Trans. Inst. Indian Geographers
Vol. 6, No.1, January 1984

HUMAN INDUCED GEOMORPHIC HAZARDS IN VISAKHAPATNAM COASTAL STRIP, ANDHRA PRADESH

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ABSTRACT : A major part of the 150 kms coastal stretch between Patapolavaram and Mukkam in Visakhapatnam district in Andhra Pradesh is rocky. In spite of it being rocky, at places there is considerable development of beach and (modern) sand dunes along and behind a few bays along this coast. The paper deals first with sand dunes and dune sands in the area in general and the problems they cause, both due to natural processes and due to human interference. Secondly, it specifically deals with a sand deposit at Bhimli, atop which some important constructions are coming up. Almost the entire sand deposit is wind borne. The huge modern dunes and thick dune sands covering vast areas are found north/northeast to the confluence of rivers and streams here. This is due to the fact the northeast longshore drift is quite powerful,causing considerable accretion of sand on the beaches. There are two types of sand dunes formed in two different ways. One type owes its origin to the natural process of dune formation and the second type owes its formation to artificial obstacles. The sand dunes at Pudimadaka have been a nagging problem to the authorities of the Light House. Nowhere along this stretch of the coast, sand dunes are as high (40 metres) as the dunes at Pudimadaka around and abutting the Light House. At Bhimili the deposit forms the site for important constructions. These constructions serve as nuclei (obstacle) around which the sands accumulate to considerable heights and may eventually cover them.

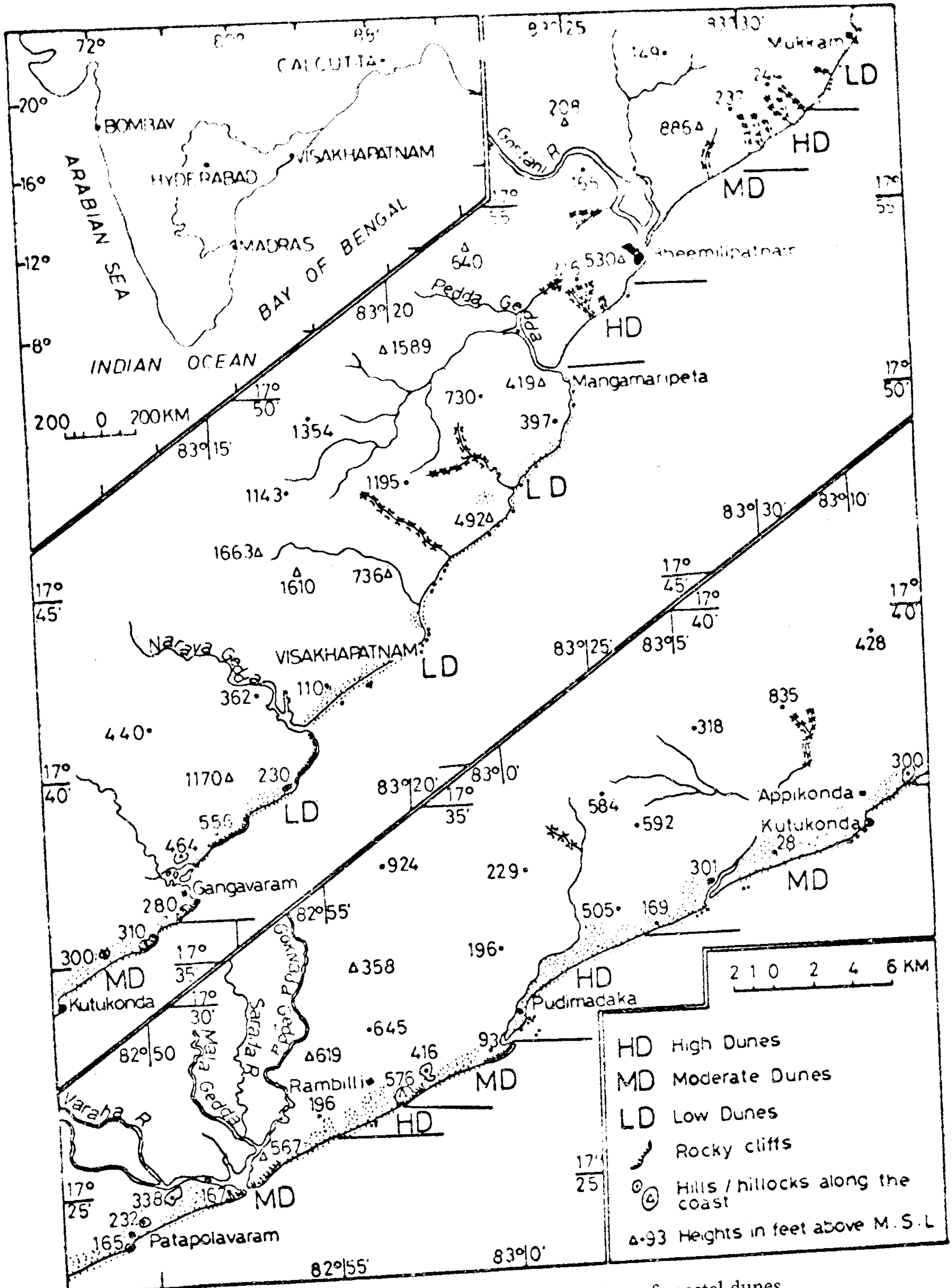

Fig. 1 : Location of the area and distribution of coastal dunes

INTRODUCTION

A major part of the coastal stretch between Pata Polavaram and Mukkam in Visakhapatnam district of Andhra Pradesh is rocky. It is unlike sections of west coast along which a bold continuous scarp of mountains (Western Ghats) in close to the coastline, but shows a cuspate/bay-like pattern with individual hills/hillocks and promontories jutting and protruding into the sea as headlands/forelands, with bay like intervening areas (Fig.1). It is along this stretch, the Eastern Ghat mountains deviate from their usual northeastern trend to an east-west trend, with some hills/ hillocks protruding into the sea. These are due to digitations and faults in a major dome and basin structural province (Natarajan and Nanda, 1981).

In spite of it being rocky at places, there is considerable development of beach and (modern) sand dunes along and behind the bays. The paper deals first with sand dunes and dune sands in general and the problems they caused and are likely to cause at a few places along this stretch of the coast, both due to natural processes and due to human interference. Secondly, it specifically deals with a sand deposit of about 7 sq.km. with a doubly convex curvature like a dome (Prudhvi Raju et al., 1983 communicated) at Bhimli which rises upto 90 metres above M.S.L., (Fig.2) adjoining the sea, atop which some important constructions are coming up. The nature of the material, the processes that operated to accumulate this material and the processes that are operating now over this area and the various implications of geomorphic causes and effects that the constructions may induce,are discussed.

COASTAL SAND DUNES AND DUNE SANDS

With material being the same, there is a subtle difference between sand dunes and dune sands. Sand dunes are landforms with a particular form/shape. The dune sands are nothing but the sands winnowed out from sand dunes as well as beach, and carried away by wind both vertically and horizontally to considerable heights and distances inland, and are seen spread like a sheet, either massive or thin.

There are modern sand dunes of considerable dimensions along certain stretches of the coast from Pata Polavaram to Mukkam in Visakhapatnam district of Andhra Pradesh over a distance of about 150 kms. The areas of localisation of sand dunes along the coast are shown in Figure 1. A few high sand dunes at Rambilli Pudimadaka and Bhimli measure in the range of 5 to 40 metres high and occur from behind to a height of 80 metres above M.S.L. The sand dunes at Pudimadaka have been a nagging problem to the authorities of the Light House. Nowhere along this stretch of the coast sand dunes are as high (40 metr--es) as the dunes at Pudimadaka around and abutting the Light House The moderate and low dunes measure in the range of 3 to 5 metres and 0.5 to 3 metres in height respectively. During the cyclone of 1969 an entire hamlet of fishermen, just north of Gangavaram, disappeared below sand dunes in just about 12 hours time.

The dune sands are seen covering extensive areas behind the bays, and also perching over the coast. They are seen covering considerable extent along the hill slopes particularly over the hills about 7 km. north of Pudimadaka upto a maximum height of 75 metres and at Visakhapatnam upto a maximum height of 60 metres above M.S.L. (Prudhvi Raju and Vaidyanadhan, 1978, Fig. 1). At Bhimli their vertical migration can be seen upto a height of 90 metres above M.S.L.

BHIMLI (RED) SAND DEPOSIT

The (red) sand deposit at Bhimli has been described in detail by Prudhvi Raju et al. (1983, communicated). With a height of 90 metres above M.S.L., it has an areal spread of about 7 sq.km. adjoining the sea (Fig2). It has a doubly convex curvature and looks like a dome. A cumulative area of about 3 sq.km., about 2.5 sq.km. in the east and about 0.5 sq. km. on the west, has been intensely dissected to form a typical badland topography, which is familiarly known as Bhimli badlands. They are comparable in dissection and form, if not in extension, to the badlands at Perth Amboy, New Jersey (Schumm, 1956). The dissection is not uniform in these badlands. It is of the order of 50 metres maximum, in the east and 10 metres in the west.

Despite the material being same, and slope almost being same the eastern flank (slope) of the deposit facing the sea, is not uniformly dissected. Towards the north and west, the dissection is very shallow and the southern portion is entirely free of dissection (Fig,2). The major stream (southwesternmost in the badlands on the eastern side) in these badlands has an extensive network of tributaries towards north and east but is totally devoid of tributaries on the other southwestern side (Fig.2). The material composition of the deposit is not homogeneous all through its thickness. The different sand/sedimentary horizons are described in detail by Prudhvi Raju et al., (1983, communicated). White dune sands from a thin cover the top of this deposit particularly towards north and west. They can also be seen perching on the pillars and ridges in the badlands. The southern side of the deposit is fully covered by sand dunes (Fig.2) A horizon of fine red sands of maximum 30 metres thick occurs below the sand dunes and

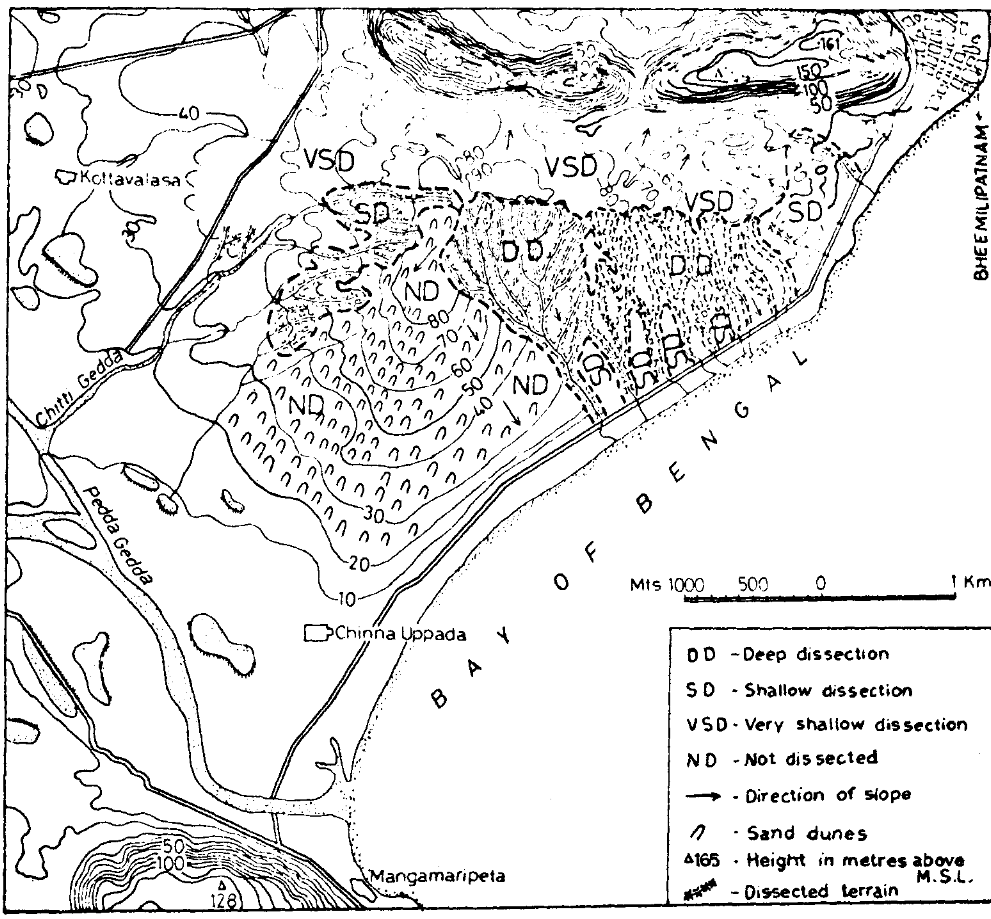

Fig. 2 : Nature of dissection in the coastal dunes southwest of Bheemilipatnam

dune sands. Another horizon of coarse white to brownish sands of a maximum thickness of 40 metres occurs next to red sands. The thicknesses of these horizons are not uniform all along and across the deposit. Yet another kind of white to yellowish sands, which are a fraction coarser than the white to brownish sands above, and pebbly are seen upto a distance of about 1 km. from the sea and to a height of 12 metres above M.S.L. Excepting for these sands which are thought to be a marine (beach) deposit, the sands of the other horizons referred to above are considered to be wind borne (Prudhvi Raju et al., 1983, communicated).

DUSCUSSION AND CONCLUSIONS

The stretch of the coast in the present study is generally considered to be devoid of modern sand dunes (Srihari, 1980). While it cannot be denied that by and large the coast all along is devoid of modern sand dunes of considerable dimensions, there do occur modern sand dunes of huge dimensions at a few specific locations along this coast (Fig.1). There seems to be a relation between the occurance of rivers/streams and areas of huge dune formation, which are usually towards the north of the confluence of rivers. Two prominent longshore currents, northeast longshore drift and southwest longshore drift, transporting and distributing sediments have been reported on the continental shelf off east coast of India (La Fond and Prasada Rao, 1954). Of the two, the northeast current is more powerful causing considerable accretion of sand on the beaches along this stretch of the coast (Sastry et al.,1979). The rivers/streams which debouch into the sea along this stretch of the coast being of smaller order, the load they carry in their discharge cannot be pushed far away into the sea. So whatever sediment that is brought in by these rivers will be carried away by the northeast drift which pushes back some of the sediment over to the beaches, which in turn supplies sand for the dunes. The huge modern dunes and thick dune sands covering vast areas are found, only north/northeast to the confluence of major rivers/streams (Fig.1). There are two types of sand dunes formed in two different ways. One type owe its origin to the natural process of dune formation and the second type owes its formation to artificial obstacles and may be termed obstacle dunes. The trees and structures (constructions) serve as nuclei (obstacles) around which the sands accumulate to considerable heights. But for the trees at Rambilli and constructions (the Light House, associated buildings and fencing) at Pudimadaka the sand would never have accumulated into huge dunes but would have spread out as dune sands.

Almost the entire sand deposit at Bhimli (Fig.2). is wind borne (Prudhvi Raju et al., 1983, communicated). The occurrence of sand dunes and dunes upto almost 90 metres above M.S.L. confirm the work of present aeoline process. The absence of dissection over the southern portion, non-development of tributary network along the southwestern side of the major stream in the badlands referred to earlier and presence of definite sand dunes over this area indicate intensive aeoline process continuously adding sands over the southern portion. This portion of the deposit formsthe site for important construction.

These constructions provide effective nuclei (obstacle) for more sand accumulation. The sands of the deposit are easily susceptible to erosion. The migration and accumulation of dune sands around the constructions can be prevented by having a barricade of trees along the beach. Thus trees may effiectively stop the drifting sands from reaching the site of constructions. But because of the loss of constant addition of sand, heavy rains during occasional cloud bursts, which are quite common in this region, may induce dissection, undercutting the sand deposits upto the foundation level of the constructions and cause damage to the same. So the constructions will have the problem of encroaching sands around them, if precautionary measure such as planting trees along the beach is not taken up, and also the problem of setting in of dissection which may cause damage to the constructions, if the accumulation of sands over the site is prevented, since the site is left undissected only because of the constant accretion of sand. Considiring these alternations it is perhaps advisable not to go for important constructions at this site (at Bhimli) in particular and at place where there are at present concentration of high modern dunes in general.

ACKNOWLEDGEMENTS

The authors are thankful to Prof. R. Vaidyanadhan of the Department of Geography for suggestion in the preparation of the manuscript and also to Dr.K.V.Mohan Kumar, of the same department for providing his vehicle for field trips. One of the authors (S.V.B. Krishna Bhagavan) is thankful to the University Grants Commission for the award of a Junior Research Fellowship.

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