

TECTONICS AND GEODYNAMIC EVOLUTION OF INDO-PAKISTAN PLATE: CLOSURE OF TETHYS FROM PAKISTAN

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Abstract

Tectonics and geodynamic study of Indo-Pak is significant due to its present contact with Asia but past contact with Gondwana. Ironstone and ferruginous brown strata of Jurassic-Cretaceous boundary provide a clue of separation from Madagascar and start of northward journey at 135 Ma. Marine strata was dominant in the Lower Cretaceous while clastic sandstone were dominant in the Upper Cretaceous. Eastern part of upper Indus shows a wide range of erosion where Precambrian Salt Range Formation in Eastern Salt Range and Cambrian dolomite in Tatta Pani, Kotli are capped by Infra Tertiary boundary Indus Formation (bauxite/ laterite). This erosion show a long journey of more than 5000 km in a period of 67 Million years (135 Ma–68 Ma) with average speed of 8-10cm/year. When Indo-Pak plate came close to Asian plate, the stress created subduction of Tethys at the line of Karakoram Suture under Hindukush- Karakoram resulted. Further stress at later created subduction of Tethys sea plate at the line of Northern Indus Suture under Kohistan-Ladakh belt resulted in the form of Kohistan-Ladakh magmatic arc. Indo-Pak collided first time with Afghan block at Latest Cretaceous about 68 Ma. Western Indus suture (UthalBela-Wad Khuzdar-Nal- western Sorab- Kardgap/western Shirinab- Sheikh Wasil- west Quetta/Samungli- Kuchlak-Muslimbagh- Qila Saifullah- Zhob- western Waziristan- Kurram- Mohmand) and northern Indus suture (Mohmand-Swat-Besham-Chilas-Haramosh-Astore-Shontar top-south Deosai-Kargil-Ladakh) well developed by the obduction of ophiolites. Later on left lateral Chaman transform fault into existence by further northward moving of Indo-Pak plate. Indo-Pak plate docked with Kohistan-Ladakh Tethyan belt. During Early Paleocene the sea transgressed in these areas. During Late Paleocene, sea regressed from western Sulaiman, northern Balochistan, upper and uppermost Indus due to further uplift and continued collision. This collision is responsible for the birth of Paleo Indus River Systems generally flows from north to south and northwest to southeast. As a result of collision and continued northward movements, the northwestern margin of Indo-Pak became elevated creating a terrestrial environments for the deposition of Latest Cretaceous Vitakri Formation (overbank red muds and meandering sandstones) in the lower and middle Indus while the Indus Formation (bauxite and laterite) in the upper Indus. During Early Eocene the Northern Indus Suture and surrounding areas were uplifted enough to originate the Paleo Indus River systems supplying first time detritals/clasts from northwest and north and generally flows from northwest to southeast in Sulaiman (middle Indus) and north to south in upper and uppermost Indus. During Eocene the Paleo Indus river systems deposited the Shagala Group in Balochistan basin, Chamalang (Ghazij) in middle Indus, and Nammal, Panoba and Kuldana groups in upper Indus. Tethys further regressed and permanently closed from uppermost, upper and middle Indus of Pakistan during Late Eocene while the Lower Indus was under Tethys Sea. At Latest Eocene (40–35 Ma) Indo-Pak plate collided hard with Asia which resulted in the uplift, folding and faulting (mainly south verging thrusts) and deposition of terrestrial Potwar/Vihowa (Siwalik) Group. From Lower Indus Tethys closed permanently during Early Miocene. The last major geoevent at Pliocene- Pleistocene boundary created further uplift, folding and faulting and the deposition of Sakhi Sarwar Group (Dada conglomerate and Sakhi Sarwar sand and clays). This orogeny is responsible for creating highest peaks and present morphology.