

## **A geological field excursion in Pakistan**

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### **Abstract**

In the present plate tectonic scenario, Pakistan is located on the northwestern corner of the Indian plate. Before its present tectonic position, during the early Cretaceous, Indian plate was welded to Madagascar and Seychelles micro-continents. Rifting of India from Africa and Madagascar probably started in late Cretaceous. By 65 million years the Tethyan Ocean separated India from the southern Eurasian margin. This margin comprises the Karakoram-Hindu Kush mountain chains in the west and Lhasa block in the east. The sediments that had been laid down on the continental shelf extending south of Eurasia were eroded demolished before the Indian plate's persistent advance producing the Himalayan mountain chains and the foreland fold-and-thrust belts. The Precambrian basement rocks are exposed in Nagar Parkar, the extreme south east corner of Pakistan bordering the Indian Rajasthan, along the Sargodha High in Punjab and the Besham area of Khyber Pakhtunkhwa. Several plutonic activity ranging from Precambrian to Permian and even Himalayan age have been recorded in the northern areas. The Himalayan mountain chains from south to north are comprised of three large tectonic thrust slices and related folds separated by four major fault systems. These include the Main Frontal Thrust that carries rocks of the Himalaya southward into the Ganga fore deep. The Sub-Himalaya, which forms a 10- to 25-km-wide physiographic terrain, lies to the north of the Main Frontal Thrust. The Main Boundary Thrust carries Precambrian– Mesozoic low- grade schist and unmetamorphosed sedimentary rocks of the Lesser (or Lower) Himalaya southward over the Sub-Himalaya. Above the Lesser Himalaya, there are high-grade gneisses and granitic rocks of the Greater (or Higher) Himalaya. The Greater Himalaya consists of Precambrian gneiss overlain by Paleozoic and Mesozoic sedimentary rock of Tethyan origin. The progressive decrease in the age of thrusting from north to south within the Himalaya defines a foreland- propagating fold-thrust system. At depth, each of the three main thrusts of the system merges downward into a common décollement called the Main Himalayan Thrust. In the northern areas of Pakistan, a fossil island –arc-back arc system exists between the Eurasian and the Indian continental plates separated by the Main Karakoram Thrust (MKT) in the north and Main Mantle Thrust (MMT) in the south. A discontinuous belt of ophiolite running through the Muslim Bagh, Bela, Zhob and Waziristan valleys represent the suture zone between the Indian and Eurasian plate. Presently, the Chaman/Ornach-Nal Transform Fault Zone (COTFZ) marks the western plate boundary between the two continental plates. There are also Indus and Balochistan basins which are known for oil and gas potentials. The Indus Basin includes Upper, Middle and Lower Indus basins and preserves sediments of Late Proterozoic to Cenozoic age. The area west of collision belt represents the Balochistan basin, which includes the Makran Subduction Zone area and Kakar Khurasan Flysch Trough. The evolution of the Balochistan and Makran areas pursued a different fashion from that of the Indus Basin. The northward drift of the central Iran, Lut and Afghan micro-continents from the Gondwana, most probably started in Permian. The presence of arc associated volcanics in the Chagai and Raskoh magmatic belts of the Campanian age suggest that a subduction complex developed along the southern margin of these micro plates.