visible. The age of the rock-cut slip-way is determined on ceramic evidence. The Kassite ware of 12-14th century BC is found in the sediment sealing the floor.
The *in situ* portions of the northern and southern antierosion walls submerged in 3.6 to 4 m water depth at high tide indicate that the ancient town was 500 to 600 m wide. The box-like construction of the wall seen in the cliff section at intervals suggests that it served as a defence against enemy attacks. It is thus obvious that the island town of Bet Dwarka (Shankhodhara) was well protected.

It appears that after the protohistoric town was almost totally submerged by sea, leaving a few patches of the landward wall, there was no occupation of the island for nearly 1000 y. Onshore excavation in BDK I brought to light early historic structures (1st century BC-5th century AD) abutting and disturbing what little remained of the protohistoric fortification wall in the cliff section.

Only 2 small fragments of partly charred wood were found in a trial trench dug in the intertidal zone of Balapur Bay (BDK VI; Fig. 4). Surface humus of 5 to 10 cm covering the specimens suggests that they are of recent origin.

In the absence of wood or charcoal sufficiently old for $^{14}$C dating the ceramic evidences further corroborated by other evidences such as the Indus type seal and the inscription on a votive jar are relied upon for dating. The mature Harappan pottery type that has survived in Bet Dwarka is the beaker (Fig. 12 types 1-2), while parts of the dish-on-stand (Fig. 12 types 3-5) belong to the late Harappan period. The post-Harappan occupation is clearly suggested by two Lustrous Red Ware bowls one small and the other large (Fig. 12 types 8 and 9). The small bowl from the intertidal zone has retained its lustrous red slip while the core of the large carinated bowl is affected by wave action. It has a pitted surface. Both the types of the Lustrous Red Ware found in Bet Dwarka occur in the middle levels of Period III of Prabhas designated as “Late Prabhas Culture”[12]. The bowls of Black-and-Red Ware of BDK I—II belong to the Late Prabhas Culture which was dated 1500-1200 B.C. Dhavalkar[12] observes that the Prabhas Culture which flourished for about 6 centuries vanished without leaving
Fig. 9—A 3 holed stone anchor from Dwarka waters  

Fig. 10—The holes in the anchor used for fixing wooden stakes and post  

Fig. 11—North wall of submerged town of Bet Dwarka exposed in lowest tide (building stone blocks are covered by oyster shells, etc.)  

any trace whatsoever around 1200 BC. However long before their sudden end, the people of Prabhas came in contact with the Lustrous Red Ware users of Rangpur. The Lustrous Red Ware of Dwarka and Bet Dwarka is of inferior fabric as in Machiala Mota. It is therefore reasonable to assign it to 1300-1400 BC.  

Another important evidence for dating is provided by the inscribed votive jar from the intertidal zone of Bet Dwarka (Fig. 12, type 10). Being an associate ware of the Lustrous Red Ware culture, it is assignable to 14th century BC. The 7 letters inscribed on the votive jar (Fig. 13) are definitely of the post-Harappan period comparable to the linear signs occurring on Daimabad and Lothal Period B pottery. The writing is from left to right as in Brahmi inscriptions of 3rd century BC and the last 4 signs are comparable to the Brahmi characters cha, ya, ja and pa or sa, except one (cha), all the 7 signs are in the post-Harappan script, and are identical with the Semitic script. If the phonetic value of the known (Semitic) script is given to the Bet Dwarka characters the legend reads ma-ha-hag(ka)-cha-sha-h-pa = mahakacha-shah-pah conveying the sense 'Sea Lord (mahakacha shah) protect (pah)'. Pathak has suggested the reading mahakachha-prayajasa. In either case the purpose of the offering to the Sea God was to seek his protection. It is relevant to note here that the temple of the Sea God (Varuna devata) is situated at Dwarka and the subterranean passage in the temple suggests that there was an earlier temple of Sea God here, and as the sea level rose, it was reconstructed at a higher level. In Bet Dwarka island the temple of Shankhanarayana was originally dedicated to the Sea God.  

Spectrophotometric analysis of 3 iron objects from BDK I-II shows the following element composition: major element - Fe, and minor elements - Si, Mn, Mg, Al, Ca and Ti. As regards their fabrication Agrawal observes that they were fabricated from impure wrought iron bloom.
Perhaps the iron mines presently situated 40 km from Dwarka were exploited in the protohistoric period. According to literary evidence iron tools and weapons were used for the first time in the Bharata War\(^{18}\), and iron technology must have been in a primitive stage, as reflected in the Bet Dwarka implements. The latest dates for iron and Black-and-Red Ware associated Megaliths of Kumaranahalli in Karnataka are 1320 BC. The assumed date of 900-1000 BC for the Bharata War based on Painted Grey Ware and iron at Atranjikhera in Uttar Pradesh can now be safely rejected. Since the earliest date of use of iron at Kumaranahalli goes back to 14th century BC, the first use of iron in the Bharata War could as well be dated 14th century BC. This date agrees well with the ceramic and inscriptive evidence of Bet Dwarka and Prabhas, the two well-known sites of Mahabharata fame.

The three holed trapezoid stone anchors of Dwarka weighing 100 to 150 kg are almost identical to the Late Bronze Age anchors of Ugarit and Kition. Frost\(^{19}\) has dated the Ugarit anchors to 13th century BC or a few centuries earlier. The Kition anchors are from a late 13th century BC site where they were reused as building stones and hence may be earlier in date.

The presence of very heavy three holed anchors of 14-13th century BC is an important evidence of a protohistoric jetty in Dwarka harbour. The building blocks of the jetty are very heavy with slits on the margins for wedges. Before the port towns of Bet Dwarka and Dwarka came into existence in the 15-14th centu-
ries BC, there appears to have been an earlier settlement at least in the island of Bet Dwarka, which is attested by the late Harappan seal of conch shell and the parallel-side blades of chert, and a few sherds of beaker and perforated jar. They are undoubtedly survivals of mature Harappa Culture in the late Harappan context. The seal from a trench in Bet Dwarka waters depicts a three-headed animal with exaggerated eyes and body drawn in outline suggesting influence of Bahrainian art. It may be recalled that a Bahrain type seal occurs at Lothal and Indus type seals occur in Bahrain. The late Harappan settlement in Bet Dwarka preceded the 15-14th century BC settlement. The former perhaps represents Kusasthali on the ruins of which, according to Bhagavata, Dwarka was built.

The second urbanisation in India can now be said to have begun with Dwarka which was a large fortified town. The low stand of the sea level in the first half of the second millennium BC (Fig. 11) implies that the island of Bet Dwarka and the mainland Dwarka were connected by land. The Gulf is very shallow between Shankholia Point and Kui (Fig. 4). The sheltered harbour in Bet Dwarka lay on the southern and eastern flanks of the island. So far as mainland Dwarka is concerned the mouth of the Gomati river extended at least 1 km seaward and ships must have been anchored near the jetty which is now submerged.

The net rise in sea level in the Gulf of Kutch around Bet Dwarka since 1400 BC can be said to be 5.1 m, on the basis of the in situ wall in BDK I which is submerged in 3.6 m water depth at high tide. Off Dwarka the sea floor slopes gradually from 1 to 3 m over a distance of 700 m from Samudranarayana temple. The net rise can be found out after the ancient working level of the jetty is traced over considerable length. On the basis of structural remains noticed so far a rise of 5 to 6 m in sea level during the last 3300 y is postulated for the Dwarka zone.

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