



## Ecological response of foraminifera to past warming events in Bartonian section of Western India using carbon isotope stratigraphy

Sonal Khanolkar (1), Pratul Kumar Saraswati (1), and Karyne Rogers (2)

(1) Department of Earth Sciences, Indian Institute of Technology, Bombay, 400076, India (sonal.k.12@gmail.com), (2) National Isotope Centre, GNS Science, Lower Hutt, New Zealand

The presence of warming event in the Middle Eocene known as the Middle Eocene Climatic Optimum (MECO), is marked by an increase in seawater temperatures by 5° to 6°C and a corresponding negative carbon isotope excursion. The MECO is biostratigraphically constrained to have lasted from the later part of P12 to P13.

In this study, the carbon isotope stratigraphy and foraminiferal assemblage in the corresponding Bartonian section from a low- paleolatitude site in western India are studied to examine how foraminifera responded to warming during this interval. Litho-stratigraphically, the section is referred to as the Harudi Formation at the bottom, and the Fulra Limestone at the top. The base of the planktic foraminiferal zone P13, marked by the first appearance of *Orbulinoides beckmanni*, is recorded in the upper part of the Harudi Formation.

The  $\delta^{13}\text{C}_{org}$  records a marked negative shift of  $\sim 1.5\text{‰}$  ( $-24.5\text{‰}$  to  $-26\text{‰}$ ) at  $\sim 2$  meters below the base of P13. A previous study on the same section indicated a strong depletion in  $\delta^{13}\text{C}_{carbonate} \sim -3.5\text{‰}$  and  $\delta^{18}\text{O}$  values  $\sim -0.5\text{‰}$ . The negative excursion in  $\delta^{13}\text{C}_{org}$  also coincides with the appearance of *Nummulites obtusus*, *N. vredenburgi*, *N. spectabilis* and *N. praediscorbinus*. The smaller benthic foraminifera are dwarfed species of *Nonion*, *Nonionella*, *Rotalia*, *Brizalina* and *Bulimina*. The diversity of foraminifera is low ( $\alpha \sim 1 - 8$ ;  $H \sim 1 - 1.8$ ). A bloom of triserial planktic foraminifer *Jenkinsina* ( $>40\%$ ) coincides with  $\delta^{13}\text{C}$  excursion indicating eutrophic conditions. It is followed upward by a highly fluctuating and distinct positive excursion of  $\delta^{13}\text{C}_{org}$  ( $-25.3\text{‰}$  to  $-23.5\text{‰}$ ) around the P12 – P13 boundary. This interval of about 1.5m is characterized by an increase in planktic and larger benthic foraminifera (LBF) numbers including *Acarinina rohri*, *Acarinina topilensis*, *Orbulinoides beckmanni*, *Discocyclina*, *Linderina*, *Halkyardia* and *Lockhartia*. The diversity of foraminifera ( $\alpha \sim 14 - 38$ ;  $H \sim 2.2 - 3.4$ ), abundance and their size increases markedly in this interval. The overlying section is characterized by more stable  $\delta^{13}\text{C}_{org}$  values ( $-25.8\text{‰}$  to  $-24.2\text{‰}$ ). The foraminiferal assemblage continues to be dominated by larger benthic foraminifera, the main constituents of the platform deposited Fulra Limestone, suggesting oligotrophic conditions of deposition. There is a visible increase in the abundance and diversity of LBF.

We observe i) negative  $\delta^{13}\text{C}_{org}$  excursion in the upper part of P12 zone and corresponding low diversity, dwarfed foraminifera coinciding with the bloom of triserial planktic *Jenkinsina*. ii) a fluctuating  $\delta^{13}\text{C}_{org}$  at about P12 – P13 boundary, characterized by an increase in diversity and abundance of planktic and larger benthic foraminiferal species iii) a more stabilized values of  $\delta^{13}\text{C}_{org}$  in the overlying section spanning the most part of P13 marks the development of platform deposited carbonate succession.