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Role of ancient marine algae in building a healthy global marine ecosystem

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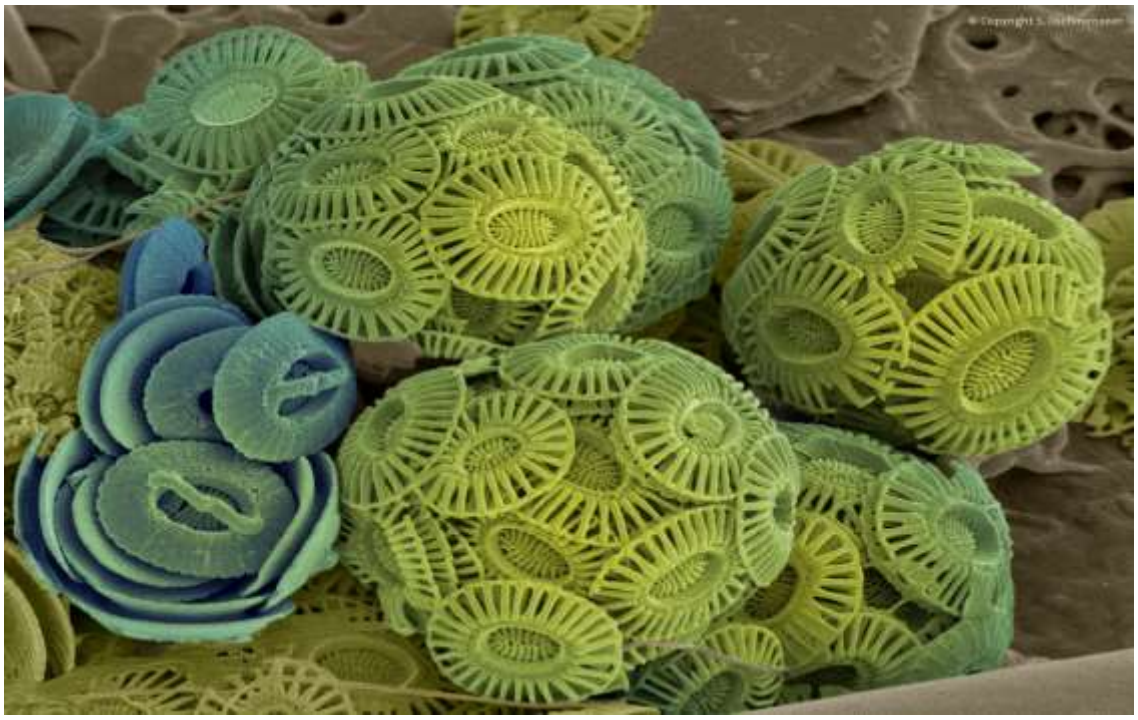
A study of a microscopic ancient marine algae (Coccolithophores) led by the National Centre for Polar and Ocean Research (NCPOR) found that due to the increase in the concentration of another single-celled algae known as diatoms is resulting in a decrease of oceanic calcium carbonate ($CaCO_3$) concentration in Southern Indian ocean. This in turn is affecting the growth and skeleton structure of the Coccolithophores, which has a potential significance in the world ocean ecosystem. Coccolithophores are single-celled algae, which live in the upper layers of the world's oceans and playing a key role in marine ecosystems and the global carbon cycle for millions of years. Coccolithophores are calcifying marine phytoplankton that produces up to 40% of open ocean calcium carbonate and responsible for 20% of the global net marine primary productivity.



Transmission Electron Microscope (TEM) image of Coccolithopores

Coccolithophores build exoskeletons from individual $CaCO_3$ plates consisting of chalk and seashells building the tiny plates on their exterior. Though carbon dioxides are produced during the formation of these plates, coccolithophores at the same time help in removing the carbon dioxide from the atmosphere and ocean by consuming it during photosynthesis. At equilibrium, coccolithophores absorb more carbon dioxide than the carbon dioxide they produce which is beneficial for the ocean ecosystem.

NCPOR, National Institute of Oceanography (NIO) and Goa University revealed that abundance and diversity enrichment of coccolithophores in the southern Indian Ocean is highly time dependent and influenced by various environmental factors like silicate concentrations, calcium carbonate concentration, diatom abundance, light intensity and availability of macro and possibly micronutrient concentrations.

The research team's analysis revealed that reduction of coccolithophore diversity in the early summer as well as late summer periods is due to an increase in diatom algae abundance which occurs after sea ice breakdown with climate change and ocean acidification, and increases the silicate concentration in the waters of the Southern Ocean. The Scientists also analyzed the maximum coccolithophore diversity during mid-summer in the Subtropical Zone (STZ) and Subantarctic Zone (SAZ) which is controlled by elevated silicate, low temperature, and low salinity conditions.

Scientists found that the biogeographic boundaries of coccolithophores in the southern Indian Ocean are highly variable, controlled by environmental factors in early and mid-austral summer, and grazing pressure in late austral summer. Also, physical forcing may play an important role in the transport of coccoliths and coccospheres at high latitudes, which is Indicating that the southward extension of the Coccolithophorus is important and may occur for short periods during hot summer.

Scientists suggest that climate change has significantly altered the coccolithophore calcification rate. It is due the different environmental factors that would influence where the species can live, their abundance, how fast they can grow, and their ability to adapt to those environmental changes that would ultimately determine the future coccolithophore calcite production. These investigations are important for future intervention to bring positive changes in the marine ecosystem and global carbon cycle.

Led by Shramik M. Patil, the research team comprised of Sathish Rahul Mohan, Sahina Gazi, of NCPOR, Ministry of Earth Sciences, Goa, Suhas S. Shetye of National Institute of Oceanography and Pallavi Choudhari of Goa University. The research paper is published in the *Journal of Deep-Sea Research Part II* (available online from 27 February 2020).