Exploration for Shipwrecks off Sunchi Reef, Goa, West Coast of India
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Exploration for shipwrecks off Sunchi Reef, Goa, west coast of India

Sila Tripati, A. S. Gaur, Sundaresh and S. N. Bandodker

Abstract

Archival records show that a number of ships have sunk in the waters off Goa, on the west coast of India, as a result of foul weather, warfare and human error. Explorations were carried out in 1997-9 to locate shipwrecks using a boat-towed metal detector and visual surveys in 3 to 9m water depth off Sunchi Reef. A wreck was discovered and its investigation revealed guns, a shot, potsherds, glass bottle pieces, a broken rudder and dressed granite stone blocks. These finds suggest that the wreck dates from the Portuguese period (seventeenth to eighteenth century AD) and was therefore a wooden-hulled ship. The most probable cause of the wrecking was the shallow laterite shoals in the region. Although modest in scope, this project is important as one of the few underwater investigations yet to be undertaken by Indian archaeologists.

Keywords

Shipwreck; maritime archaeology; guns; Sunchi reef, Goa.

Introduction

The documented maritime history of Goa, in central west India, dates from 200 BC onwards. Among the dynasties that ruled over the Goa region the Shilaharas (AD 750–1010) and the Kadambas (AD 1008–1300) were great maritime powers, and maintained trade contacts with the countries of west Asia and east Africa (Gune 1990). The empires had shifted their capital and port towns from Chandrapura to Gopakapattana in the early historical period and from Gopakapattana to Old Goa on the bank of the River Mandovi during the medieval period, as a consequence of siltation caused by the rivers of the Zuari. During Portuguese rule in the seventeenth to eighteenth centuries Old Goa continued to be the capital and port town of Goa.

No ancient or medieval wrecks have been discovered in Goan waters, but the marine and Portuguese records kept in the Goa State Archives, Panaji, give a list of ships lost off Goa during the Portuguese period. These records are usually not specific about the exact location of the wrecks, but they are an important source of information about the
The coastal geomorphology of Goa

Coastal and marine geology, hydrography, and other environmental parameters are essential to the study of shipwrecks. The coastal tract of Goa can broadly be classified into beaches, sea cliffs, promontories, estuaries, dunes, hard rock, wave-cut platforms and sandy patches. The rivers Chapora, Zuari, Sal, and Mandovi define the drainage pattern. The coastal belt of Goa is characterized by a number of geomorphological features relating to marine erosional and depositional processes. The hydrographic survey maps show that the continental shelf is relatively wide. The seabed consists of silty clay at water depths less than 50m, and sandy silt from 50 to 100m depth. Longshore and tidal currents and strong winds blowing from the Arabian Sea have played an important role in shaping the coastline. Evidence of sea-level change in the form of marine platforms and beach rock in the coastal belt shows that at one time the sea had encroached upon the plains of Goa. Even the present Marmagao headlands were once an island, but are now connected to the mainland by a tombolo (causeway) where the town of Vasco-da-Gama now stands (Wagle 1982).

Location and topography of Sunchi Reef

Sunchi Reef is located between Marmagao and Cabo headlands (Fig. 1). Bathymetric contours indicate that the seabed has a gradual slope towards the west. The river Zuari with its opening to the sea, near the Amee shoal in the west, is the main conduit for sediment dispersal to coastal areas. The reef consists of lateritic shoals more than 5m high that extend in a north–south direction, separating Marmagao Bay from the Arabian Sea and extending onshore (Ambre 1991). The region is a shallow, high-energy maritime zone that abounds with hazards to navigation. The reef near the wreck consists of uneven laterite shoals ranging in water depth from 3 to 9m. Currents and wave action have been responsible for depositing layers of silt on the wreck; the seabed is characterized by shelly sand and lithified sediment, some of which thinly covers the bedrock (Wagle et al. 1988). The maximum speed of the ebb flow during neap tides is about 1.5 knots, whereas during the
Figure 1  Location of possible seventeenth- or eighteenth-century AD shipwreck on Sunchi Reef off Goa.
spring tide it is about 3 knots. As the region is very shallow the current action is strong and severely hampered the survey work.

Methodology

After obtaining the information on wrecks off Goa from archival sources and Hydrographic Chart No. 2020, local divers were also consulted regarding a shipwreck reported off Sunchi Reef and finds in the adjoining area. Subsequently marine archaeological explorations were conducted in 1997–9 to locate the wreck, and this was achieved using swimline and circular search surveys. Particular attention was paid to the distribution, variety and preservational state of artefacts lying on the seabed. In addition, natural features such as rock outcrops, seabed topography, depth and movement of sediments, and current direction in the region were noted. A number of small artefacts belonging to the wreck were retrieved for analysis after proper documentation.

The uneven topography of the site necessitated considerable visual survey. Exploration began at the central part of the wreck site and gradually extended to adjoining areas. Divers carrying out the survey covered about 5 to 10m radius in a circular search pattern, with dives sometimes lasting for more than 30 minutes. The artefacts were cleaned, drawn, photographed and videod in situ and the site environment was also recorded. The co-ordinates of the wreck and associated finds were fixed using a NAV 5000 DLX GPS (Global Positioning System). Boat-towed metal detector (Pulse 12) surveys were also carried out over the wreck site and adjoining areas.

In all, an area of roughly 50×50m at a water depth of 3–9m was thoroughly explored at Sunchi. The artefacts scattered widely over this area included four cast-iron guns, a shot, ceramic sherds, pieces of glass bottles, a rudder, and dressed granite stone blocks. The artefacts were covered by a thin layer of silt as well as by marine organisms such as barnacles and mussels (Sila Tripati 1998).

Guns

All four of the guns are lying on one area of the seabed, suggesting that they were deployed close together on board the ship. The muzzles of two guns were angled into the seabed whereas the other two were lying flat (Plate 1). In all cases the iron had corroded to produce a concretion layer which was heavily encrusted with calcareous material, barnacles and mussels, obscuring any monogram, inscription, symbols or identification marks that may have existed. The trunnions on both sides of the guns are plain without any lifting dolphins or rings; the vent fields have yet to be uncovered, but it appears that they have two reinforcements and a chase. The guns also have a distinct cascabel button which was slightly rounded.

All of the guns are identical, approximately 2m in length, and are likely to date to the seventeenth or eighteenth century from one unknown company. From their shape it appears that they are swivel guns, which were generally made of iron and sometimes cast with a separate breech chamber. Similar kinds of gun, also with plain surfaces and
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Plate 1  Marine archaeologists preparing to draw guns on Sunchi Reef, Goa.

belonging to the Portuguese period, are preserved in the town of Goa and the Old Goa Museum. Before firm conclusions can be drawn, the guns at the wreck site need to be lifted and treated to determine the alloy and to reveal the seal or manufacturing mark. The drawings are based on records made in situ (Fig. 2).

Shot

A cast-iron gun-shot weighing 1.218kg was retrieved from the western side of the site approximately 15m away from the guns; no artefactual material relating to the ball was recorded in the surrounding area (Plate 2). The diameter and specific gravity of the ball are 9.54cm and 4.76 respectively. The surface was uneven and partly covered by marine growth. No stamps or other identification marks were noticed.

Water had impregnated the corroded surface of the ball but was removed in the lab by heating. The benthic activity and corrosive property of seawater were responsible for cracking the surface; pits would first have formed allowing water to penetrate, which in turn would have widened the cracks, oxidized the ball and promoted crumbling and cracking. Fungal growth as well as a black, sulphurous material, possibly gunpowder or another explosive, was noticed inside the ball, although there was no visible fuse hole and it may
be a solid shot. Similar kinds of shot are in the Old Goa Museum and belong to the Portuguese period.

A small piece of iron was removed from the shot for Scanning Electronic Microscopy (SEM) and Energy Dispersive X-ray analysis (EDS) to establish its chemical composition. The SEM examination shows the shot to be loosely bound, porous and cracked (Plate 3). The EDS analysis shows that the metal varied in iron content and other oxide percentages (Fig. 3; Table 1). The iron oxide (Fe$_2$O$_3$) content varies from 77 to 96 per cent iron with impurities of oxides of Si, Ca, K, Al, and Na; the variation in the oxide percentage could be attributable to changes in the seafloor environment or to the manufacturing process.

**Pottery**

Survey in the area adjacent to the guns revealed several potsherds lying in the crevices of laterite (Sila Tripati 1999). These include rim, base and body sherds, as well as two
Plate 2  Cast iron shot found on Sunchi Reef, Goa.

Plate 3  Part of cast iron shot under low magnification, showing large cracks and its porous nature.
Figure 3  Energy Dispersive X-ray analysis (EDS) graph showing chemical composition of shot (AU = gold coating of the sample).

Table 1  Chemical composition of cannon ball found in Sunchi reef

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage (1)</th>
<th>Percentage (2)</th>
<th>Percentage (3)</th>
<th>Percentage (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe₂O₃</td>
<td>95.98</td>
<td>93.57</td>
<td>92.00</td>
<td>77.53</td>
</tr>
<tr>
<td>SiO₂</td>
<td>–</td>
<td>2.91</td>
<td>4.81</td>
<td>5.76</td>
</tr>
<tr>
<td>CaO</td>
<td>–</td>
<td>2.20</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Na₂O₃</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>9.83</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5.98</td>
</tr>
</tbody>
</table>

moulded handles (Figs 4 and 5; Plate 4). The sherds are badly abraded, removing any decoration which may have existed and revealing the light yellow of the clay fabric.

The size and shape of the sherds indicate that they belong to storage jars. It is most likely that they are a Chinese product. Under the Ming dynasty (AD 1368–1644), similar sizes of wheel-thrown jars were produced for maritime trade; they have a narrow opening,
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Figure 4  Martaban pottery from Sunchi Reef.
Figure 5  Martaban pottery with handles around the neck from Sunchi Reef.

Plate 4  Martaban pottery found on Sunchi Reef.
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a slightly concave side profile and a circular base. Four small handles are placed around the neck which is surmounted by a rolled lip (Plate 4). Before wheel-throwing they were usually fabricated by the coiling method, or made in parts which were put together at a later stage because of their size and weight. The moulded, applied or incised decoration can be very elaborate, consisting of religious, plant or geometric motifs and sometimes spaced dots along the vessel, and was often surmounted by a slip or glaze; sometimes a chocolate-brown glaze was applied over the light yellow clay fabric. These jars can be a metre in height, but are usually 70–80cm; even the larger dimensions were common from the thirteenth century onwards. They were fired at a temperature of about 1,100 degrees C (Vander Pijl-Ketel and Kist 1982).

It appears that these jars served to transport perishable foodstuffs, especially pickles. The narrow mouths were stoppered with wooden or clay bungs for the better preservation of foodstuffs. Rope tied on the handles made their transportation easier and a ring was placed around the narrow base to give it greater balance (Desroches 1998). This type of ceramic is named after the town in which it originated, Martaban, in the south of what is now Burma. Jars of this type have been found on the remains of ships that sailed the Indian Ocean in the sixteenth to seventeenth centuries, for example the VOC ship Risdam wrecked off Malaysia (Green 1986). One broken and two unbroken vessels were found during the excavation of a hull, probably of the nau Nossa Senhora dos Martires, lost at the entrance of Lisbon harbour in 1606 on her return from Cochin, India (F. J. S. Alves and P. J. P. Rodrigues, pers. comm.).

Other finds

Besides guns, shot and potsherds, a number of well-dressed granite blocks were also recorded at the wreck site. They were lying randomly over a large area and some had fallen between the laterite rocks. One block retrieved for study measures 85×43×12cm; some are still bigger. As these blocks have been under water for a long period, they have served as substrata for the growth of organisms which have obscured any possible markings. The size and number of the blocks would seem to indicate that they were meant for use in construction. They may have been ballast or a cargo consignment of building material.

Discussion and conclusions

The wreck is mentioned neither in the hydrographic charts nor in the marine records housed at Goa State Archives, Panaji. To date, few shipwrecks of the many that must have occured in Goan waters have been found; those that have been discovered and characterized are valuable archaeological sites representing discrete events in time. The wreck at Sunchi Reef could have been caused by the accidental grounding of the ship on the shallow submerged rocks following human error in navigation; hidden rocks and submerged reefs are the focal points for shipwrecks in the Goa region. The wreck appears to have been salvaged as it lies in shallow water.
Topography, sedimentary characteristics and water movement play important roles in the preservation of shipwrecks. Sunchi Reef is a high-energy, shallow-water site which is not conducive to the preservation of ship timbers and other organic materials. Any durable objects will be exposed on the seabed thereby increasing the chances of corrosion and heavy encrustation. Nevertheless, important data have been recovered and further detailed studies at the site could provide more insights into how the ship wrecked, its origin and cargo, and the kind of artillery being carried.

From the findings it is difficult to determine whether the vessel was a merchantman or a warship. The Old Goa Museum contains guns and shot belonging to the Portuguese period which resemble the Sunchi Reef finds. The ceramics from the site are similar to sherds found on the wrecks of the Nossa Senhora dos Martires at Lisbon and the VOC ship Risdam off Malaysia of seventeenth-century date. This evidence and the guns strongly suggest that the Sunchi reef wreck belongs to the Portuguese period of the seventeenth to eighteenth century AD. The investigation is important for breaking new ground in Indian underwater archaeology, and the explorations off Sunchi Reef suggest that Goan waters offer rich potential for shipwreck archaeology in the future.

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