

Paper Number: 334

Paleo beach-ridge complexes, indicator of sea-level changes and climatic fluctuations: A case study from part of the Andhra Pradesh coast, India.

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The coastal landforms and their responses to sea level and climate changes are significant for geomorphological reconstruction of the coastline and understanding of the coastal dynamics. The Indian coastline stretching over 7,500km is the sixth largest one in the world and has been subject to many spells of sea level changes since Last Glacial Maximum (LGM). The eastern coastline of India has been originated in post Cretaceous times and it was considerably modified during Quaternary due to progradation of deltas and at places by the impacts of glaciations and deglaciation. The present study has been carried out at the central part of the Andhra Pradesh coast to understand the paleoclimatic changes and / or transgression / regression phases along the Andhra Coast during the Quaternary.

The area is characterized by >45 km long NE-SW trending curvilinear coast line and a very wide (12km in NE to 5 km in SW), low lying (6m msl) strand plain with coast parallel linear ridges covered by sand dunes with low lying swales/tidal flat as inter ridge area, active dune complex, tidal flat etc. The beach ridges are separated by low-lying swales with subdued topography and at present day both are being modified by anthropogenic activities. From the landward margin towards coast, five sets (R-I to R-V) of ridges could be recognized. The ridge R-I, R-II (palaeo) and R-V (present day) has prominent relief and remarkable continuity. However, ridge R-III and R-IV (palaeo beach ridges) are discontinuous and appears to be partially truncated. The present day coastline is characterised by active intermediate type beach, berm, back-barrier-dune complex and tidal creeks, in meso-tidal setting.

Beach ridge complexes are composed mostly of fine to medium sand. Medium to coarse sand is also present at places. Sand is massive to thinly laminated, fine-black heavy minerals define the laminations. In sections, the top part is represented by light brown massive fine sand, followed by finely laminated sand with darker hue. Vertical and sub-vertical burrows are also present. Similarly, the modern coastline dominantly contains medium to fine sand with occasional clayey silt in geomorphic depressions. The

black coloured fine sand contains angular to rounded heavy minerals (both opaque and non - opaque), like Garnet, Ilmenite, Pyroxene, Magnetite, Amphibole, Monazite, Rutile, Sillimanite, Zircon etc.

Each beach ridge of the strand plain represents a palaeo-shoreline, suggesting progradation of coastline with sea level changes, during the Quaternary period. Preliminary interpretation from the limited OSL dates received till date, quantifies depositional events around 15ka and 1 ka. Deposition of sediments of the oldest beach ridge R-I, has been initiated before 15ka; and can be related to the increased summer monsoon during MIS-2 after LGM (26 to 18 ka) and it is in contrast with the existing data which relates formation of oldest beach ridge with Holocene transgression (i.e. ~6000 yr B.P.) [1, 2]. The OSL date obtained from R-IV indicates the depositional processes was active at least upto ~1ka. The OSL dates obtained from the near surface sediments implies the aeolian sand dunes over the beach ridges are still in dynamic condition. The sedimentation rate of the sand dunes is higher (>3mm/yr) than that of the beach ridges (<1mm/yr).

References:

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[2] Kunte P D and Wagle B G (2004). Journal of Coastal Research. Special Issue No. 42.

