

**MICROPALEONTOLOGICAL, BIOSTRATIGRAPHICAL AND STABLE ISOTOPE
GEOCHEMICAL ANALYSES OF THE P/E BOUNDARY INTERVAL, NAMMAL
GORGE, SALT RANGE, PAKISTAN**

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Abstract

The Patala Formation, Nammal Gorge Section, Salt Range, Pakistan yielded significant micropaleontological, biostratigraphical and stable isotope geochemical signatures pertaining to the Paleocene-Eocene Boundary (PEB) interval. Four distinct lithological units were identified in the Patala Formation in stratigraphic order from bottom to top; unit-1: is composed of creamy and light grey thick bedded to nodular limestone interbedded with dark grey and greenish shales, unit-2: is dominantly composed of dark grey shales, unit-3: is yellowish, thick bedded larger foraminifera rich limestone interbedded with greenish to yellowish brown shale and unit-4: it is dominantly composed of greenish grey shale. The top of unit-3 hosts closely spaced three unconformities demarcated as U1, U2 and U3. These frequently occurring unconformities may be the reflection of the Himalayan orogeny in the earliest Eocene subsequent to the India-Asia collision. From bottom to top, the detailed study of facies sequence and variation along facies are indicated by deepening then shallowing which is further followed by the deepening of the basin. A negative shift of 1.61‰ in $\delta^{13}\text{C}$ indicating the Carbon Isotopic Excursion (CIE) in unit-2 is used to represent the PEB interval. Additionally, the first appearance of the cosmopolitan dinoflagellate species, i.e. “*Axiodinium augustum*” coinciding with the negative excursion in $\delta^{13}\text{C}$ is another indication of the PEB interval. The PEB interval is also represented by The Larger Foraminiferal Turnover (LFT) Tethys-wide and is indicated by the replacement of the orbitoidiform larger foraminifera by orthophragminids, *Alveolina* and *Assilina* in the Salt Range, Pakistan. The orbitoidiform larger foraminifera including species of *Setia* and *Orbitosiphon* in the Lockhart Limestone and lower part of the Patala Formation represent the late Paleocene Smaller Benthic Foraminiferal Zone 4 (SBZ4). The first appearances of *Alveolina vredengurji*, *Discocyclina ranikotensis*, *Orbitoclypeus schopeni*, and *Assilina* sp. within the unit-3 of the Patala Formation represent the earliest Eocene SBZ5. The LFT coincides with the boundary between shallow benthic biozones SBZ4 and SBZ5 and closely correlates with the Paleocene-Eocene Thermal Maximum (PETM) and allows the recognition of the PEB interval in Patala Formation of the Indus Basin.