

Khalkattapatna port: the lost archaeological heritage of Odisha, east coast of India

Sila Tripathi, R. Mani Murali, Jaya Kumar Seelam, Atula Kumar Pradhan, Rudra Prasad Behera and Richa Choudhury

The history of Odisha, lying on the east coast of India, is well documented from the Stone Age onwards. The evidences suggest that the ports of Odisha had contacts with the Arabs, Mediterranean countries and South Asia, as well as Southeast Asian countries. Khalkattapatna, a medieval port located on the banks of River Kushabhadra was discovered by archaeological excavations which suggest that between the 13th and 15th centuries it flourished and had contacts with Arabia and China, in addition to other countries. During recent explorations, a number of terracotta ring wells, stamped pottery, Chinese and celadon ware sherds, bricks and brickbats, and terracotta beads were found on the riverbank and in the waters of River Kushabhadra because of erosion of the north bank of the river. Remote sensing images of this region from 1977 to 2014 were analysed to delineate the river mouth and its course. Google Earth images of 2003 and 2011 were also referred to for an understanding of the migration of the northern bank of River Kushabhadra. This note describes the present state of the Khalkattapatna port, causes of erosion, change of north bank of the river course and its consequences.

Maritime contacts of India with other countries is datable to the Bronze Age. Odisha (previously known as Kalinga, Utkal, Odra and Orissa) had played a significant role in the maritime trade. Archaeological and other evidences suggest that ports on the east coast of India had trade, cultural, political and matrimonial relations with the Arab and Mediterranean countries, South Asia as well as Southeast Asian countries since the 6th–5th centuries BC, if not earlier^{1–4}. In maritime trade, ports, harbours, wharfs, dockyards, boat shelters, etc. are noteworthy and each plays a significant role. The inland explorations and excavations along the coastline of India have brought to light, (a) dockyards at Lothal, Gujarat; Vijaydurg, Maharashtra, and Akhnur, Jammu and Kashmir; (b) wharves and warehouses at Lothal and Prabhasa, Gujarat; Kaveripattinam, Tamil Nadu; Dharanikota, Andhra Pradesh; Arikamedu, Puducherry, and Rajbandar, Maharashtra; (c) jetties at Kuntasi, Gujarat; Inamgaon, Maharashtra and Ganjam, Odisha, and (d) lighthouses at Chilika, Odisha; Mahabalipuram, Tamil Nadu and Kanheri, Maharashtra, all of which are datable from the proto-historic to the modern period⁵. Ports were either located on a coast or shore having harbour(s) where ships could dock and cargo could be handled. Literature suggests two types of ports, namely Pattana and Dronimukha⁶. Pattanas were situated on the sea coast where cargo was loaded and

unloaded, whereas Dronimukha refers to a port situated near the confluence of a river and the sea, and associated with upstream routes. Probably Khalkattapatna was a Dronimukha port. A harbour is a place where ships take shelter; it can be man-made or natural. Man-made harbours will have sea walls or breakwaters, while a natural harbour is surrounded by land. Over a period of time many ports came into existence and were active for some centuries, then declined due to either man-made or natural causes. In the *Geography*, Ptolemy (AD 150) mentions ports of Odisha, namely Nainagana (Puri), Katikardama (Kataka or Cuttack), Kannagara (Konark), mouths of the rivers Manada (Mahanadi), Tyndis (Brahmani), Dosaron (Baitarani?), Adams (Subarnarekha?), Minagara (Jajpur?) and Kosamba (Pipili or Balasore), which had overseas trade relations with other countries⁷. But he did not refer to Tamralipti, Manikapatna, Palur, Che-li-ta-lo and Khalkattapatna ports, which also played a significant role in the maritime trade and cultural contacts of Odisha with other countries. The Chinese pilgrim Hiuen Tsang (AD 7th century) refers to Che-li-ta-lo, which was a coastal city and resting place for sea traders and strangers from distant lands⁸; whereas the *Brahmanda Purana*, a 10th century AD text, mentions that Chilka Lake was a port¹. The Arab and Persian writers of the 9th and 10th centuries AD refer to Mahisya (Midnapore) and Ganjam

(South Odisha) as ports⁹. None of the above sources refers to Khalkattapatna, nor has the port been mentioned in any charts, inscriptions, maps and records. However, Khalkattapatna served as a port between the 12th and 14th–15th centuries, and had contacts with Arabian countries and China. In the later colonial period Balasore, Pipili, Ganjam, Harishapur, Chandabali and Dhamra contributed significantly to the maritime activities of Odisha¹⁰. These ports declined either due to man-made or natural reasons. But causes of decline of individual ports have not been studied in detail. Likewise, Khalkattapatna port flourished during the 14th–15th centuries, and had contacts with China and Arabian countries. However, its earlier history and exact causes of decline are not known. Terracotta beads, ring wells, varieties of pottery, bricks and brickbats were found during explorations at Khalkattapatna and on the north bank of River Kushabhadra. During the explorations it was observed that the flow of the river had changed towards Khalkattapatna; therefore, archaeological finds and structural remains of the port were washed out into the river. Taking into account the above aspect, an attempt has been made here to understand the causes and rate of erosion along the north bank of River Kushabhadra, and its consequences on archaeological remains. The role of Khalkattapatna in the maritime trade of Odisha is also discussed.

Table 1. Details of satellite images used in the study and changes in the river morphology from 1977 to 2014

Satellite	Date of pass	Multispectral pixel resolution (m)	Width of the river mouth (m)	Distance from Khalkattapatna (m)	Direction of shift from Khalkattapatna
Landsat 2	10 February 1977	60	340	2510	SE
Landsat 3	17 January 1980	60	94	3744	SE
Landsat 4	15 March 1989	30	140	1683	SE
Landsat 5	26 December 1991	30	422	2260	SE
IRS	13 January 2002	23.5	420	1884	SE
Landsat 8	26 April 2013	30	247	4477	SE
Landsat 8	24 February 2014	30	146	1559	SE

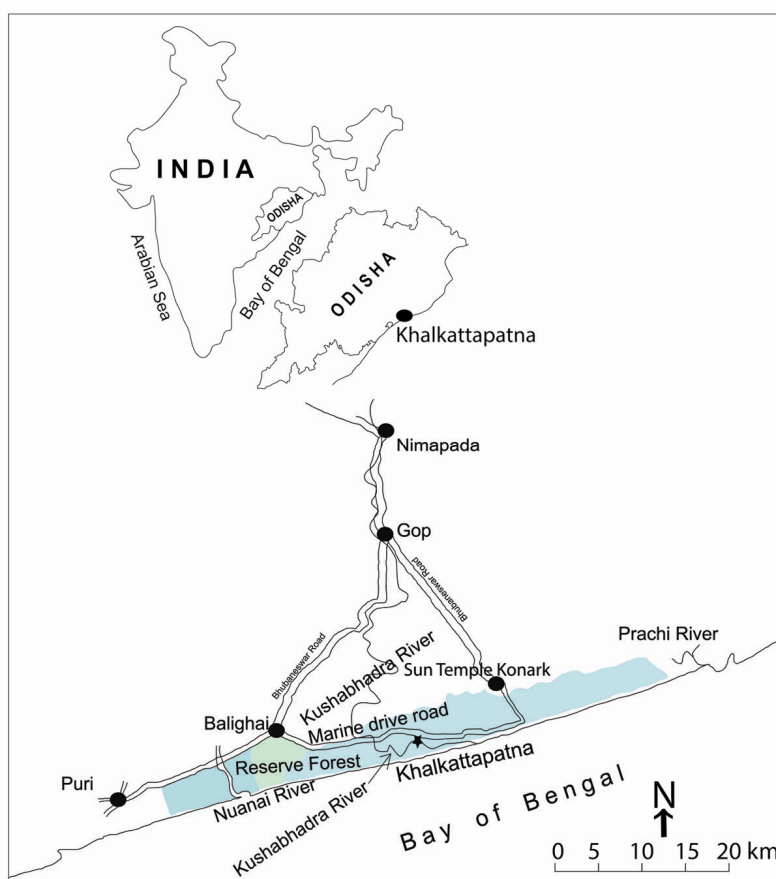


Figure 1. Map showing location of Khalkattapatna port and surrounding regions.

Methodology

In order to understand the causes of erosion at Khalkattapatna, and in the absence of published sources, the archived remote sensing data at earth explorer.usgs.gov, and nrsdc.gov.in. were accessed, because only remote sensing data can provide answers to this issue. The available remote sensing images have been studied to delineate the river course and its behaviour for the last past 40 years or so, as the port came to be known only in 1984–85. Prior to this, no information

was available about it. Maximum care was taken to make use of satellite images of similar season, so that seasonal change and the effect of local processes could be avoided. Table 1 describes the use of different satellite imagery data for the study of migration of River Kushabhadrta. This has led to a clue that River Kushabhadrta is migrating rapidly to and fro with respect to the oceanographic processes and in response to the intensity of natural disasters. Earlier studies along the Odisha coast have inferred erosion^{11–14}. Shoreline changes affect the archaeo-

logical remains which have been recently well studied along the Indian coast^{15–17}. The present study has been taken up at Khalkattapatna to reconstruct the maritime history of Odisha.

Previous work

Khalkattapatna (86°02'08"E and 19°51'22"N) is situated on the northern bank of River Kushabhadrta and on the right-hand side of Puri to Konark Marine Drive at a distance of more than 3 km from the Bay of Bengal along the riverbank and about 1 km aerial distance from the coastline (Figure 1). In the year 1983–84, soil was brought from Khalkattapatna for construction of the Marine Drive road between Konark and Puri. While digging for soil, archaeological remains were noticed and the Archaeological Survey of India (ASI) was informed about the findings (R. V. Rao, ASI, pers. commun.). ASI conducted excavations during 1984–85 and 1994–95, in order to understand the historicity and nature of the deposit at Khalkattapatna. The mound was extensively damaged because of quarrying for soil used in the construction of the road. The excavation brought to light a brick jelly floor which could have served as a loading and unloading platform^{18,19}. Other findings included Chinese ware, celadon ware, egg-white glazed and glazed chocolate wares of Arabian origin and indigenous wheel-turned dark grey pottery. The main shapes included jars, vases, bowls and bowls with lug handles, miniature pots and lamps. Some sherds had mat impressions and stamped geometrical designs on their neck. These ceramics occurred throughout the deposit and were wheel-made. No structural remains were found during excavation. Oven and hearth were noticed, including numerous ring wells connected with houses, suggesting

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their usage as soak pits instead of drawing water from the well. Even today terracotta ring wells (Figure 2a) and pottery pieces can be seen at the site. Two fragmentary and one intact Chinese copper coin (Figure 2b) with legends on both sides and square perforation in the middle have been unearthed during excavations. Besides, terracotta figurines, spherical as well as areca nut beads with collar on one side and a few glass bangle pieces have been found^{19–21}. On the basis of material evidence and chronology of the site, both the excavations of 1984–85 and 1994–95 suggest that the period of Khalkattapatna port could be placed between 12th and 14th–15th centuries^{22,23}.

Recent exploration

In order to understand the causes of decline of Khalkattapatna port, adjoining regions, namely Ashram, Tikina, Garudeshwar, Khalkattapatna and Kushabhadra riverbank were explored and terracotta ring wells, terracotta animal figurine, lid (Figure 2c), beads, pottery, Chinese ware and celadon ware sherds were found; even bricks and potsherds could be seen in the sections (Figure 2d). Similarly, along the bank of River Kushabhadra, several terracotta ring wells (Figure 2e), brick structures, stamped ware (Figure 2f), grey pottery, Chinese ware (Figure 2g), celadon ware sherds (Figure 2h) and terracotta beads (Figure 2i) were observed; the pottery was collected for study and analysis (Figure 3). Most of the sites with these findings submerge during high water (Figure 2j–l), and slowly go into the river; then they are either washed out or buried in the sediment. Potsherds and bricks can be seen in the river. Khalkattapatna port extended from Tikina, Ashram and Garudeshwar and beyond. According to the local people, Tikina was a boat-building centre. It has been observed that the right bank of River Kushabhadra is prone to erosion at Khalkattapatna; therefore, archaeological artefacts are carried away by the river.

Results and discussion

Prior to the construction of the Marine Drive nothing was known about Khalkattapatna port, nor was there any reference to this port in the literature or from other sources. Archaeological evidences suggest



Figure 2 a–l. Chinese coins, terracotta ring wells, figurine and beads, Chinese and stamped pottery noticed during exploration at Khalkattapatna port site and riverbank.

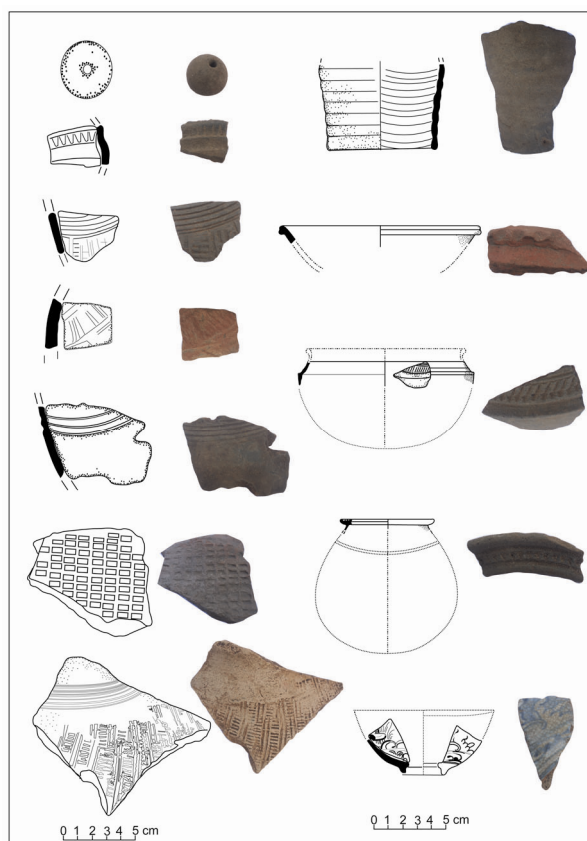


Figure 3. Different types of pottery collected from Khalkattapatna during exploration.

that Khalkattapatna port was in the lime-light during the 12th century AD. Neither the excavations nor the explorations, has yielded evidence of settlements or maritime activities beyond the 15th century AD; which implies that Khalkattapatna served as a port during a particular period and continued for a couple of centuries. The excavation findings of Khalkattapatna brought to light, habitation remains of a single culture. In the absence of structures, it could be presumed that the site was probably occupied seasonally. Some of the stamped ware sherds (Figure 2f) of Khalkattapatna are similar to the finds of Kottapatnam^{24,25} and Motupalli^{26,27} in Andhra Pradesh. Similarly, stamped ware sherds of Khalkattapatna are comparable with Kota China in North Sumatra²⁸, Johore Lama in Malaysia²⁹ and Bagan in Burma, which are datable to the 11th–12th and 13th–14th centuries, also distinct paddle marks can be seen on these sherds (J. Miksic and E. E. McKinnon, pers. commun.). It is now certain, that the stamped ware pottery continued for a longer period starting from the 3rd century BC up to the 14th–15th century AD, as is evident from Khalkattapatna. Likewise, pond, lotus leaf and bunch of flowers with stalk are depicted on one Chinese sherd, whereas other sherds are decorated with blackberry vine and scroll with leaves. These sherds belong to the Ming and Yuan Dynasties respectively and are datable to the 14th–15th century AD (Figure 2g) (J. Miksic and E. E. McKinnon, pers. commun.), whereas all the celadon sherds (Figure 2h) of Khalkattapatna belong to the 13th century AD. Khalkattapatna port was active during the rule of the Ganga Dynasty. King Narasingh Deva (AD 1238–1264) of the Ganga Dynasty constructed the world famous Konark temple and it is said that stone blocks were transported through Khalkattapatna port for its construction. The depiction of a giraffe, an African animal, and ‘Martanda Bhairava’ dancing on a boat on the walls of Konark temple, suggest the maritime activities of Khalkattapatna port³⁰. Structural activities at Konark by the ruling dynasties, contributed either directly or indirectly, to the sustenance of Khalkattapatna port.

The records of the Ganga Dynasty suggest that the important source of income was from agriculture and land, and good economy led to the growth and development of urban centres, guilds, trade

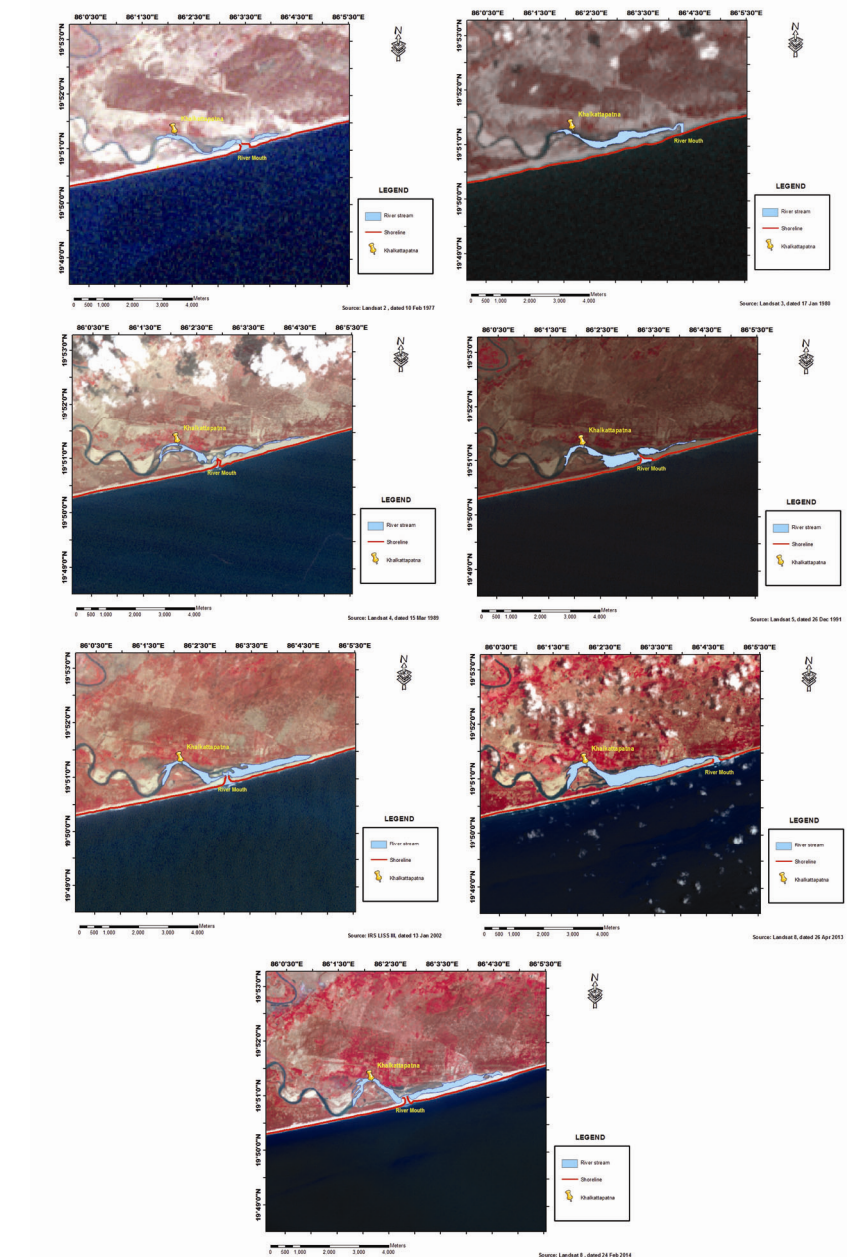


Figure 4. Progressive morphology and shifting of the mouth of River Kushabhadra as visible from satellite images from 1977 to 2014.

centres, marketplaces and ports. Guilds contributed to trade and commerce. Among others, the main items of trade were varieties of textiles, oil, etc. Trading activities were not confined to local scale and the epigraphic evidence refers to the establishment of ‘hatta’ (village market), which served as the direct link for businessmen, cultivators and craftsmen. Detailed information on marketplaces, trade routes and ports, namely Dantapura and Kalingapatnam is mentioned in the grants and inscriptions of the Ganga Dynasty. During the rule of

the Ganga Dynasty, gold ‘fanam’ (coins) were under circulation and these have been reported from different parts of Odisha. Evidences suggest that under the Ganga Dynasty, Odisha witnessed a remarkable development in the field of trade and commerce^{30–32}. Silver, copper, clove, spikenard, silk, Chinese pottery, were imported and ivory, elephant, cloth, diamonds were exported since ancient times from the ports of Odisha^{33,34}. Once the decline of the Eastern Ganga Dynasty started, Khalkattapatna port lost its importance and glory. The location of

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Khalkattapatna was suitable for a port and ideal for anchorage. No evidences are available pertaining to the decline of Khalkattapatna port or its desertion after decline of the Ganga Dynasty.

It has been observed that ports and maritime structures along the coast have declined or have been deserted because of tectonic activities, storms and cyclones, shoreline changes, coastal erosion as well as due to man-made factors^{35–37}. Either singly or in combination, these factors might have caused the decline of Khalkattapatna port. For instance, Konark temple was built on the shore. Presently, the temple is situated 4.8 km away from the shore. According to Ahmad³⁸, this is due to upliftment of land. The evidence of shoreline changes in this region indicate changing forcing conditions from waves as well as river discharge³⁹. Cyclones and storms could also be a reason, because the cyclone in the October of AD 1848 had blown off a part of the tower of Konark temple; there was great destruction in Balasore, Cuttack and Puri districts, including crops³⁵. From available cyclone history, about 13 very severe cyclonic storms and a multitude of depressions and cyclones have crossed Odisha over a period of about 277 years (1737 till date; www.imd.gov.in). These storms significantly contribute to incessant rainfall resulting in flooding of the rivers. The effect of heavy flooding augments the removal of sediments along the banks resulting in erosion of

riverbanks. As the port was situated on the eroding bank, this could be a major reason for its decline. Studies suggest that Odisha coast as well as the banks of River Kushabhadra are also prone to erosion^{40,41}. The Kushabhadra is a natural, untrained river, which is prone to meandering. The port site is located on the outer curve of the meander and is prone to erosion during floods. Being a rainfed seasonal river, flooding of the river occurs during heavy rainfall. It is observed from the Google images that about 35 m of the riverbank was eroded over a period of 8 years. The archaeological remains of Khalkattapatna are on the verge of vanishing due to riverbank erosion. However, the present causes of erosion cannot be correlated with its decline in the 15th century AD. In addition to erosion by flooding, a regular tidal influence also erodes the site, and the highest tidal range in this region is about 1.50 m. Satellite imagery for the years 1977, 1980, 1989, 1991, 2002, 2013 and 2014 and Google images of 2003 and 2011 have been used for studying erosion in the region (Figure 4). Details of the satellite data are given in Table 1. Polygons were digitized to quantify the width of the river mouth, its shift in position with respect to Khalkattapatna port site from satellite data in GIS environment. The shorelines were also demarcated to observe any major shift due to dynamicity near the river mouth. The figure represents the changes in the river course and

shift of the river mouth. In 1977, the width of the river mouth was 340 m and Khalkattapatna was located 2510 m SE of the river mouth. In 1980, the river mouth shifted about 1234 m towards SE and the width of the mouth considerably reduced to 94 m. After nine years, the river mouth had a major shift of 2061 m. The width of the river mouth was 140 m in 1989. In January 2002, the width of the mouth was 420 m. The changing trend of the river mouth spatially starting from 1977 to 2014 (Figure 5) provides a clue that this rapid shift of mouth of the river and associated shoaling and erosion on the other side, could have been responsible for the decline of the port. The net change is about 951 m in 37 years. We presume that such changes on the river mouth are possible since historical times; hence Khalkattapatna port might have disappeared because of fluvial erosion. It is observed that the river is changing its course and the river mouth is undergoing changes due to the river discharge and the waves. It is inferred that from 1977 onwards, Khalkattapatna port remains are falling into the river due to erosion of the northern bank of the river (Figure 5).

Conclusion

A study of port sites provides an insight into the trade contacts between countries, causes of their decline, etc. Sometimes the inscriptions or contemporary writings of a period specify the causes of decline of one port and building of another at an appropriate location. It is a fact that maritime trade has never stopped, albeit declining of ports owing to natural and man-made factors. Khalkattapatna port was unknown before 1984–85. However, the findings suggest that maritime trade contacts of Khalkattapatna existed with the Persian Gulf countries, China and other Southeast Asian countries. This could be corroborated with the findings of stamped ware sherds of Kottapatnam and Motupalli and comparable with Kota China of North Sumatra and Bagan of Burma, which are datable from 12th to 13th century AD. Similarly, the Chinese sherds of Khalkattapatna belong to the Ming and Yuan Dynasties and are datable to the 14th–15th century AD. None of the records suggest how and when Khalkattapatna port declined after the Ganga Dynasty. But it could be presumed that lack of royal patronage might

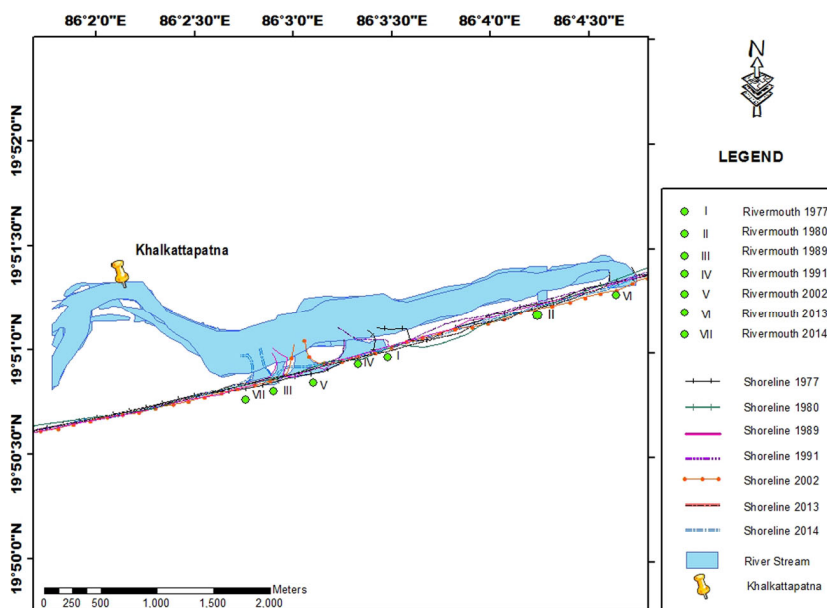


Figure 5. Shifting of River Kushabhadra mouth between 1977 and 2014.

have caused its decline. However, other factors cannot be ruled out. Moreover, history of Khalkattapatna is known only from 1984–85 and no information was available prior to this period.

Thus the discovery of Khalkattapatna adds a whole new dimension to our understanding of the maritime history of India in general, and Odisha in particular. Presently, the archaeological heritage of Khalkattapatna port is vanishing, because of riverbank erosion caused due to change of river course and flooding of the river. The data show that the present riverbank erosion is of recent origin; if the river has been eroding since historical times, no evidence would have survived. Maritime history of a nation can be accessed from the port sites and related findings. Hence, it becomes imperative to preserve the port sites for posterity. With the advancement of remote sensing technology, it is possible to extract information of the past from the archived data, and to infer glimpses of recent erosion along the coastline. The exploration has brought to light state-of-the-art remains of Khalkattapatna and proper steps should be taken to control the erosion before losing the evidences forever. It is essential to explore other port sites of India to understand their state of preservation and necessary steps should be taken to preserve the sites for posterity.

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Sila Tripathi*, R. Mani Murali, Jaya Kumar Seelam, Rudra Prasad Behera and Richa Choudhury are in the CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004, India; Atula Kumar Pradhan is in the Directorate of Culture and Archaeology, MGM Museum, Civil Lines, Raipur 492 001, India. *e-mail: sila@nio.org