

STRUCTURED ABSTRACT

GEOBIOTECHNOLOGICAL APPROACH TO EVALUATE BACTERIA AS PROXIES FOR PALEO-SEA LEVEL RECONSTRUCTION

Senthil Kumar Sadasivam^{1,4*}, Bhavatharini Shanmuganathan¹, Shan P Thomas¹, Sivakumar Krishnan², Kartika Goswami³, Maha Dev³, Manoj Kumar Jaiswal³, Anbarasu Kumaresan².

¹Geobiotechnology Laboratory, PG and Research Department of Biotechnology, National College (Autonomous), Tiruchirappalli – 620 001, Tamil Nadu, India.

²PG and Research Department of Geology, National College (Autonomous), Tiruchirappalli – 620 001, Tamil Nadu, India.

³Department of Earth Sciences, Indian Institute of Science Education and Research (IISER), Kolkata, West Bengal, India.

⁴PG and Research Department of Botany, National College (Autonomous), Tiruchirappalli – 620 001, Tamil Nadu, India.

*Corresponding and presenting author: senthil@nct.ac.in

BACKGROUND

Although microbes account for 90% marine biomass, tracing bacteria for paleo-sea level reconstruction remains unexplored. Unveiling bacterial diversity in beach ridges through metagenomic approach and bacterial microenvironment annotation throw insights into tracing paleo-sea levels.

METHODOLOGY

A 25-m-long sediment core was excavated from a paleo beach ridge at Vettaikaraniruppu (VKI; 2.6Km inland; 10.553467 N, 79.835450 E) located at Cauvery delta, South East Coast of India. Bacterial diversity was assessed through V3 region targeted 16SrDNA metagenomic analysis. Micropaleontological studies and Optically Stimulated Luminescence (OSL) Dating were performed.

RESULTS

Metagenomic analysis of subsamples of VKI-top (VKI-T: 2.8m), VKI-middle (VKI-M: 7.2m) and VKI-bottom (VKI-B: 24.5m) revealed the presence of 38 bacterial phyla totally. VKI-B exhibited 16 phyla and only one phylum was exclusive for VKI-B, whereas the phyla increased to 37 and 15 were exclusive in VKI-M. However, the phyla decreased to 20 in VKI-T and did not show any exclusive phyla. Diversity indices revealed highest species richness at VKI-M depicting 701 bacterial species. VKI-B possessed 472 species and VKI-T showed 588 species. Marine bacterial diversity was the highest at VKI-M showing 29 exclusive marine bacterial genera, while VKI-T and VKI-B showed only 16 exclusive marine bacterial genera each. Marine bacterial species increased by 81% at VKI-M when compared to VKI-T and VKI-B. Consequently, marine bacterial signatures were present and abundant at each taxonomic level only at VKI-M. The abundance of marine bacterial genera at VKI-M had been validated by the presence of benthic and planktic foraminifera. Optically Stimulated Luminescence (OSL) chronology revealed the epoch of VKI-B as late Pleistocene (146.64 ± 36.81 Ka BP); VKI-M as mid Holocene; and VKI-T as late Holocene (6.04 ± 1.25 and 3.36 ± 0.42 Ka BP respectively).

CONCLUSION

Exploring bacteria for tracing sea-level reconstruction through metagenomic analysis is first reported in this study. The highest marine bacterial diversity and presence of abundant marine bacterial signatures at VKI-M, the pattern and ratio of abundance to rare marine bacterial species exhibited at three different depths of VKI illustrated the prospects of employing bacterial proxies for tracing paleo-sea level reconstruction. Geochronological and micropaleontological studies substantiate bacteria-based sea level reconstruction precision for Vettaikaraniruppu paleorecords.

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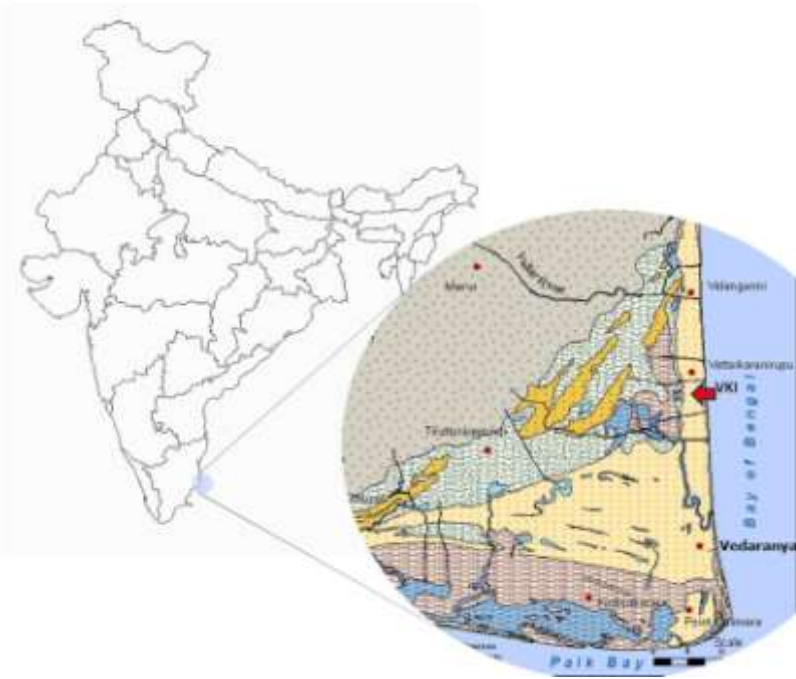


Figure 1 Location of Vettaikaraniruppu (VKI) beach ridge in the geomorphology map

Figure 3 Sedimentary layers of the VKI core showing OSL dates and foraminifers

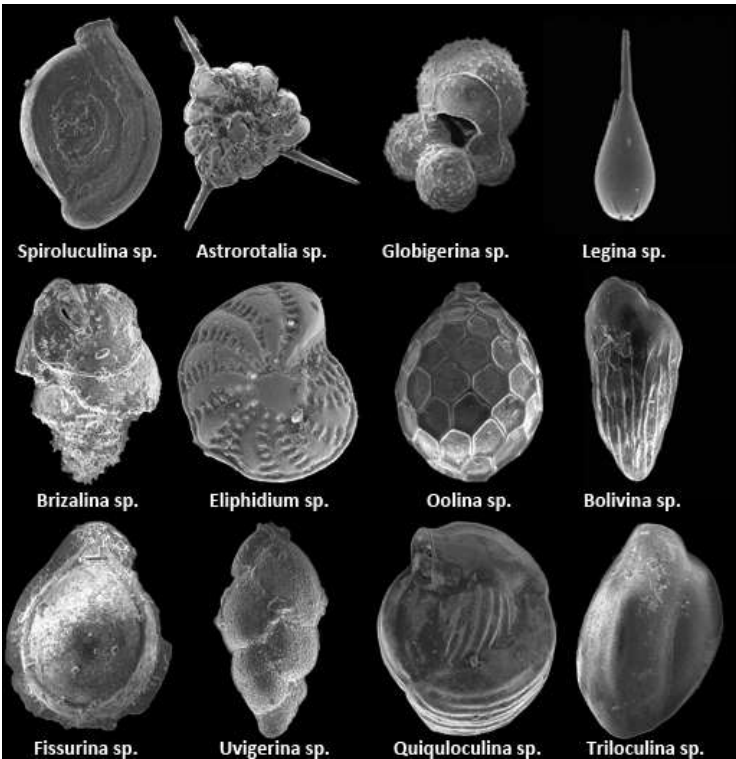
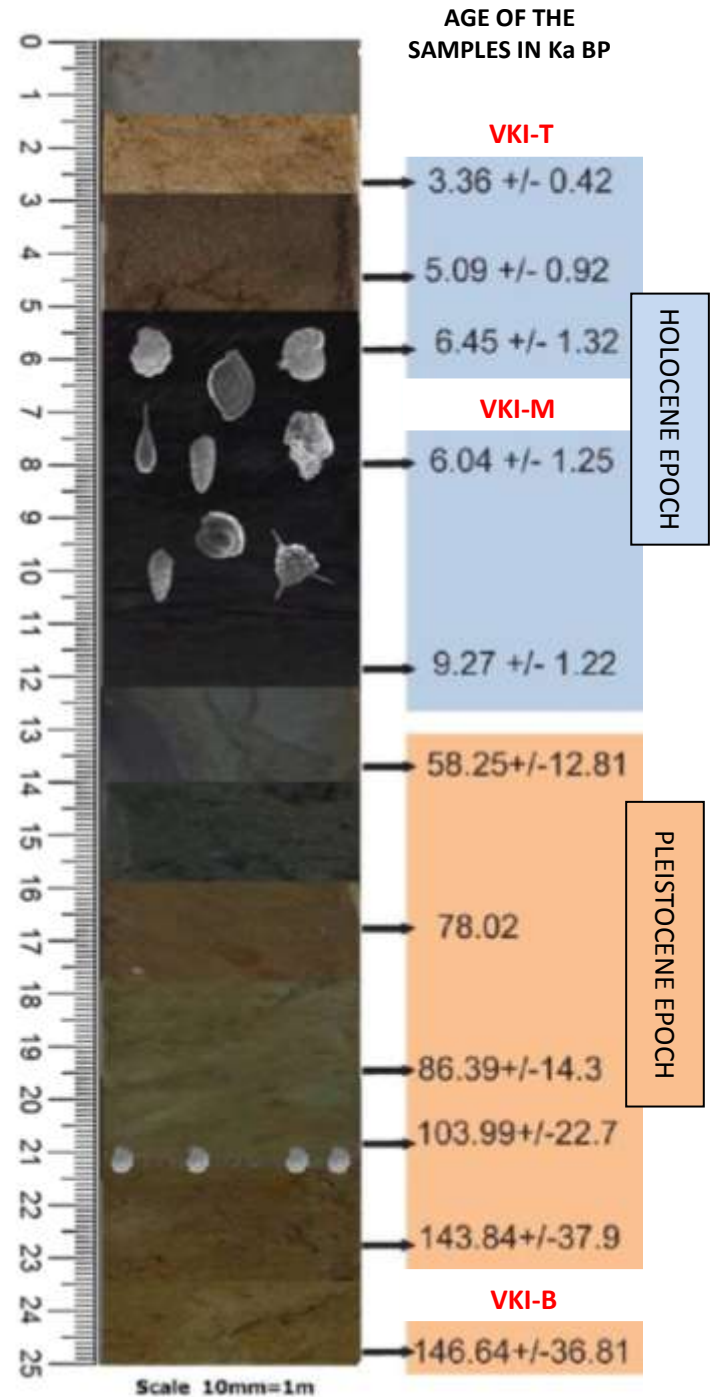


Figure 2 Foraminiferal species observed at VKI-M

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