

CERAMAH TEKNIK TECHNICAL TALK

Neogene palaeoceanography of the northern Indian Ocean: Evidence from the microfossils

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The above talk was delivered by Dr Arindam Chakraborty (UM) on 16th June, 2023 via Zoom. Some 30 members participated. An abstract of the talk is given below:

Abstract: The Neogene was a geological time period of great climatic, floral and faunal changes across the globe. The Miocene-Pliocene epoch has gained lots of attention due to the potential for understanding the climate sensitivity to CO₂ forcing and projected near future temperature rise. During this period, northern Indian Ocean experienced several climatic events. Among the various Neogene sequences in India, Andaman-Nicobar is most important for representing the marine deep-water facies and few shallow water sequences in the northern Indian Ocean. The rocks of deep-water origin in the offshore region have large inputs of biogenic. These sediments contain abundant foraminifera, nannofossils, radiolarians, diatoms, calcareous algae etc. The Neogene marine deep water and more rarely shallow water sediments exposed on Andaman and Nicobar group of islands in the northern Indian Ocean endows an excellent opportunity to reconstruct paleoenvironments based on qualitative and quantitative analysis of the marine biogenic components and in turn to document changing climate and its influence on the evolution of marine biota. For the reconstruction of past oceanographic changes, retrieval of proxy biotic records from the marine realms is a unique tool. The microfossils those can be used as proxies for marine temperature, nutrient levels and other environmental parameters. The calcareous and siliceous microfossils from the outcrops on Andaman and Nicobar group of islands and the recovered offshore cores show a diverse assemblage with tropical low latitude marker forms. Dominance of warm water microfossils during the early to middle Miocene is correlatable to the Miocene Climate Optimum (MCO). The nannofossil assemblages of this age also reflect strong preference for warm tropical climate and nutricline condition i.e., depth dependent high variation of nutrient content. The presence of relatively unusual assemblage compositions, especially abundant sphenoliths and small reticulofenestrids, in conjunction with rare discoasters and alongside common diatoms, are indicative of high-productivity surface waters and probably upwelling conditions in the late Miocene. In the Tortonian (upper Miocene), low abundance of discoasters and high abundance of small reticulofenestrids (<3 µm) indicate eutrophic condition. The high-productivity surface-water environments can be linked to the intensification of the Indian Summer Monsoon.

Siliceous microfossils from the early Pliocene sediments shows that there was decrease and cessation of biogenic silica in the region that may be due to nutrient depletion as an impact of Indonesian Through Flow (ITF) constriction. Well-preserved calcareous nannofossils have also been recovered from the Zanclean (lower Pliocene). During the Zanclean, warm water condition prevailed and a transgressive event was recognised in the northern Indian Ocean. The assemblages of calcareous algae (including both coralline red and halimedacean green algae) and benthic as well as planktic foraminifera recorded from the Serravallian, Tortonian and Piacenzian sediments of Little Andaman (Hut Bay) and Car Nicobar Islands indicate a fairly conducive benthic environment for the survival of the algal forms along with other biogenic components. Variety of characteristic growth-forms and taphonomic features have been noticed in the coralline algal taxa. Several biofacies have been identified from the three outcrops of Little Andaman (Hut Bay) and Car Nicobar Islands. Moderate environmental interference, hydrodynamic conditions and availability of substrate may have played a major role in the diversity of calcareous algae. The overall coralline algal and benthic foraminiferal assemblages indicate a shallow to relatively deeper bathymetry of approximately 20 to 40 m that corresponds to a more or less moderate to slightly higher hydrodynamic activity.

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