The present study illustrates that variation in the hydrodynamic regimes of Mandovi estuary are markedly controlled by prevailing seasons with the southwest monsoon generating the most profound influence on all the parameters.

Changes in the hydrographic characteristics of the estuary are in complimentary resonance to the seasons. Results reflected in the variations in salinity, pH and temperature show a distinct marine dominance over the estuary during fairweather season and a freshwater dominance during monsoon.

Season signatures are embossed in the spatial variations of total suspended matters (TSM) and bedload of the estuary. During fairweather season, two distinct zones of high TSM concentration are delineated - one associated with the geomorphic setup and dissipation of energy within the high salinity zone near mouth and the other further upstream, associated with conditions conducive of development of turbidity maxima at freshwater-saltwater interface. Highest concentrations of TSM in estuary and its tributaries during monsoon clearly point out to the mines and mine dumps as main source of sediment at the upstream. In the bedload, sediments during monsoon are impoverished in finer fraction owing to increased flow velocities predominant towards downstream and high accumulation of clay fraction at mouth and high TSM during premonsoon that is when the estuary shows
marine dominance, probably indicates an inflow of sediment from the sea into river mouth.

The mineralogical studies show a presence of fine major clay minerals. kaolinite is the most dominant followed by illite, montmorillomite and gibbsite. From the observed trends in relative abundance of these minerals and their seasonal variations, it is inferred that kaolinite, illite and gibbsite are predominantly derived from the drainage basin along with some amount of montmorillomite. A major portion of montmorilloHITE is brought into the estuary from the offshore along with other minerals associated with the sediment that is brought in low swells during fairweather season. The mineralogy of suspended sediments in premonsoon and monsoon is dominated by kaolinite.

Results of geochemical analysis and various computations reflect varying degrees of alteration and chemical maturity of the sediments. Sediments showing higher alteration index in tributaries are invariably associated with close proximity to mine sites and characterized by higher concentration of heavy metals and trace elements. Low concentrations of the same in tributaries little affected by human activities show that the elements and metals are essentially released by mining activity. Element mobilization in the estuary is probably regulated by several factors but the grain size seem to be most important in regulating the concentrations of
elements. Sediments rich in clay and silt fraction are distinctly enriched in the elements. Due to the release of metals from mining at various places along the length of estuary and the tributaries, most of the sediments show considerable enrichment of chemical constituents against background indicating clearly the environmental impact of these activities. Index of geoaccumulation, a measure of pollution is not very alarming for toxic metals like Pb, Cu, Zn and V but with respect to Fe, Mn and Cr, it shows an enrichment by several folds. Since the index was computed for bulk sample composition, it might show even higher values for < 2 μm fractions for which it is supposed to be determined.

An attempt to decipher the contributing sources of the elements, the results of R-mode factor analysis point out to four distinct sources (i) detrital factor - associated with predominantly fine fraction during fairweather and coarse fraction during monsoon (ii) Carbonate factor (iii) Heavy mineral factor (iv) Anthropogenic influence particularly. With respect to mining.

Concentrations of all the heavy metals are very high in the suspended sediments compared to bedload. Since large amount of suspended sediment is influenced from land into the estuary possibly an equally large amount of elements are
released into the system ultimately carried into the ocean during monsoon.