

GRAPNEL STONE ANCHORS FROM SAURASHTRA: REMNANTS OF INDO-ARAB TRADE ON THE INDIAN COAST

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Gujarat is a pioneer province in maritime trade and commerce in India. Recent excavations in the Kachchh area of Gujarat suggest that as early as the beginning of the third millennium BC a group of people migrated from Sind to Kachchh in search of a suitable coastline and source of raw materials for trade and commerce.¹ During the Harappan period, Gujarat had very active overseas trade contact with Mesopotamia and other Gulf countries.² The early historic period witnessed a brisk overseas trade with the Mediterranean world as well as with the Southeast Asian countries. Before the arrival of the Portuguese into Indian waters the Arabs had been the dominant power in the Indian Ocean, undertaking and controlling maritime trade since the second century AD. Initially, they ventured into the Mediterranean Sea and were involved in several raids.³ For a long time they were the supreme maritime power in the Red Sea and occupied the East African as well as Indian coasts. They reached as far east as China, and several stories of Arabian nights were narrated on the voyage from Arabia to China. At several places on the Indian coast, pirates were very active during this period. It is said that one had to be careful during the voyage to Kachchh and Kathiawar. Hourani has mentioned that Arab navigation in the Indian Ocean underwent a slow decline after the arrival of Vasco da Gama in the Indian Ocean.⁴

Underwater archaeological explorations by the Marine Archaeology Centre of the National Institute of Oceanography, Goa, have brought to light a large number of stone anchors of different types and sizes, especially from Dwarka, Bet Dwarka,⁵ and Somnath⁶ in Gujarat, and Sindhudurg⁷ and Vijaydurg⁸ in Maharashtra. A few more stone anchors have been reported from the Tamil Nadu coast⁹ and Lakshadweep.¹⁰ This evidence indicates that India was once a focal point for maritime activity.

This paper describes the grapnel or Indo-Arab anchors that were documented during marine archaeological explorations off Dwarka, Bet Dwarka, Aramda and Somnath from 1991 to 2001. The paper also discusses the origin and dating of these anchors.

A BRIEF HISTORY OF ARABS ON THE INDIAN COAST

In the seventh century AD Arabs gained control of shipping in the Persian Gulf. In the mid-seventh century they fought a war against Broach and Thana, possibly because they wanted to control their trade. At the beginning of the eighth century

Arab traders began to come to India by sea in great numbers, principally as traders, with no serious notions of conquest. As Strabo observes, 'The Arabs are not very warlike even on land but rather traders and merchants and not at all warlike on the sea'.¹¹ By the ninth century the Arabs has become so powerful that they were able to fully control shipping from the Red Sea to southern China, although they were always threatened by pirates around Dwarka, Chaul, Dhabhol and the Malabar coast. Muhammad bin Qasim made a peace accord with the people of Saurashtra, who were fighting the sea pirates in the Bet Dwarka.¹² By the end of the twelfth century the Arabs controlled the east coast of India, especially after the decline of Cholas on the Coromanadal coast.

LOCATION OF THE ANCHOR SITES

The study area is the west coast of India at three sites, namely Dwarka, Bet Dwarka and Aramda, located in the Okhamandal taluka of Jamnagar district, and one site at Somnath in the Junagarh district of Gujarat (Fig. 1). A brief description of each site is given below.

Dwarka

Dwarka is situated in the Okhamandal taluka of Jamnagar district of Gujarat, and its western boundary is marked by the Arabian Sea. The Dwarka coast is represented by silvery beach on the south side and high cliffs on the north side. Dwarka is one of the most important religious centres for Hindus and is one of the four *Dhamas* on the extreme west coast of India. Since 1983 we have been carrying out underwater explorations off Dwarka, and a large number of structural remains have been recorded, including massive walls, bastions and stone pillars¹³ and various types of stone anchor¹⁴ from onshore and offshore areas.

Bet Dwarka

Bet Dwarka Island is situated in the Gulf of Kachchh about 5km north of the mainland of Okhamandal and east of Okha port. Bet Dwarka is also known as Bet Shankhodhar. The eastern part of the island comprises sand-hills and bushes and is known as Hanuman Point. Its southwestern half is a rocky tableland of about 15–18m (50–60ft). Previous excavations near Nilakantha Mahadev Temple, behind Dhingeshwara Mahadev Temple, identified an early historic settlement. Onshore exploration in 1979¹⁵ has produced a number of potsherds belonging to the Protohistoric period (2000 BC) from cliff sections near Siddi Baba Pir at the southeast tip of the island. Marine archaeological surveys have revealed a large quantity of pottery and other antiquities¹⁶ of the late Harappan period (2000–1500 BC).

Aramda

The village of Aramda is situated 7km south of Okha port on a high tableland. The village was an important centre of maritime activity during the medieval period. A late medieval fort is present in the middle of the village and a few hero stones bearing boat motifs are also present on the western side of the village. The earliest of these dates to AD 1800. The village also has a jetty which at present is extensively used for the repair of ships.

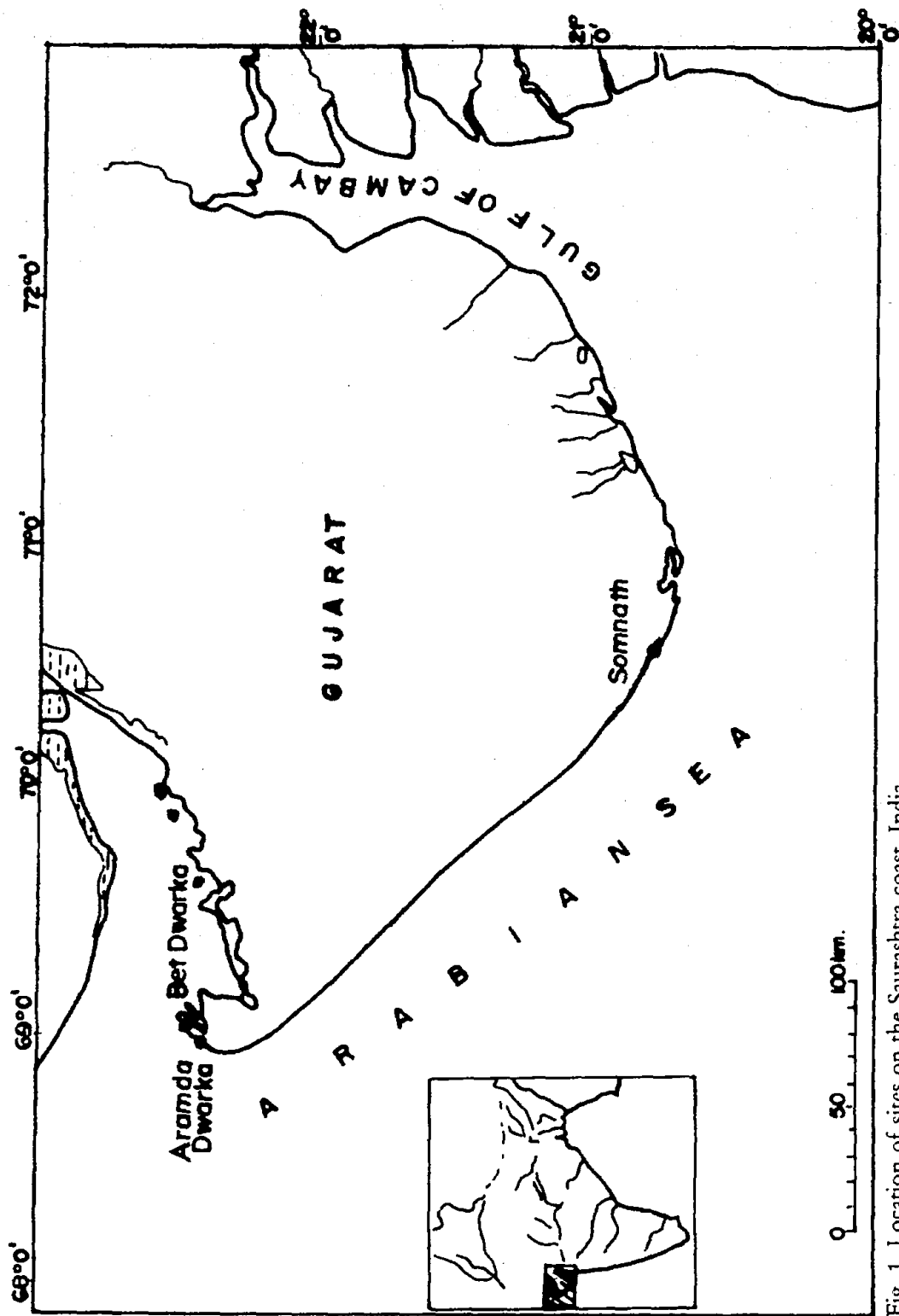


Fig. 1. Location of sites on the Saurashtra coast, India.

Somnath

Somnath is situated 5km east of the famous port town Veraval in the Junagarh district. The land excavations yielded evidence of a township of 2000 BC.¹⁷ Prabhasa-Somnath is situated on the southwest coast of Saurashtra at the mouth of the River Hiranya or Hiran. The Somnath-Prabhasa has an almost straight coastline which reveals a vivid manifestation of marine aeolian and fluvial processes that have resulted in a number of important geomorphic land forms, such as the near shore zone characterized by the formation of recent alluvium deposits, sand bars, mud flats and mangrove swamps. The coastal zone is covered with beach and littoral sands, oyster beds and sand dunes.¹⁸

METHODOLOGY

Onshore exploration was carried out at Dwarka, Bet Dwarka, Aramda and Somnath to locate archaeological objects such as anchors, cannons and jetties. Offshore explorations were undertaken during the fair weather season using SCUBA and SDDE diving methods. A circular search pattern was used by the diver-archaeologists for underwater observation, and each diving team covered a 50m radius area. A buoy was tied to each location wherever archaeological objects such as structures and anchors were noted, and each object was interconnected by rope for *in situ* plotting of the anchors. Underwater finds were documented by underwater TV camera, still camera and drawings.

RESULTS

A large number of grapnel-type anchors have been recovered from onshore, intertidal and offshore zones from Dwarka, Bet Dwarka, Aramda and Somnath. The largest number of anchors has been reported from Dwarka, totalling 63, followed by Bet Dwarka (17), Somnath (1) and Aramda (1). Anchors have been divided into three groups on the basis of material and shape. Group 1 comprises various sizes and the primary raw material is basalt. The anchors of Group 2 are made of fine limestone and are very similar in shape to Group 1. The raw material in Group 3 is also limestone but often porous and the upper hole is absent. The upper section of the anchor is circular. A brief description of the anchors from each site is given below.

Dwarka

Underwater explorations were carried out over a large area of Dwarka waters, where 63 grapnel stone anchors have been reported (Figs 2-4, Table 1). Most of the anchors are made of locally available limestone and a few of basalt rock. On the basis of material and state of preservation, the anchors were divided into the following three groups.

Group 1

Six anchors fall into this group (nos. 10, 19, 20, 30, 58 and 60) and are made of basalt rock. The anchors are of medium size and heavy in weight compared with those in the other groups. The maximum length of an anchor is 142cm (Fig. 5a), weighing 175kg, and the smallest is 90cm long (lying underwater) with an estimated weight of

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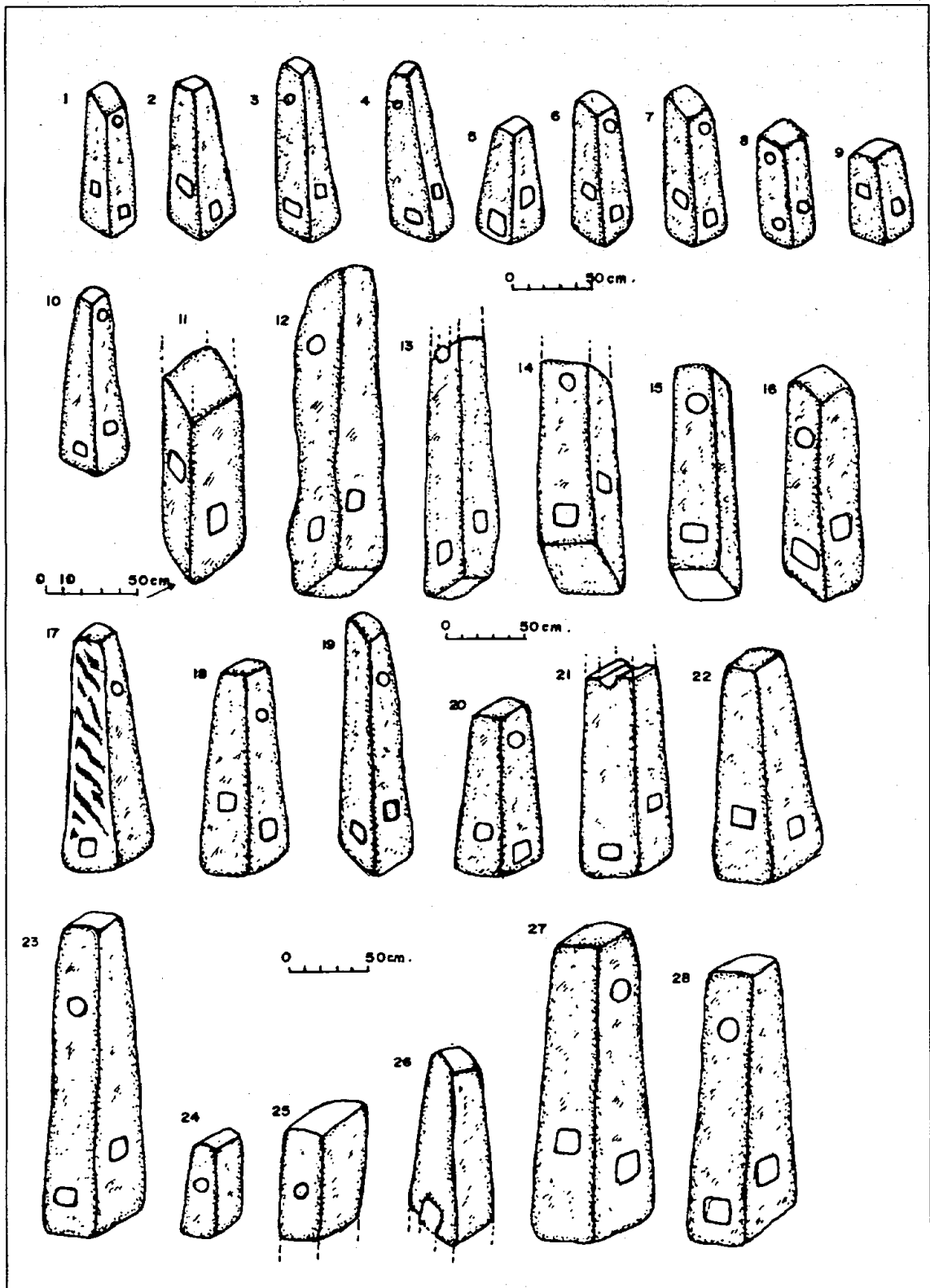


Fig. 2. Stone anchors from Dwarka.

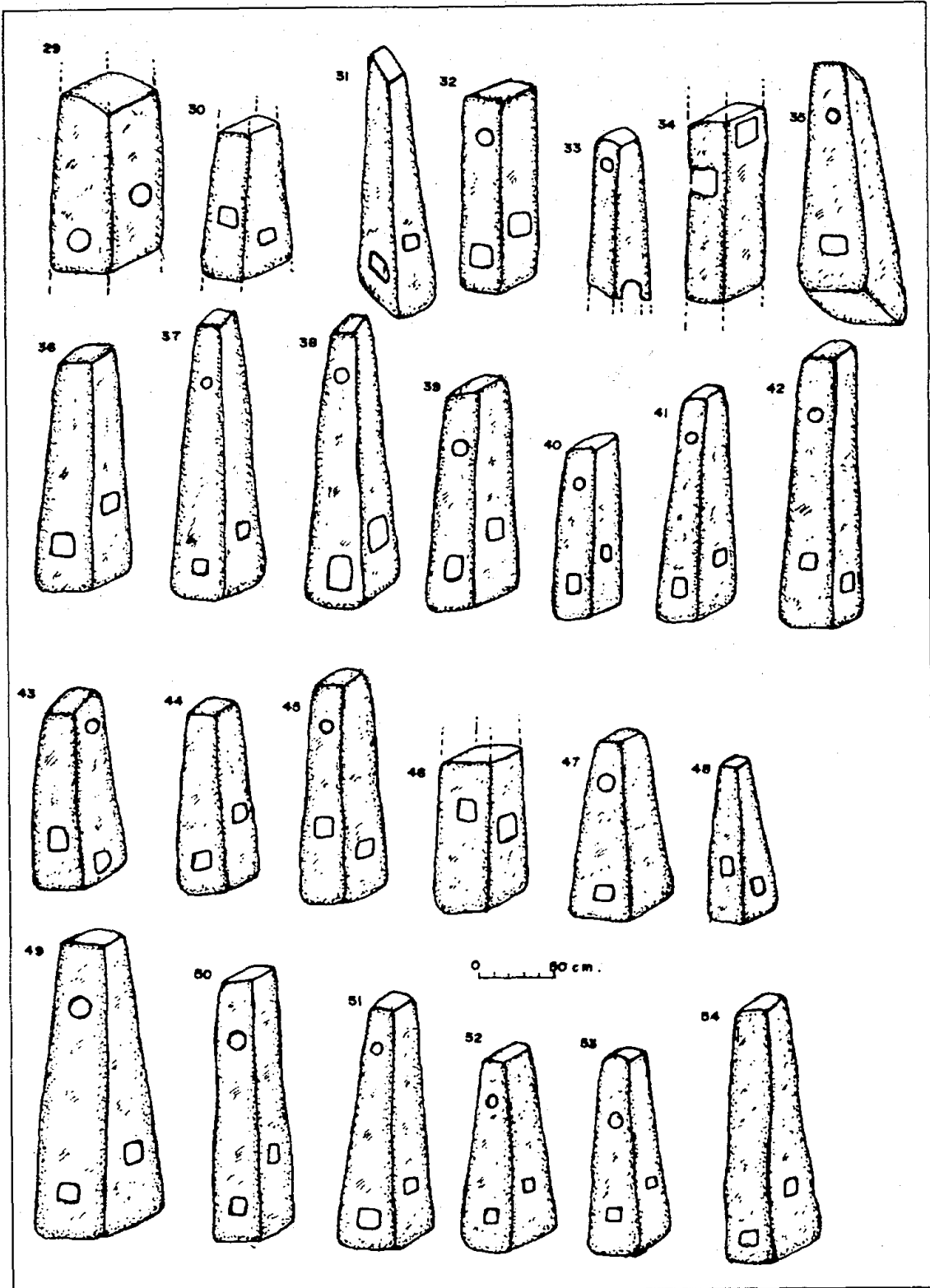


Fig. 3. Stone anchors from Dwarka.

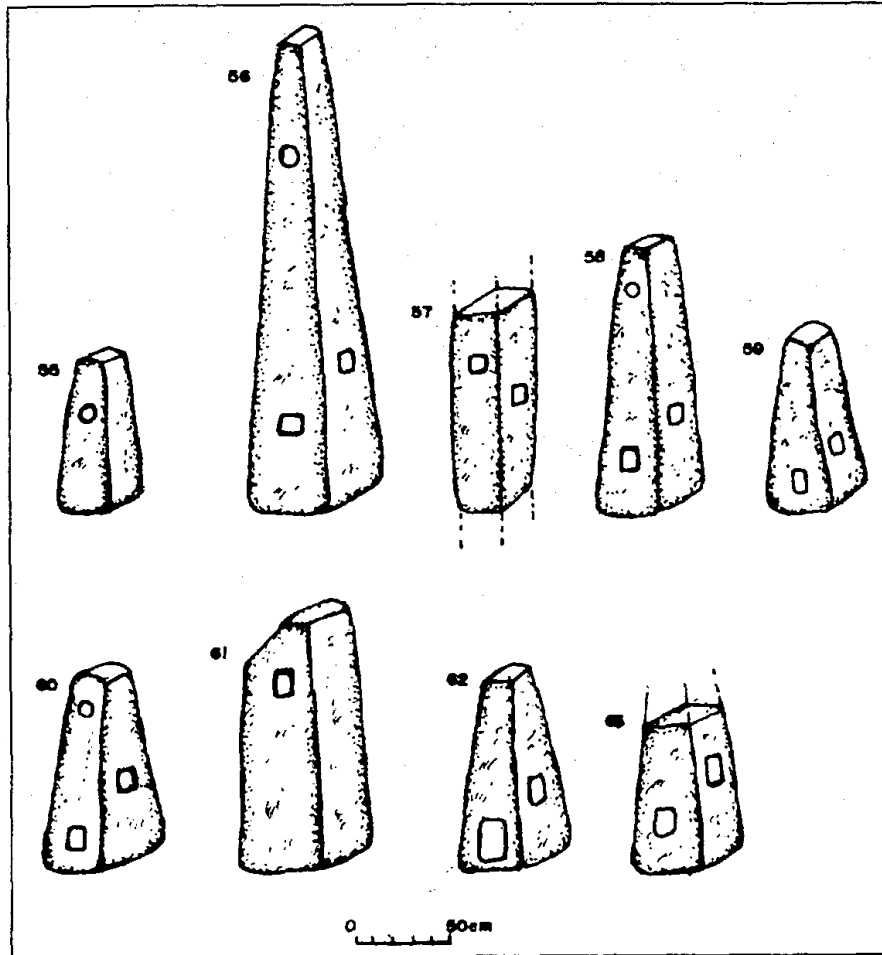


Fig. 4. Stone anchors from Dwarka.

TABLE 1: Indo-Arab anchors from Dwarka (dimensions in centimetres)

SL no.	Year & location	Raw material	Length	Width	Thick-ness	Dia. of upper hole	Lower holes	Est. weight in kg
1	Before 1997	Sandstone	114	22	22	7	8x11, 8x8	125*
2	-do-	Limestone	118	33	28	-	13x16, 14x14	169
3	-do-	Sandstone	136	28	28	8	10x11, 10x11	150*
4	-do-	Limestone	135	40	17	7	12x10, 11x11	129
5	-do-	-do-	87	24	30	-	20x15, 9x13	68
6	-do-	-do-	112	27	23	12	11x12, 9x13	103*
7	-do-	-do-	117	25	20	9	8x8, 8x8	157
8	-do-	-do-	88	27	25	7	9	96*
9	-do-	-do-	70	28	29	-	11x11, 10x10	75*
10	-do-	-do-	150	30	30	8	9x10, 9x10	225
11	1998 IZ	-do-	85	36	24	-	12x14, 12x14	165
12	1998 IZ	-do-	230	40	28	15	13x13, 15x14	586
13	1998 IZ	-do-	176	38	21	8	12x12, 12x12	268
14	1998 UW	-do-	110	30	30	10	15x11, 15x10	147
15	1998 UW	-do-	116	27	18	11	15x15	104

SL no.	Year & location	Raw material	Length	Width	Thick-ness	Dia. of upper hole	Lower holes	Est. weight in kg
16	1998 UW	-do-	108	25	20	14	14x14, 14x14	91
17	1999 B-8 UW	-do-	145	30	30	8	12x12, 12x12	216
18	1999 B-11 UW	-do-	128	28	-	5	12x12, 12x12	181
19	1999 B-10 UW	Basalt	142	28	27	5	11x11, 11x11	232
20	1999 B-12 UW	-do-	105	27	28	10	10x10, 10x11	199
21	1999 B-14 UW	Limestone	125	34	25	10	10x11, 10x11	206
22	1999 B-14 UW	-do-	130	35	35	-	14x14, 12x12	209
23	1999 B-14 UW	Limestone	188	38	30	10	10x10, 10x12	326
24	1999 B-14 UW	-do-	55	17	20	6	-	41
25	1999 B-16 UW	-do-	65	30	30	7	-	113
26	1999 B-16 UW	-do-	100	30	20	-	16x16	118
27	1999 B-18 UW	-do-	185	40	40	15	17x17, 17x17	443
28	1999 B-18 UW	-do-	170	35	35	5	10x15, 17x17	328
29	1999 B-18 UW	-do-	110	38	35	-	12x12, 15x16	310
30	1999 B-12 UW	Basalt	90	25	30	-	12x12, 12x12	126
31	1999 B-21 UW	Limestone	155	31	31	-	12x12, 12x12	203
32	2000 B-13 UW	-do-	130	25	28	10	14x15, 14x15	176
33	2000 B-13 UW	-do-	104	22	-	9	15x15	118
34	2000 B-17 UW	-do-	120	30	17	-	15x15	164
35	2000 B-17 UW	-do-	155	36	45	6	12x12, 15x13	263
36	2000 B-15 UW	-do-	147	38	25	-	16x16, 15x15	202
37	2000 B-14 UW	Sandstone	180	33	30	5	8x10, 8x8	264
38	2000 B-19 UW	Limestone	175	35	30	10	16x20, 17x20	188
39	2000 B-20 UW	-do-	140	33	30	10	12x12, 12x14	210
40	2000 B-21 UW	-do-	100	25	20	6	8x8, 8x8	100
41	2000 B-18 UW	Sandstone	145	28	25	6	8x8, 8x8	198
42	2000 B-12 UW	Limestone	177	35	25	10	10x10, 10x12	299
43	2000 B-9 UW	-do-	105	35	30	11	12x13, 12x13	184
44	2000 B-10 UW	-do-	108	28	23	-	10x12, 10x12	122
45	2000 B-8 UW	-do-	135	30	28	7	12x13, 10x10	192
46	2000 B-24 UW	-do-	95	38	-	-	14x12, 14x16	182
47	2001 B-21 UW	-do-	110	35	28	10	12x12, 12x12	180
48	2001 B-17 UW	-do-	120	24	19	8	14x12, 12x12	82
49	2001 B-12 UW	-do-	191	44	41	13	13x13, 15x15	562
50	2001 B-31 UW	-do-	170	30	23	11	8x11, 11x12	216
51	2001 B-38 UW	-do-	155	34	27	6	10x11, 7x7	219
52	2001 B-18 UW	-do-	130	35	28	10	9x11, 9x11	229
53	2001 B-45 UW	-do-	132	30	28	10	10x10, 10x10	197
54	2001 B-42 UW	-do-	167	32	31	-	14x11, 10x11	258
55	2001 B-41 UW	Limestone	108	26	23	6	-	371
56	2001 B-40 UW	-do-	237	40	34	14	12x12, 12x12	97
57	2001 B-12 UW	-do-	100	20	18	-	10x9, 10x11	103
58	2001 B-19 UW	Basalt	135	30	30	5	12x10, 11x9	184
59	2001 B-22 UW	Limestone	85	25	20	-	11x8, 8x11	65
60	2001 B-25 UW	Basalt	96	35	30	7	10x10, 10x10	128
61	2001 B-47 UW	Limestone	125	42	28	-	11x11	283
62	2001 B-33 UW	-do-	100	30	29	-	17x20, 13x12	111
63	2001 B-7A UW	-do-	76	32	28	-	13x12, 14x10	110

*Actually valued.

Value of basalt per m³ = 2,900kg.

Value of sandstone per m³ = 2,300kg.

Value of limestone per m³ = 2,500kg.



Fig. 5a. Stone anchor of basalt in Dwarka waters.

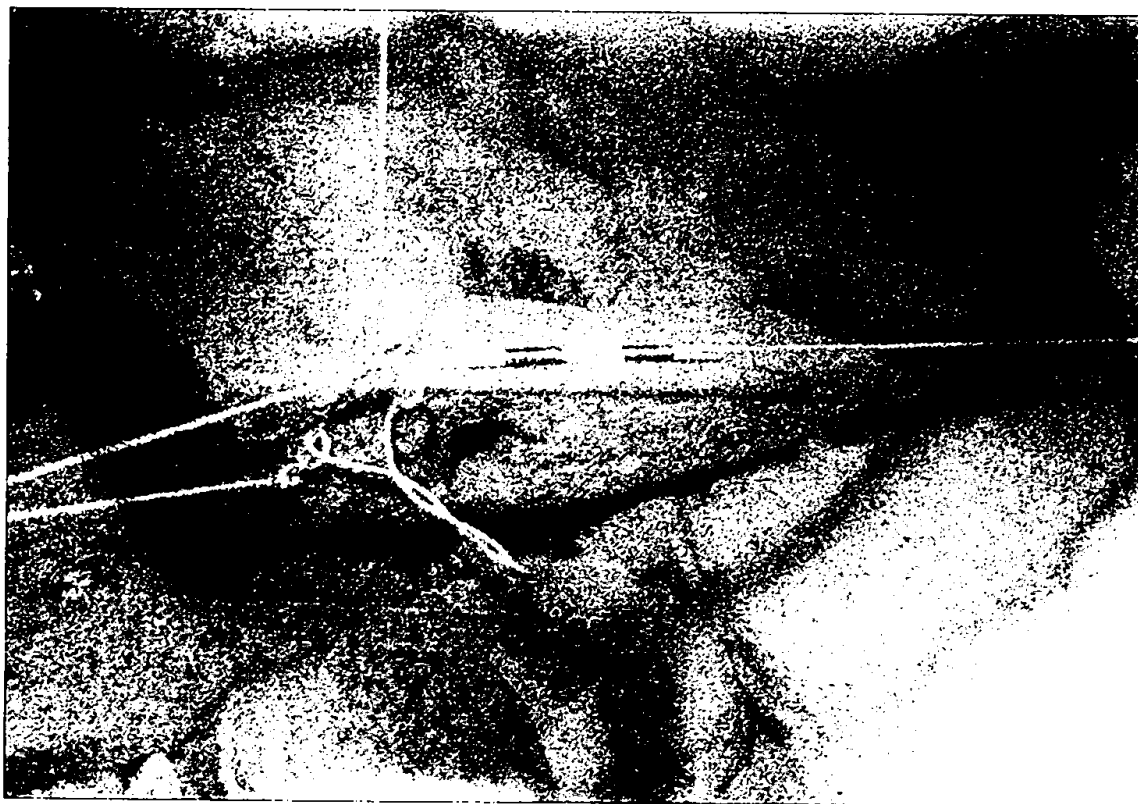


Fig. 5b. Stone anchor of limestone in Dwarka waters.

125kg. Most of the anchors have been chiselled from an elongated prismatic shape of basaltic block. The anchors of this category have a smooth surface and blunt edges except for no. 10 which has a rough surface grid and the upper portion is irregular. Often the anchors have a thick, broad lower side and taper on the upper side. Anchor no. 60 is made out of a circular elongated basalt block, therefore both ends of the anchor are circular. All anchors have an upper circular hole while the lower two holes are square or rectangular. A few anchors have chisel marks in the hole as well as on the surface.

Group 2

A large number (46) of stone anchors belong to this group. The basic material is locally available limestone and other sedimentary rocks (Fig. 5b). The shape of the anchors is the same as those of Group 1 but sizes vary in length from 88cm to 237cm. Nine anchors (12, 13, 23, 27, 37, 38, 42, 49 and 56) are longer than 175cm. Most of them have a smooth surface and sharp edges. A large number of anchors have been eroded. Some of the anchors also indicate extensive use as their holes have been widened. They often have an upper circular hole and two square/rectangular lower holes. Most of the anchors are lying exposed on the sea bed, however a few lie partially buried in sand and a few are trapped between rock boulders. The exposed portions of the anchors are covered with marine growth. A few anchors are also present in shallow waters of less than 5m.

Group 3

Anchor nos 2, 5, 22, 26, 31, 34, 36, 44 and 54 are included in this group. The basic material is porous limestone. The upper end section is often circular and lacks an upper hole. The two lower holes are usually rectangular/square. They have a smooth surface and blunt edges. It is suggested that these kinds of stone might have been used as bollards. Most of the anchors lie exposed on the sea bed with marine growth on the exposed portion. The maximum length of anchor in this group is 167cm (no. 54) and the smallest anchor is 87cm (no. 5).

Bet Dwarka

In the course of the marine archaeological investigations, a total of 17 grapnel anchors (Fig. 6, Table 2) was noted. Two anchors were lying in the intertidal zone while the remaining 15 were found in a water depth of 5–8m. The anchors from the intertidal zone (nos 64 and 65) are made of conglomerate and sandstone respectively. Fifteen anchors fall into Group 2 and the other two into Group 3. Anchor no. 65 is one of the heaviest anchors reported from Bet Dwarka. A few boats were anchored here with a rope through the anchor hole. The remaining anchors reported from offshore are made of locally available limestone (Fig. 7). Most of them lie exposed on the sea bed and are covered in seaweed. The biggest anchor (no. 71) measures 190cm in length and has an estimated weight of 283kg, while the smallest (no. 80) is 65cm and weighs 37kg. Like the Dwarka anchors, a few have no upper circular hole (nos 70 and 76) and two others (nos 64 and 75) have lost their upper hole. Nos 69, 75, 77 and 79 have lost their lower portion. These anchors are very similar in shape and size to those found at Dwarka.

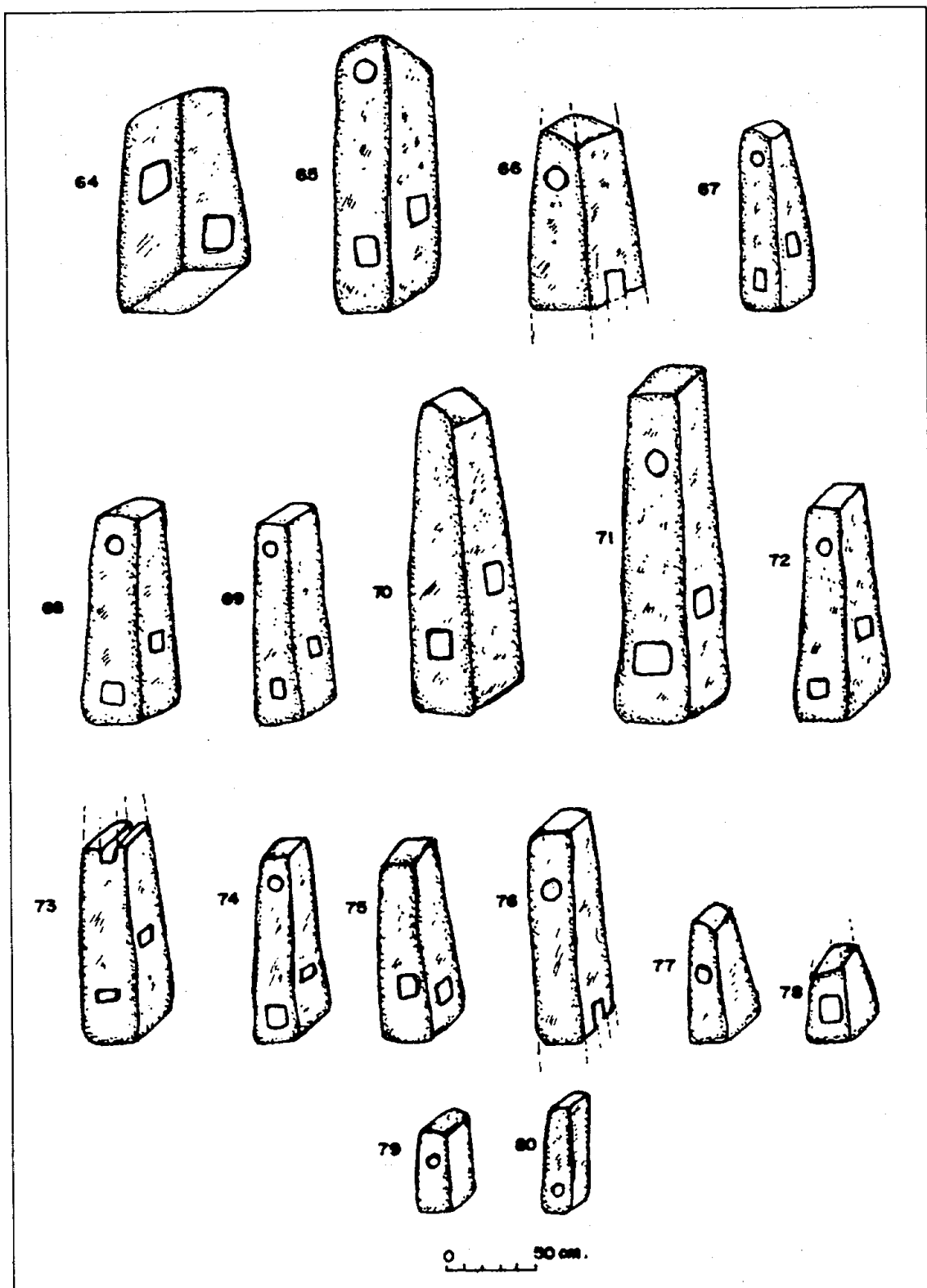


Fig. 6. Stone anchors from Bet Dwarka.

TABLE 2: Indo-Arab anchors from Bet Dwarka (dimensions in centimetres)

SL no.	Year & location	Material	Max. length	Max. width	Thick-ness	Dia. of upper hole	Lower holes	Est. weight in kg
64	1998 IZ	Conglomerate	80	32	-	-	15x16, 14x16	121
65	1998 IZ	Sandstone	146	36	-	14	18x18, 18x20	289
66	2001 UW	Limestone	100	25	-	8	13x14, 8x10	72
67	2001 UW	-do-	90	18	-	6	10x10, 10x10	48
68	2001 UW	-do-	95	20	-	6	12x12, 10x10	76
69	2001 UW	-do-	75	20	-	10	10x10	71
70	2001 UW	-do-	150	30	-	-	11x14, 11x15	205
71	2002 UW	-do-	190	45	25	15	20x20, 18x20	283
72	2002 UW	-do-	130	30	28	7	12x12, 12x12	167
73	2002 UW	-do-	115	30	25	7	10x12, 10x10	143
74	2002 UW	-do-	108	25	22	7	11x13, 8x8	93
75	2002 UW	-do-	40	24	20	-	12x12	30
76	2002 UW	-do-	95	30	22	-	12x12, 12x12	110
77	2002 UW	-do-	110	25	25	12	12x12	156
78	2002 UW	-do-	65	20	27	6	-	67
79	2002 UW	-do-	50	20	22	6	-	51
80	2002 UW	-do-	65	24	10	4	-	37

Value of sandstone per m³ = 2,300kg.

Value of limestone per m³ = 2,500kg.

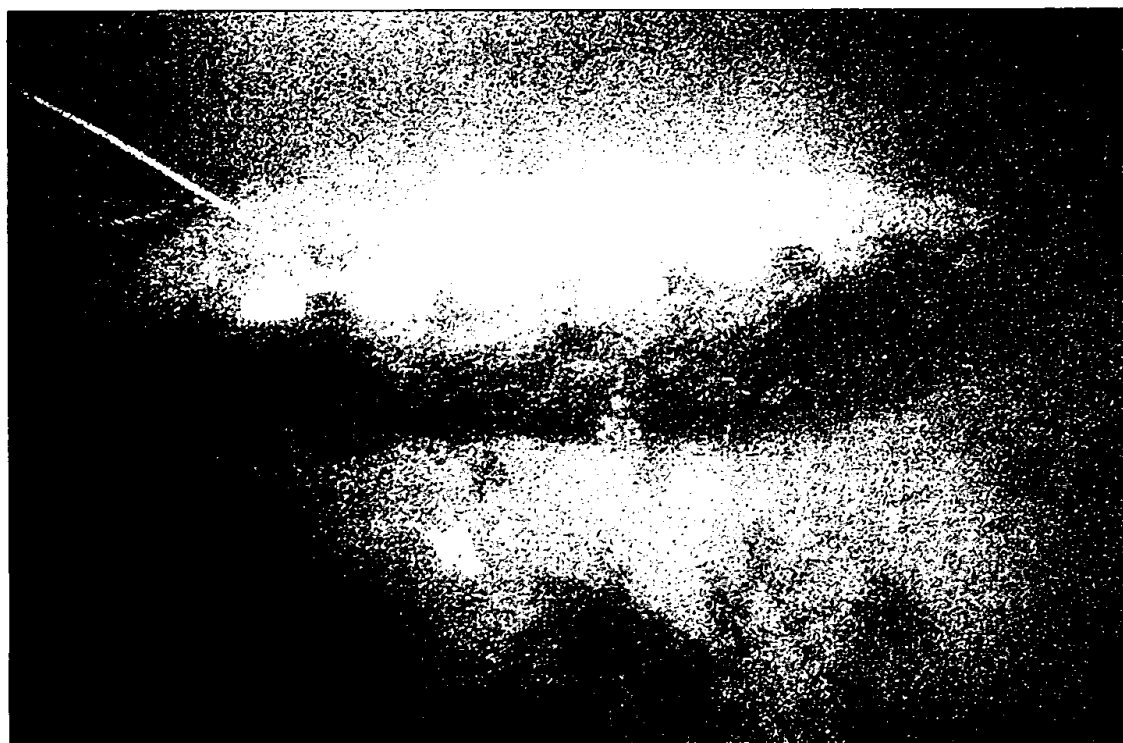


Fig. 7. Stone anchor in Bet Dwarka waters.

Aramda

Only one broken grapnel anchor (no. 81) made of sandstone was found near the Aramda jetty (Table 3, Fig. 8). A single lower rectangular hole is preserved.

TABLE 3: Indo-Arab anchors from Aramda (dimensions in centimetres)

SL no.	Year & location	Material	Max. length	Max. width	Thick-ness	Dia. of upper hole	Lower holes	Est. weight in kg
81	1998 IZ	Limestone	37	27	36	-	11x14	56

Value of limestone per m³ = 2,500kg.

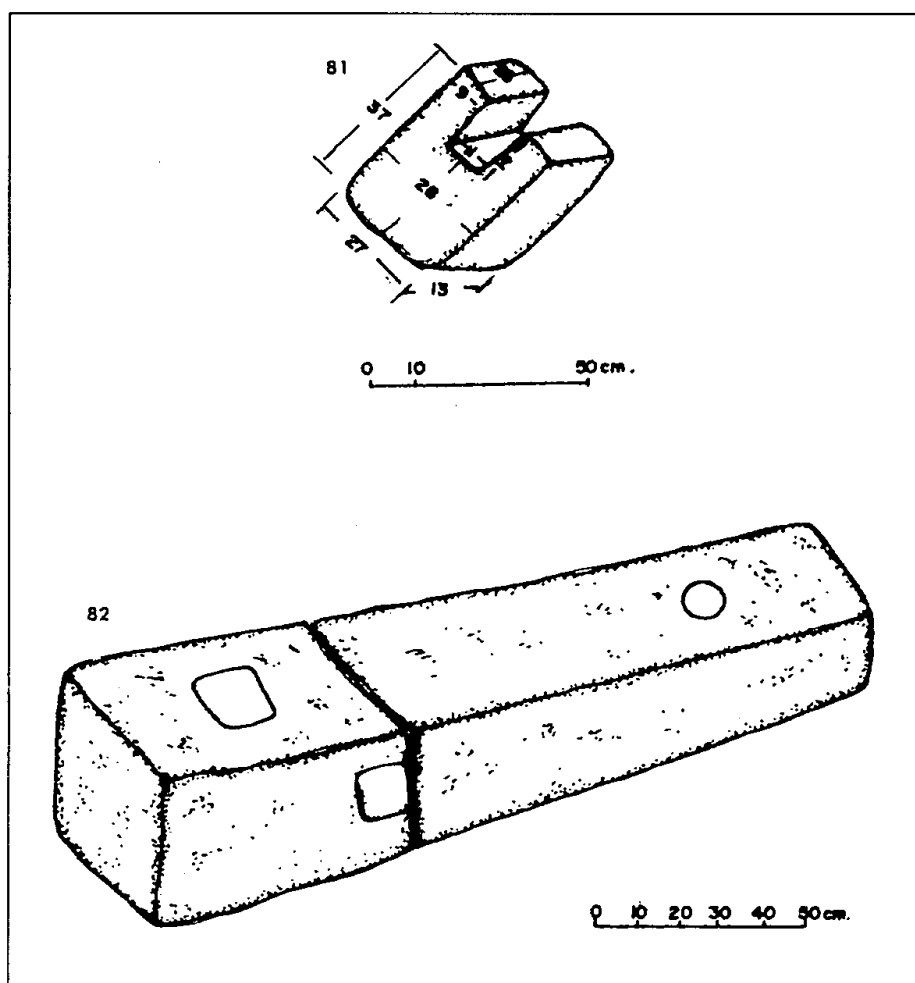


Fig. 8. Stone anchors from Aramda and Somnath.

Somnath

A grapnel anchor, noted during marine archaeological investigations in a water depth of 10–15m, is described briefly below (Table 4, Fig. 8).

TABLE 4: Indo-Arab anchors from Somnath (dimensions in centimetres)

Sl. no.	Year & location	Material	Max. length	Max. width	Thick-ness	Dia. of upper hole	Lower holes	Est. weight in kg
82	1992 Buoy 1	Limestone	180	35	32	9	12x14, 10x12	370

Value of limestone per m³ = 2,500kg.

Grapnel anchor no. 82, made of limestone, is broken in two and lies in a channel. The lower broken portion has two rectangular holes and the upper portion has a circular hole. It has a smooth surface and blunt edges. This anchor belongs to Group 2.

DISCUSSION

The introduction of larger boats for long voyages across the sea necessitated the invention of a new type of stone anchor (different from the traditional composite type), which could hold the boat firmly in the water. Generally, grapnel anchors are long, heavy and made of fine raw materials compared with the composite anchors of the Mediterranean Sea. Grapnel anchors are confined to the trade routes and ports visited by Arab traders around the Indian Ocean; therefore the credit for introducing grapnel stone anchors goes to the courageous Arab traders. The anchors have been modelled in such a way that their grip in a sandy and rocky sea bed is excellent, and they lift out well from a small passage. Grapnel anchors are often very strong and not easily broken when being lifted or thrown into the sea. Another advantage of this anchor is that it occupies little space on board compared with other types. On several occasions grapnel anchors were reused as mooring stones. Perhaps all these qualities led to the extensive use of this kind of anchor along the Indian Ocean. This is evident from the discovery of a large number of grapnel anchors from Dwarka waters, Vijayadurg and the Sindhudurg area of the Indian coast.

Mooring or anchor stone?

Honor Frost¹⁹ terms these anchors 'Arabic' and 'grapnel type'. However Kapitan²⁰ has recently argued that 'anchor shanks with a rectangular cross-section cannot belong to grapnels. The shaft of four-armed grapnels are square or round'. His arguments may be valid when we compare the anchor shanks with the modern iron grapnel type, but they are not conclusive. Furthermore, Kapitan suggests 'the use of these anchors as stone shanks ... not so much applied as ship's anchors to be cast from on board, but serving as mooring anchors'. However, recent discoveries from Dwarka and Bet Dwarka do not confirm his hypothesis, as out of a total of 80 anchors only two have a length of more than 2m and a maximum estimated weight of less than 600kg, while a majority of anchors are 1-1.5m long and have an estimated weight of 100-250kg, which can be lifted easily by three or four crewmen. From Dwarka only two anchors would serve as mooring stones and the others (individually) would not hold large boats such as Arab dhows. A few anchors from Group 3 might have served as mooring stones on jetties as they have no upper circular hole and their upper section is circular, which indicates that boats would have been tied up with them but

they would certainly not serve for mooring on the sea bed due to their weight. Kapitan²¹ also argues that around the Indian Ocean there are no safe harbours and they need an anchoring point; also, the idea that these anchors served as mooring anchors is not on a firm footing because a number of places where these anchors are reported do have a safe harbour, such as Bet Dwarka and Vijaydurg on the west coast of India. However, there are instances where these anchors have been reused as mooring stones on jetty and dockyard at Vijaydurg and Sidhudurg. One may be surprised to note that these anchors were also used as lintel stones in Vijaydurg fort, though that was not the original function of the anchors.

Origin

Grapnel anchors have been found associated with Arab trade on the East African coast, and in Gulf countries. The various literature related to Arab navigation²² indicates that these anchors were fundamentally modelled by Arab traders, however later became popular along the Indian coast. The description also suggests that a single boat used to have several anchors on board. Each boat would have a main anchor, which would be the heaviest of all the anchors.²³ This evidence has also been noted at Dwarka where at least seven grapnel anchors of more than 1.75m in length were recorded (nos 12, 13, 23, 37, 38, 49 and 56) at different locations. At one place it is mentioned that the captain asked the crew to throw six anchors into the water.²⁴ Moreland²⁵ mentioned that 'the anchors were, according to contemporary accounts, merely lumps of rock' and no mention of holes and sizes has been made. The lumps could be one of two types of anchor: ring stone or grapnel.

Comparison with other sites in Indian Ocean countries

A large number of Indo-Arab type anchors have been reported from India, Sri Lanka, Maldives and East African countries. Recent explorations at Malwan²⁶ and Vijaydurg in the Sindhudurg district of Maharashtra yielded a number of stone anchors. In Vijaydurg, eight grapnel anchors used as lintels in the parapet wall of the fort during the Maratha period have been identified.²⁷ This proves that these anchors were in use prior to the Maratha period. Furthermore, mooring stones have been identified on the unused dockyard located on the Vaghotan riverbank. Archaeologically, these ports are not dated earlier than the beginning of the Christian era.

The excavation of the twelfth to fourteenth-century AD port at Periyapattinam in the Ramanathapuram district of Tamil Nadu yielded an identical grapnel three-holed mooring stone, installed on the bank of the River Kappalaru. Oral information in the village clearly stated that the stone was used for tying up boats.²⁸ Another two grapnel anchors from south of the Tamil Nadu coast have been reported which are similar to those of the Dwarka anchors. Rajamanickam²⁹ dated them to 1000 BC.

Raban³⁰ believes that if these anchors were fundamentally made for safer anchorage in a coralline bottom, typical of the Indian Ocean, then they were not necessarily confined to Arab boats or modelled on Arab influence. Parallels to this type of anchor have been found from the Red Sea, on the Lone Mushroom wreck.³¹ A similar type of grapnel anchor is reported from Kilwa Kisiwani and Mogadishu on the East African coast.³² David Whitehouse's excavations at Siraf on the Persian Gulf have yielded two fragmentary stone shanks (anchors) of a similar nature which

he compares with a complete specimen found at the same place by the villagers.³³ According to his dating these stratified fragments are not later than the eighth century.

Dating

It is unfortunate that not a single anchor associated with stratigraphy has been found in India; however, a few disputed anchors (some say these were used as counterweights for a water lifting device, which is still in practice today to lift water from a well or pond in Guarat) have been reported from the Harappan site at Lothal dating back to 2400 BC and two anchors from another Harappan site at Kuntasi.³⁴ The anchors under discussion are entirely different from the Harappan anchors reported at the above sites. As suggested earlier, these anchors are associated with Arab traders who were active in the Indian Ocean countries from the second to the fifteenth century AD, therefore a possible date for these anchors should fall between the second and fifteenth centuries AD. However, along the Indian coast Arab traders were active after the seventh to eighth centuries AD and grapnel anchors have been reported from medieval period sites at Vijaydurg, Sindhudurg and the Tamil Nadu coast. The date of stone anchors from the Tamil Nadu coast has been assigned to the thirteenth to fourteenth century AD.³⁵ Onshore excavations in Dwarka and Bet Dwarka have suggested a huge habitational deposit belonging to the medieval period. The date of the grapnel anchors from Dwarka, Bet Dwarka and Somnath may fall between the eighth and fifteenth century AD. After the arrival of western powers, these were replaced by iron anchors, however other (composite) types of anchor were still popular among the fishermen till recent times.

CONCLUSION

The discovery of a large number of grapnel anchors from Dwarka suggests that this was a very important and active port during the medieval period. On the basis of materials used, a few anchors are of local origin while some are from other places. A similar discovery of a large number of these anchors from other sites in Gujarat, especially Bet Dwarka and Somnath, indicates that the Indian coast witnessed hectic maritime activity during the medieval period. The finding places of these anchors were associated with Indo-Arab trade, therefore to term these anchors Indo-Arab is a natural nomenclature. On the basis of the probable dates of the ports concerned, the anchors on the Indian coast can be dated to between the eighth and fourteenth centuries AD.

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References

- 1 A. S. Gaur, *Maritime Legacies of Harappans in Gujarat* (Asian Publication Service, New Delhi, 2000).
- 2 S. R. Rao, *Lothal – A Harappan Port Town*. Memoir of Archaeological Survey of India (New Delhi, 1979).
- 3 G. F. Hourani, *Arab Seafaring in the Indian Ocean and Early Medieval Times* (New York, 1975).
- 4 *Ibid*, 84.
- 5 Sundaresh, A. S. Gaur, P. Gudigar, S. Tripathi, K. H. Vora and S. N. Bhandodkar, 'Stone Anchors from Okharnandal Region, Gujarat Coast, India', *International Journal of Nautical Archaeology*, vol. 28 no 3 (1999), 229–52. A. S. Gaur, Sundaresh, S. Tripathi, P. Gudigar, K. H. Vora and S. N. Bhandodkar, 'A group of 20 stone anchors from the waters of Dwarka, on the Gujarat Coast, India', *International Journal of Nautical Archaeology*, vol. 30 no. 1 (2001), 95–108.
- 6 S. R. Rao, S. Tripathi and A. S. Gaur, 'Marine archaeological exploration off Somnath', *Journal of Marine Archaeology*, vol. 3 (1992), 13–16.
- 7 T. Sila and A. S. Gaur, 'Stone Anchors from Sindhudurg – west coast of India', *International Journal of Nautical Archaeology*, vol. 26 no. 1 (1997), 51–7.
- 8 T. Sila, M. K. Saxena, Sundaresh, P. Gudigar and S. N. Bhandodkar, 'Marine archaeological exploration and excavation of Vijaydurg – a naval base of the Maratha Period, Maharashtra, on the west coast of India', *International Journal of Nautical Archaeology*, vol. 27 no. 1 (1998), 51–7.
- 9 P. Jaykumar and N. Athiyama, 'Stone Anchors of the Tamilnadu Coast'. Paper presented in the Second International Conference on Marine Archaeology, Thane, Mumbai, 8–10 January 1999. N. Athiyama, 'Stone Anchors from the East Coast of India, a precursor for Marine Archaeology of Tamilnadu' in *Historical Archaeology, Epigraphy, Numismatics and Archives*, Proceedings of the 61st Session of Indian History Congress, 2001.
- 10 G. Kapitan, 'Stone-sank anchors of the Arab-Indian trade period – were they mooring anchors?', *AIMA Bulletin*, vol. 18 (1994), 1–6.
- 11 K. Sridharan, *Maritime History of India* (Publication Division, Government of India, New Delhi, 1982).
- 12 M. Chandra, *Trade and Trade Routes in Ancient India* (Abhinav Publications, New Delhi, 1977).
- 13 S. R. Rao, *Progress and Prospects of Marine Archaeology in India* (National Institute of Oceanography, Goa, 1987), 39. S. R. Rao, T. Sila, A. S. Gaur, P. Gudigar, Sundaresh and K. H. Vora, 'Underwater Archaeological Exploration of Dwarka and Somnath – Results of 1992 Survey and Problem to Attend', in S. R. Rao (ed.), *The Role of Universities and Research Institutes in Marine Archaeology* (NIO, Goa, 1994), 113–19.
- 14 Sundaresh *et al*, 'Stone anchors from Okharnandal Region'. Gaur *et al*, 'A group of 20 stone anchors'.
- 15 IAR: *Indian Archaeology – A Review*, 1979–80, Archaeological Survey of India, New Delhi, 29.
- 16 S. R. Rao, 'Excavation of the legendary city of Dwarka in the Arabian Sea', *Journal of Marine Archaeology*, vol. 1 (1990), 69.
- 17 IAR: *Indian Archaeology – A Review*, 1971–2, Archaeological Survey of India, New Delhi. *Ibid*, 1975–6.
- 18 *Oceanographic Studies off Sutrapada*, Technical Report (NIO, R.C. Bombay), 1985.
- 19 H. Frost, 'Egypt and stone anchors: some recent discoveries', *MM*, vol. 65 no. 2 (1979), 137–61.
- 20 Kapitan, 'Stone-sank anchors', 3.
- 21 *Ibid*.
- 22 Hourani, *Arab Seafaring*.
- 23 *Ibid*, 115–16.
- 24 *Ibid*, 116.
- 25 W. H. Moreland, 'The ships of the Arabian Sea about AD 1500', *Journal of the Royal Asiatic Society* (1939), 65.
- 26 Sila and Gaur, 'Stone Anchors from Sindhudurg'.
- 27 Sila *et al*, 'Marine archaeological exploration'.
- 28 Rajan, pers. comm.
- 29 G. V. Rajamanickam, 'Marine Archaeological Exploration Activities from the Centre of Tamil University, Tamilnadu' in N. Kasinathan (ed.), *Seminar on Marine Archaeology* (Madras, 1992), 34–44.
- 30 A. Raban, 'Medieval anchors from the

Red Sea', *International Journal of Nautical Archaeology*, vol. 19 no. 4 (1990), 303.

31 *Ibid.*, 299–306.

32 N. Chittick, 'Stone anchor shanks in Western Indian Ocean', *International Journal of Nautical Archaeology*, vol. 9 no. 1 (1980), 73–6.

33 D. Whitehouse, 'Excavations at Siraf, Third interim report', *Iran*, vol. VIII (1970), 141.

34 M. K. Dhavalikar, M. R. Raval and Y. M. Chitalwala, *Kuntasi – A Harappan Emporium on the West Coast* (Pune, 1996).

35 Athiyama, 'Stone Anchors', 1298.

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