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Provenance and paleoenvironmental events inferred from the geochemical records of Quaternary marine sediments from South Andaman Sea

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The sediments deposited in the Andaman back-arc basin are mainly derived from the continental margin, where the sediments are accumulated in response to tectonic settings and climate change over the region. Present study is focused on identifying the major source and associated paleoenvironment events using bulk geochemistry and rare earth elements (REE) of the sediments from a 28.85m piston core (PC) from south Andaman Sea (SAS). The core (PC-I) was retrieved from a water depth of 3137m (07°19.8566'N; 94°39.2624'E) in the SAS during SR-003A cruise onboard RV Samudra Ratnakar, a Geological Survey of India (GSI) deep sea survey vessel. The nature of the sediment is dominantly silty clay to silt with intercalation of clay layers at places. The average bulk geochemical data of the sediment core is ordered as $\text{SiO}_2 > \text{Al}_2\text{O}_3 > \text{Fe}_2\text{O}_3 > \text{CaO} > \text{MgO} > \text{K}_2\text{O} > \text{Na}_2\text{O} > \text{MnO} > \text{TiO}_2$. The first and last appearing events of planktonic foraminifera at levels 18.3m (0.61Ma), 14.3m (0.22Ma) and 3.4m (0.12 Ma) was utilized to constrain the bio-chrono-stratigraphic and depth-age relationship. Six major zones have been delineated from the bulk geochemical variation in the down core sediments from 210 subsamples. The zone I-VI was bounded between Present to 0.10 Ma [0 to 3m below sea floor (bsf)], 0.10-0.15 Ma (3 to 7m bsf), 0.15-0.17 Ma (7 to 9m bsf), 0.17- 0.21Ma (9 to 14m bsf), 0.21-0.77 Ma (14 to 20m bsf), and 0.71-1.59 Ma (20 to 28.85m bsf). The negative or least correlation of SiO_2 with CaO and Al_2O_3 suggests that two distinct (biogenic and terrestrial respectively) source of sediment deposition plays the dominant role in the south Andaman basin. The chemical index of alteration (CIA) value ranges from 60 to 84 with an average of 75 suggests that the sediments are derived from moderately weathered environment. The Chondrite normalized REE value of the 106 subsamples was compared with Upper Continental Crust (UCC), Post Archean Australian Shale (PAAS) and North American Shale Composite (NASC), volcanic (ash/pumice of Toba) and other continental detritus such as Andaman Island, Ganges, Brahmaputra and Irrawaddy suggests that the sediments deposited in this region are essentially derived from Irrawaddy and hinterlands of Andaman Islands. The down core variation of REE shows peaks of light rare earth element (LREE) in various depths with enrichment of glass shards implies that these glass shards layers (0.86m - 0.031 Ma, 1.85m - 0.064 Ma to 2.35m - 0.083 Ma, 12.66m – 0.20 Ma, 15.71m- 0.37 Ma, 22.02m – 0.98 Ma, 22.62m – 1.03 Ma and 24.93 – 1.23 Ma) are of volcanic ash/pumice derived from adjacent Volcanic island chains of Sumatra-Java region including Toba eruption. The major toba ash event such as Young Toba Tuff (YTT ~74Ka), Middle Toba Tuff (MTT ~540Ka) and Old Toba Tuff (OTT ~ 840Ka) is considerably matching with the inferred volcanic ash events in the present study. The Source of the majority of sediments seems to be channelled to South Andaman Basin from the Irrawaddy River system intercalated with volcanic sediment from Indonesia.

