

Temperature variability recorded in the laminae of Miocene lacustrine stromatolites from Ebro Basin, Spain

SANCHITA BANERJEE¹, PROSENJIT GHOSH^{*1,2}, YOGARAJ BANERJEE¹, LETICIA MARTIN-BELLO³, CONCHA ARENAS³, CINTA OSÁCAR³, LUIS F. AUQUÉ³,

¹Centre for Earth Sciences, Indian Institute of Science, Bangalore, India; ²Divecha Centre for Climate Change, Indian Institute of Science, Bangalore, India; ³Department of Earth Sciences, University of Zaragoza, Zaragoza, Spain

Email addresses: ¹sanchita933@gmail.com;

¹ybanerjee15@gmail.com; ³leticia.martin.bello@gmail.com;

³carenas@unizar.es; ³cinta@unizar.es; ³lauque@unizar.es

*Corresponding author: ^{*1,2} pghosh@iisc.ac.in

The Ebro Basin (northeastern Spain) preserves lacustrine calcitic stromatolites of early to middle Miocene age. Lamination of these stromatolites contain light dense, light porous and dark dense laminae, mostly grouped into alternating composite dark and light laminae, based on the (gray scale intensity) textural and colour variations [1]. Study of $\delta^{13}\text{C}_{\text{VPDB}}$, $\delta^{18}\text{O}_{\text{VPDB}}$ variations of composite laminae captured the signature of periodic changes of climatic and hydrological conditions during the process of deposition [1]. Clumped isotopic analysis of eleven composite laminae revealed temperature contrast during the carbonate precipitation. The estimated temperature using clumped isotope technique indicated warmer environment (22° - 32°C) during deposition of the light laminae and cooler (13 - 19°C) settings during formation of the dark laminae. The $\delta^{18}\text{O}_{\text{water}}$ estimated assuming an equilibrium condition during precipitation varied from -3.6‰ for the dark laminae, to -2.01‰ for the lighter members. The corresponding calcite $\delta^{13}\text{C}_{\text{VPDB}}$ values were -0.12 for the dark and -0.58‰ for the lighter laminae. Calcite $\delta^{13}\text{C}_{\text{VPDB}}$ and $\delta^{18}\text{O}_{\text{VPDB}}$ values are slightly different from the previously reported values but, the difference between the values of dark and light laminae ($\Delta^{13}\text{C}$ and $\Delta^{18}\text{O}$) are nearly similar. The analysis of stable isotopic composition and clumped isotope temperatures on 11 composite laminae suggested presence of water with lighter isotopic values during cold condition and warmer condition favoured enriched $\delta^{18}\text{O}_{\text{water}}$. Perhaps this implies cooler period during early and mid Miocene favoured more fresh water influx in the Ebro basin.

Refs: [1] L. Martin-Bello, et al., 2019, Palaeogeography, Palaeoclimatology, Palaeoecology 530.