Preface

Sunken ships and underwater cultural heritage across the world

According to *The UNESCO convention on the protection of underwater cultural heritage 2001,* there are an estimated more than three million undiscovered shipwrecks lying on the ocean floor. The *Dictionary of disasters at sea* also mentions that approximately 12,542 sailing ships and war vessels were lost at sea between 1824 and 1962 CE. Successful voyages of wind driven cargo ships across the seas were governed by a thorough knowledge of the intensity, strength and directional changes in the monsoon winds blowing over the oceans, in particular the Indian Ocean and the Mediterranean east. Cyclonic storms which are common to the Indian monsoon circulation during the summer and winter months were also a major hazard to be negotiated by the voyagers. Other factors such as knowledge of bathymetry along the sea route, sand and laterite ridges on the continental shelf and periodic earth movements are vital for successful voyaging in the Indian Ocean region. The trade winds blowing from the equatorial west Pacific facilitated the movement of trading ships from Southeast Asia to India and further west. Similarly, the winter easterlies from the Mediterranean favoured the Red Sea voyagers and movement of ships towards India. The north-east monsoon was also favourable for the Indian ships bound to Southeast Asia.

Underwater archaeology or nautical archaeology or maritime archaeology or marine archaeology or hydro-archaeology is a specialized branch of archaeology aimed at recovering submerged cultural heritage. Submerged ports, shipwrecks and proxy records of maritime activity from archaeological excavations, literary and archival records constitute the major source of maritime history. Underwater survey and documentation of shipwrecks occupy a special place in hydro-archaeology of maritime civilizations. Apart from literary traditions and archival sources, hydro-archaeology traces the antiquity and development of maritime activity, development of shipbuilding technology and lays emphasis on rediscovery of sunken maritime heritage, its protection and preservation. The study of shipwrecks provides an understanding of the technical achievements, cultural and trade expansions, and colonization in the past, as well as tracing the provenance of a multitude of merchandise, including artefacts, human remains, plant and animal domesticates.

With systematic hydro-archaeological expeditions and application of modern survey and documentation techniques, including remote sensing and geophysical surveys, hundreds of shipwrecks have been salvaged and excavated both in marine and fresh waters bodies.

In a landmark initiative, the government of India in collaboration with Portugal is setting up a National Maritime Heritage Museum at Lothal in Gujarat. Lothal, a Harappan Civilization site, is a littoral settlement on the Saurashtra coast of Gujarat and is 'well-known' as one of the oldest ports in India, dating to the Bronze Age (2600–1900 BCE). Maritime museums have been established across the world with the well-defined objective of protecting and preserving underwater cultural heritage which is as important as the terrestrial cultural heritage. The Lothal museum is conceived on the model of the Portuguese maritime heritage museum in all its ramifications. This, first of its kind in India, will be an independent research centre of underwater archaeology for reconstruction of maritime history, archaeology of boat building and materials traded, as well as display of salvaged cultural material from shipwreck sites in the Indian Ocean waters. At the time of going to the press, we learn that the first Director General has been appointed by the Ministry of Shipping and Culture, Government of India and the museum is presently attached to the Maritime Board of Government of Gujarat.

The maritime network in the Indian Ocean

Archaeological evidence

It has now been well established by archaeological evidence from the Persian Gulf and Southeast Asia that Indian maritime voyagers ventured into western and eastern seas of the Indian Ocean more than 4000 years ago. The Indian commercial connection with Arabia, Persia, Mesopotamia and Southeast Asia has been well-documented. The early beginnings date back to the Bronze Age Harappan Civilization. Cargo ships sailed from the Harappan ports along Saurashtra and Kachchh coasts of Gujarat through the Persian Gulf to Mesopotamia. Archaeological sites of Golbai Sasan in Odisha and Ban Don Ta Phet and Khao Sam Kaeo in Thailand have revealed evidence of fish bones, fishing hooks, barbed spears and harpoons indicating that fishing was an important part of the economy during the Neolithic period of the late third millennium BCE. Some artefacts of the Chalcolithic period at Golbai Sasan are similar to artefacts found in Vietnam, indicating possible maritime contact as early as second millennium BCE. Excavations at Ban Don Ta Phet and Khao Sam Kaeo in Thailand have material culture evidence that point to contacts between India and Thailand in the 4th century BCE.

The port towns of Harappan Civilization played a pivotal role in the sustenance of urban economy and prosperity of the Harappan Civilization (2600–1900 BCE). This was the time when a major part of the world experienced arid climate that necessitated the formation of large

scale trading networks, both overland and maritime routes, to sustain the urban economy. Riverine and maritime routes were interconnected with the port-towns along littoral Gujarat. Harappans had a regular and direct trade relationship with the Persian Gulf maritime civilizations of Dilmun, Magan and Sumer. Archaeological evidence attests to commercial connections between Meluha (the Indus Valley) and Sumer (Mesopotamia). Mesopotamian ships sailed through the Persian Gulf, but there is no archaeological evidence of them reaching the Harappan port of Gujarat and Kachchh. However, archaeological records reveal that ships from Meluha were docked at Mesopotamian ports and that trade also took place between Elam and the city states of Iran and Mesopotamia, Bahrain (Dilmun) and Oman (Magan). During the late phases of the Harappan Civilization, Dilmun appears to have played the role of mediator cum entrepôt between Meluha and Mesopotamia. Reasons for this development were perhaps more cultural than the navigable conditions in the Persian Gulf.

Among the indigenous historical sources, mention should be made of the coins issued by Satavahana rulers of the Deccan. It is well-known that during 3rd and mid-2nd century BCE to the 3rd and 4th century CE, Indo-Roman maritime trade prospered in India. Coins issued by Vasisthiputra Sri Pulamavi bears a ship motif; some coins bearing ships with single and double mast motif indicate the use of sails and wind-driven ships. Similarly the Salankayanas, the successors of the Satavahanas, had issued coins with the boat motif. Interestingly a Kadamba period inscription, the Motupalli pillar inscription of Ganapatideva of the Kakatiya Dynasty (1244–45 CE) and Annupottu Reddy (1358 CE) are the only instances referring to shipwrecks. Although the Buddhist Jatakas refer to shipwrecks, quantitative data is not known from this body of literary sources.

Literary evidence

Reconstruction of India's maritime history generally focussed attention on literary sources and folklore. The ancient Indian literary tradition, Buddhist literature and Tamil Sangam anthologies are an important source of information on sea voyaging of trading ships and shipwrecks. The Indian folk and oral traditions also shed light on ancient voyages, maritime and cultural contacts, sea dangers and behaviour of the monsoon winds, associated cyclones, typhoons and consequent shipwrecks.

Foreign literary records of ships involved in maritime trade with India date from the time of Strabo, the Roman historian and Pliny the elder, mention that during 26–24 BCE as many as 120 ships were ready to sail towards India from the Red Sea port of Myos Hormos and Berenice. Although the historicity of Hippalus is shrouded in darkness, a 1st century CE Greek text, *Periplus of the Erythreaean Sea*, and Pliny the Elder, a contemporary Roman geographer, credit the discovery of monsoon winds and their suitability for navigation between the Red Sea and India to Hippalus (45 CE), the Greek navigator. The archaeological evidence from the Bronze Age sites in the Indus Valley and the Persian Gulf shows that monsoon winds were discovered by Indian mariners long before Hippalus' voyage to India. The *Periplus* also mentions many large ports from where Indian ships sailed east towards Southeast Asia. This was a vital development for the merchants from Arabia and Persia between the 7th and 8th centuries CE. The ports of Barbaricum (modern Karachi), Barygaza (modern Baruch), Muziris (modern Pattanam), Korkai, Kaveripattinam (Poompuhar), Arikamedu, Dharanikota and many others were the main centres of maritime trade between the east and west.

Further, the *Arthasastra* clearly deals with the administration of ports and navy and mentions a set of rules and regulations governing navigation during the Mauryan period. Megasthenes, the Greek ambassador to the court of Chandragupta Maurya (350–290 BCE), makes a direct reference to the establishment of navy, that continued to exist during the time of Asoka. However, his *Indica* is silent on maritime trade. Therefore, identification of ports and the diversity and variety of cargo from India to both western and eastern kingdoms, the role of Early Historic highways, *Uttarapatha* and *Dakshinapatha*, in inland and maritime trade are important aspects of trade and cultural expansion. Since the fourth century BCE, the *Dakshinapatha* connected the hinterland with the flourishing trading ports along the coasts of the Indian Peninsula.

The early historic port towns along the Indian coasts harboured trading ships from the Roman world and facilitated brisk trade between Southwest Asia and Southeast Asia. Maritime trade ascended with the Roman annexation of Egypt by the Romans. This set in motion a series of developments: (a) continuous exchange of goods between Rome and India; (b) the emergence of ports along the western and eastern coasts and; (c) systematic maritime trade and exchange of peninsular resources, during the following millennia of the Common Era. The early part of the first millennium CE witnessed steady demand for Indian goods in the Greco-Roman world, that continued even after the fall of Rome. The arrival of Portuguese merchant ships at Calicut (Kozhikode) ushered in the new era of maritime activity in the Indian Ocean and is regarded as the turning point in the maritime history of India and that the Portuguese empire was the first to grow from the spice trade.

The maritime history of India reveals the significant role of the rulers of southern kingdoms of Chola, Chera, Pandya, Pallava, Vijayanagara, Kakatiya, etc. in maintaining a steady flow of goods through trade and exchange networks through maritime activity. Literary and archaeological records of these rulers are explicit on the

variety of import and export items. Literary sources attest to vigorous maritime activity in the eastern seas during 7th–8th centuries CE.

Undoubtedly the Indian subcontinent provided a rich resource base and attracted seafarers for thousands of years. The Indian peninsular coasts occupy a strategic geographical position interlinking maritime civilizations of the world. Overland highways interconnected both port towns and hinterland production centres. Arabian and Iranian merchant ships sailed through the Indian Ocean to reach Southeast Asia. The sea ports of India and Sri Lanka served as the entrepôts. This is amply attested by the wide coverage of shipwrecks included in the special section of this issue of *Current Science*. We invited leading underwater archaeologists to provide us with developments in hydro-archaeology in their respective countries and highlight the application of modern exploration techniques. In the following, brief summaries of their contributions are given.

In the context of upcoming National Maritime Heritage Museum at Lothal, these articles, in particular the article by Hawley *et al*. (**page 1612**) are relevant for expanding the scope of the museum. Hawley *et al*. present a useful model to manage underwater heritage sites in the Indian Ocean region, as marine protected areas. The concept of 'living museums in the sea' and modern methods of preserving and monitoring the shipwreck sites will go a long way in protecting underwater heritage for posterity.

Liphschitz (**page 1617**) discusses the development of standardized methods for dendroarchaeology of shipwreck sites and its usefulness in tracing the provenance of wood for ship building. She discusses the success of dendroarchaeology on the two sites in the eastern Mediterranean. This method can be profitably applied to several other shipwreck sites, where wooden parts of the wreckage, as well as location of the construction site of the ship are found.

Ridwan's (**page 1623**) essay on vulnerability of shipwreck sites discusses the various factors that can cause destruction of shipwreck sites. The author points out both natural and human factors endangering the preservation and protection of sites. The Indonesian seas are generally hostile to smooth sail of ships even in modern times. The region is prone to periodic earthquakes, tsunamis and rough seas during the monsoon. Commercial exploitation and pillage activities by human agency have an added impact on shipwreck sites. The largest number of shipwreck sites are known from this region and owing to the vast sea area, managing underwater heritage has become a difficult task and a cause for concern. The author underscores the need for multidisciplinary research to evolve suitable strategies to preserve the sites for posterity.

Metal detection tool is a remote sensing tool useful for identifying not only submerged shipwrecks, but also metal objects lying submerged with the shipwreck. McCarthy (**page 1629**) strongly advocated the usefulness of the metal detector based on his experience of working on the shipwreck sites in the Australian sea. The authors consider the use of metal detectors as one of the best practices of underwater explorations.

Yoshifumi *et al.*'s (**page 1635**) article, unlike those of others in the series, deals with the naval war between Mongolia and Japan during the thirteenth century CE as evidenced by the shipwreck site and associated artefacts. The finds throw fresh light on the naval tactics of war.

Miksic (**page 1640**) deals with illegal transhipment of Chinese goods during the 15th century CE when the Chinese government had banned maritime commerce in the South China Sea and Indonesia. The Bakau ship carrying large quantities of ceramics and cannons sank to the bottom of the sea. Although records give details of the cargo, there is no mention of the events that led to the disaster.

Although historical records have documented the movement of Arab maritime voyagers into Southeast Asia, since early historic times, not much material evidence from sunken ships or shipwrecks are known from eastern Indian Ocean. John Guy (**page 1647**) discusses the evidence of two shipwreck sites dating to the 9th century CE in the Java Sea. This is the first evidence of medieval ships in Southeast Asia.

Three lashed-lug ships carrying large cargo sank during the 12th century in Southeast Asian waters. They were transporting Chinese ceramics and ironware. Flecker (**page 1654**) discusses the historical context of ships carrying Chinese goods, including iron, silk and ceramics. A comparative analysis of cargo items from the three ships has been made which were bound to Southeast Asian markets.

Although the Dutch and European steam powered shipwrecks have been discovered in the recent past by the Marine Archaeology of Unit in the Sri Lankan waters, the discovery of the Godawaya and SS *Indus* shipwreck sites have historical significance. The Godawaya shipwreck dates to 2nd century BCE and the SS *Indus* sank in 1885. Although archival records mention that the SS *Indus* carried precious antiquities from the site of Bharhut stupa in Madhya Pradesh, to the British museum, the underwater explorations at the site have not brought to light any of those. Muthucumarana (**page 1664**) gives an account of fifty-year history of marine archaeological endeavours in Sri Lanka.

Sila Tripati and Ravi Korisettar (**page 1673**) give a summary of marine archaeological research in India, since the late 1970s, with special reference to shipwreck explorations carried out by the marine archaeology centre at the CSIR-NIO, Goa. Shipwreck sites have been explored in the nearshore and offshore areas along the east and west coasts of India and along the Arabian Sea archipelagos. Archival records have in store more

information on shipwrecks and reveal potential for organized underwater explorations that could shed new light on maritime history of India.

Werz (**page 1679**) gives a graphic account of how marine archaeologists endeavoured to locate the shipwreck site where the famous *Haarlem* was capsized at Table Bay, South Africa in 1647 CE. The ship belonged to the United Dutch East India Company (VOC). The events that followed had far-reaching consequences on the social fabric of South Africa.

Turner (**page 1683**) critically analyses the archival records pertaining to six shipwrecks discovered off the South African coast. All these ships were homebound to Portugal from the ports of Goa and Cochin, during the 16th and 17th centuries CE. The Portuguese ships preferred to sail round the tip of Africa. The author provides a description of the wreckages and sunken cargo items that were transported from the Indian ports.

Bita (**page 1687**) provides an account of non-western shipwrecks in the Swahili Sea, western Indian Ocean. The author mentions that movement of ships in this region was governed by the Indian Ocean monsoon circulation that facilitated bridging the sea to connect island nations of Comoros, Seychelles, Madagascar, Reunion and Mauritius. From the ports of the region, mangrove export trade reached both the Middle and Far East. Historical coastal settlements of Kismayo, Lamu, Zanzibar, Kilwa and Sofala were important port towns of call for merchant ships, as they were strategically sited along busy sea lanes.

Hossein Tofighian's (**page 1690**) account of salvage underwater archaeology in the recent past brings to the fore constraints in the recovery and protection of shipwrecks in shallow submarine conditions. As discussed above the Persian Gulf has played a major role in the maritime activity of the Bronze Age, during which time, ships from Meluha carried trade goods to Mesopotamia. Unfortunately, not much is known of the early shipwrecks in the region that has the potential for the discovery of Bronze Age shipwrecks if any. The paper emphasizes the need for deep water surveys in the Iranian Persian Gulf.

Submission of the articles to the chief editor was delayed owing to difficulty to establish contact with Nili Liphschitz of Israel for obtaining updates on her submission. Our efforts finally gave us a shocking news of her untimely death from a common colleague in Israel. She passed away in the month of May, leaving a void among the underwater archaeology fraternity. May her soul rest in peace. We have since completed the paper in consultation with her colleagues and her other publications.

We thank the editorial board of *Current Science* for accepting our proposal to bring out this special section. The contributors' cooperation was vital for the successful completion of this task. We appreciate their inexhaustible patience to deal with our demanding emails.

Ravi Korisettar
Sila Tripati
– Guest Editors