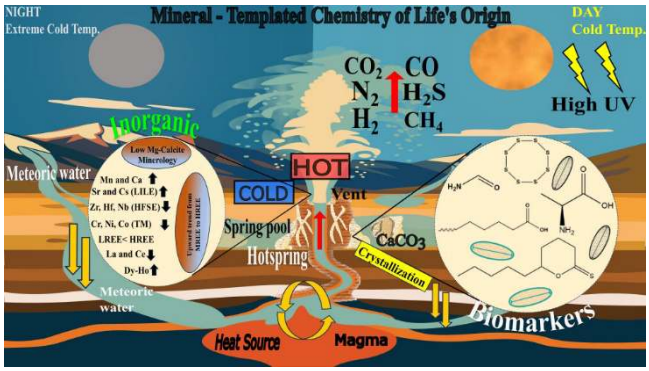
Birbal Sahni Institute of Palaeosciences

Monthly Summary of Research Activities (June 2025)

1. Important Highlights of Major Research Activity

Key Scientific Findings of the Month (June 2025)



Unraveling life's origin involves finding environments that can form and preserve organic molecules, with hydrothermal systems offering a likely setting. Terrestrial mineral deposits in the form of silicates and carbonates may have functioned as natural reactors that facilitated early prebiotic chemical reactions. At lab scale, calcium carbonate (CaCO3) surfaces accelerate key prebiotic reactions, yet natural sites focusing on organic preservation associated with CaCO3 remain limited. This study shows that CaCO3 can actively concentrate and stabilize organic molecules under extreme conditions. In this work, we present the first empirical demonstration that Puga, Ladakh's hot-spring travertine, hosts prebiotic molecules, serving as a natural template for mineral-driven organic reactions. X-ray diffraction showed C–O lattice distortions in calcite linked to biogenic input, while molecular analysis identified carbonate bands with organic groups. Biomarker analysis detected trapped biomarkers including traces of β-alanine derivatives (amino propanoic acid), pyran-2-thione, TMS-derivatized formamide, cyclooctasulfur (S8), and hexadecenoic methyl ester (fatty acid). Stable-isotopic signatures of travertine yielded δ18Ocarb ~ −24‰ VPDB and δ13Ccarb ~ −5‰ VPDB. Elemental geochemistry indicated low-temperature hydrothermal enrichment in large-ion lithophiles and depletion of high-field-strength elements. We hypothesized a four-step conceptual model emphasizing travertine's dual role in preserving inorganic tracers and organic precursors. Findings reveal that cold ambient conditions synergize with hydrothermal processes to host and concentrate prebiotic molecules within calcic matrices. Rapid CO2 degassing and cooling of vent fluids in a colder external environment trigger low-Mg calcite precipitation, encapsulating diatoms and organic moieties, offering new insights into mineral scaffolds that could have triggered early-life reactions (Chadhha et al., 2025).

Events during June 2025:

- NITI Aayog Consultative meeting of Institutional Heads on May 27–28, 2025.
- BSIP's Initiative on World Environment Day 2025: Towards a Plastic-Free Planet
- Memorandum of Understanding between BSIP & Chhattisgarh Forest & Climate Change Department, and Chhattisgarh State Biodiversity Board to advance research, conservation & climate resilience on 10th June 2025.
- International Yoga Day (21st June 2025)
- Health and wellness workshop (27th June 2025)

A total Seven research papers were published during the month in high impact Journals.

Photographs showing important highlights of major programs/research activities organizedduring June 2025: