

MAGNETIC MINERALS AND COASTAL PROCESSES

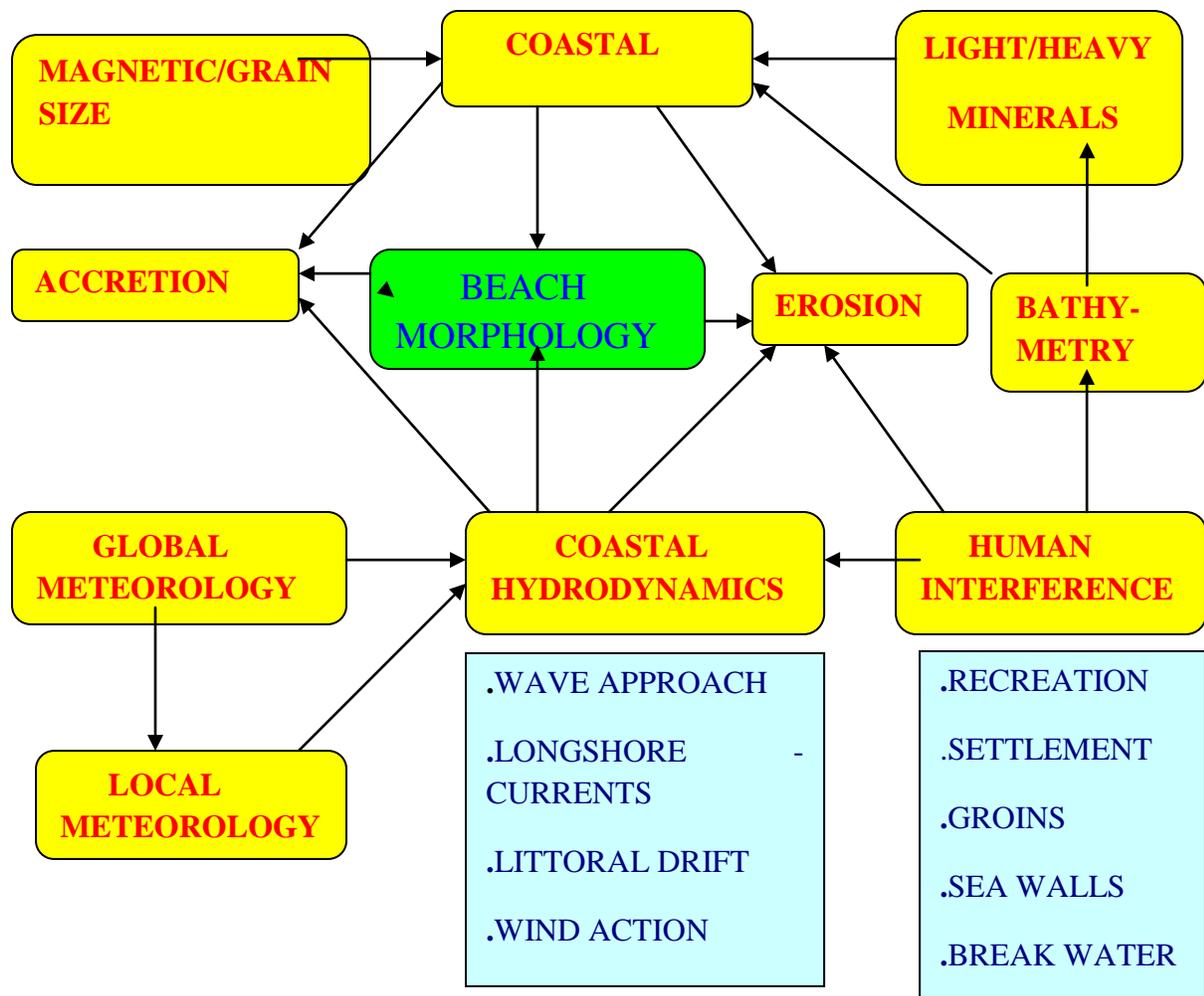
Praveen B. Gawali

The beach and nearshore environment is in constant dynamic flux that retains and loses its detrital material to different coastal processes. Tourism has boosted the economic growth of the coastal region. But, it has also brought in its wake a trail of ecological and environmental degradation. The natural processes operating in the twilight zone of land and sea need to be completely understood to avoid further decay. IIG has reconciled the magnetic methods with other conventional techniques increasing the efficacy of comprehending processes that have huge societal benefits.

The studies carried out at the Institute underlines the utility of magnetic susceptibility in studying the sediment movement along the beaches. This technique allows one to collect rapidly and reliably the initial data on sand movement and was applied on three beaches (Vengurla, Redi, Aravali) of Sindhudurg district. The magnetic minerals found across these beaches are overwhelmingly of ferrimagnetic type that includes the magnetites, which are concentrated towards the northern and southern ends of the Vengurla and Redi beaches respectively. The magnetic minerals spread across these beaches are enriched in magnetically coarse grains. The stations situated at the Aravali beach are characterized by the presence of canted antiferromagnetic (haematite) grains as well as diamagnetic and paramagnetic minerals. It is observed that the magnetic minerals are concentrated more during monsoon, especially at Redi stretch. Also, the overall concentration and assemblage of magnetic minerals is more at the northern and southern ends of Vengurla and Redi beaches. The main source or provenance of these magnetic minerals is the Deccan traps and the residual deposits.

With the support of grain size analysis, sediment dispersal pattern, it is deciphered that the elemental accumulation/erosion and dispersal is season dependent in which enrichment of some elements is seen to be more postmonsoon across Sindhudurg beaches. These seasonal changes are attributable to changing wind and wave climate, acting differently at these beaches even though situated close to each other. Transport paths in the wave dominated environment of Sindhudurg was deciphered using grain size parameters to understand the direction of sediment transport and to define areas of erosion, accretion and equilibrium. These beaches exhibit

accreting trend postmonsoon. Erosion is the dominant process occurring premonsoon and in the monsoon season. This reveals ongoing episodic and cyclic morphological processes are operative in this coastal belt. The intensity of longshore currents is more at Vengurla and Aravali, but less along Redi beach. Northerly currents were seen to prevail during fair-weather period and southerly currents occur mainly during monsoon season. Seaward grain size fining along Vengurla beach (swash-backwash phenomena), and coarsening seaward trend along Aravali and Redi beaches (high energy conditions) is seen. Thus, the sediments of these beaches are deposited under moderate to high energy conditions. The prominent transport mechanism for sediment dispersal is traction currents. Significant correlation is also found to exist between heavy metals and magnetic parameters. This has a huge potential in aiding in magnetic screening/monitoring of heavy metal pollution in coastal sediments in a rapid and cost effective manner.



Cartoon of the various processes operative and factors influencing the beach morphodynamics