



## **Danian clastic shoreface shift on time transgressive surface in Kashmir and adjoining basins, NW Himalaya, Pakistan**

Naveed Ahsan, Tariq Mahmood, Syeda Fakiha Ali Zaidi, Ayesha Ejaz, Syed Irfan Ali Zaidi, and Muhammad Armaghan Faisal Miraj

UNIVERSITY OF THE PUNJAB, INSTITUTE OF GEOLOGY, LAHORE, Pakistan (naveedahsan.geol@gmail.com)

Initial contact of Indian Plate with Kohistan Island arc, in Maastrichtian, restricted the Neo-Tethys in Hazara, Kashmir and adjoining basins that were generally developed on a widespread carbonate platform of Cambrian, Jurassic and Cretaceous ages. The initiation of collision created a bulge, particularly in the western areas now included in the Attock Hazara Fold and Thrust Belt to expose the Cretaceous sediments. However, Cambrian sediments were already exposed since Cambrian in the Kashmir Basin (eastern part) probably after the breakup of Pangaea in late Cambrian that created Muzaffarabad Paleohigh. Muzaffarabad Paleohigh restricted the deposition from Jurassic to Cretaceous in Hazara Basin, only. In lower Paleogene, a wide spread transgression overtopped Muzaffarabad Paleohigh and sedimentation resumed from NW to SE (Kashmir, Hazara and Potwar basins). The Danian transgression deposited/formed a limited succession of clastic, siliciclastic and carbonaceous sediments along with clays, laterite and bauxite in Attock Hazara Fold and Thrust Belt, Kashmir and Potwar. These deposits are represented by Hangu Formation, Danian in age.

In Kashmir Basin, Hangu Formation initiated deposition over Cambrian-Paleogene composite unconformity in Neo-Tethyan realm. Hangu Formation represents a channel deposit in eastern most part of Kashmir Basin (Devi Garh anticline) and mainly quartz arenite in the northern part of the basin near Muzaffarabad. In Kashmir Basin, Hangu Formation (at Chahla Bandi) is comprised of sandstone with some grit, ferruginous sandstone, bauxite and clay. Silty coal outcrops in the upper part of the formation. Age diagnostic palynoflora, pollen and spores are present in the silty coal horizons. At Tattapani section, laterite/bauxite and micaceous shale is present but in more proximal part near Devi Garh anticline, it is composed of sandstone deposited in fluvial channels. Paleocurrent study of these channels indicates NW depositional dip.

Transgressive carbonates overlying Hangu Formation of middle Paleocene age are represented by Lockhart Formation. These carbonates comprise thinly bedded nodular limestone (inner shelf) with intercalated shale in eastern part of Kashmir Basin. Upper Paleocene maximum flooding event covered the entire Indus, Hazara and Kashmir basins and Patala Formation (shale and limestone) was deposited followed by Eocene strata.

The hierarchy of Paleogene supercycle (Hangu, Lockhart, Patala, Margala Hill and Kuldana formations) in sequence stratigraphic framework indicates that Paleocene (cycle) and Danian clastics (paracycle) reflect relative changes in Neo-Tethyan sea level of different orders of magnitude. Paleogene is bounded by sub aerial unconformities at the bottom and top, whereas Paleocene contains sub aerial unconformity at the base and Maximum Flooding Surface (MFS) at the top (1st to 3rd cycle). Each lithological variation in Hangu Formation (in Danian paracycle, 3rd to 6th order) points to a specific system tract i.e. laterite represents a subaerial unconformity, shoreface quartz arenite indicates a LST/FSST and shales/coal belong to TST (Transgressive Systemtract). Sand and shale sequence is separated by MRS/TS whereas maximum flooding surface at the top of the Hangu Formation is represented by the transgressive nature of Lockhart Formation.