

Eocene larger benthic foraminifera of the Indus Basin, Pakistan: new developments

Muhammad Hanif¹; Ercan Özcan²; and Nowrad Ali^{1,3}

¹*National Centre of Excellence in Geology, University of Peshawar*

²*Istanbul Technical University, Istanbul, Turkey*

³*Department of Geology, University of Peshawar*
mhanif_nceg@upesh.edu.pk

Abstract

The larger benthic foraminifera (LBF) of the Patala and Drazinda formations Indus Basin, Pakistan have been revaluated in the three significant localities of the Indus Basin, Pakistan including the famous Thal section of Davies 1927 in Kohat, Nammal Gorge section in Salt Range and Zinda Pir and Rakhi Nala sections in Sulaiman Range. Three different groups of LBF were the focus of this study, these included orthophragminids of the type-locality of *Discocyclina ranikotensis* Thal, *Heterostegina* of Sulaiman Range and alveolinids of Salt Range.

New associations of the genera *Discocyclina* Gümbel and *Orbitoclypeus* Silvestri, not yet reported from Eastern Tethys, have been found in the Patala Formation at Thal. This work validates the controversial *D. ranikotensis* as the endemic species at least to the Indo-Pakistan region. The key taxa for orthophragminids zonation in peri-Mediterranean Tethys i.e. *Discocyclina archiaci* (Schlumberger) and *Orbitoclypeus schopeni* (Checchia-Rispoli) have been found in association with *D. ranikotensis*. A few other discocyclinid specimens showing affinity to *D. spansa* and *D. fortisi* suggesting a possible connection to western Tethys were also noted. According to the western Tethys orthophragminids zonation, this assemblage represent orthophragminid zone (OZ) 3. The typical western Tethyan taxa first appearing at or around the Paleocene/Eocene boundary (OZ1B/2, SBZ4/5) (e.g. assemblage of asterocyclinids, nemkovellids and ribbed orbitoclypeids) have not been identified. The occurrence of *D. archiaci* extends the geographical distribution of this taxon to eastern Tethys, which hitherto was only known from peri-Mediterranean region.

The stratigraphic utility of Eocene *Heterostegina* in western Tethys prompts an interest in the eastern Tethyan domain, where virtually no information exists on this group. The classical Eocene sections, Zinda Pir and Rakhi Nala, in west Pakistan offer a unique opportunity to fill the information gap. The genus here is confined only to the upper part of the Drazinda Formation ('*Pellatispira* beds' of the obsolete Kirthar series) associating with *Pellatispira*, *Silvestriella*, reticulate *Nummulites*, rare orthophragminids and other less significant LBF. *Heterostegina* specimens are characterized by a notably small, nearly flat, to flat test, a small proloculus and tight early spirals. The early operculinid chambers, few in number, are followed by the heterosteginid stage consisting of rectangular chamberlets, developed only in the median part of the test, but not in alar prolongations. A combination of these features permits their differentiation from the western Tethyan *Heterostegina*, also demonstrated morphometrically, and a new species, *H. indusensis* n. sp., is erected. Our data, along with the recent records of genus in tropics of Indian Ocean, show the differentiation of the eastern and western Tethyan heterostegines in Priabonian times and do not support a previous hypothesis that the genus was confined to the high-latitudes during this time.

The Patala Formation at Nammal Gorge was revisited with the aim to re-evaluate the larger benthic foraminiferal (LBF) assemblage. During this attempt, *Alveolina vredenburghi* Davies and Pinfold (1937) was encountered in ≤ 50 cm limestone bed lying 13m below the top of the Patala Formation. Therefore, this study also deals with the diagnosis, age and stratigraphic significance of *Alveolina vredenburghi* Davies and Pinfold (1937) recovered from Nammal Gorge and its comparison with the specimens reported by Hottinger et al. (1998).