

## **Ophiolites of Pakistan: their mineral resources**

M. Sadiq Malkani\*

*Geological Survey of Pakistan, Muzaffarabad, Pakistan*

*\*Email: malkanims@yahoo.com*

In general, ophiolitic mélangé or ophiolitic complex consists of igneous rocks (ultrabasic, basic to acidic) with sedimentary and metasediments deposited on sea floor spreading and later this material was obducted by tectonic and geodynamic movement. It is generally believed that Ophiolites obducted show sutures or boundaries of tectonic plates. In Pakistan, the ophiolites are obducted in Karakoram suture, Northern Indus suture, Western Indus suture, Raskoh gap (arc-trench gap) and Washuk gap (arc-trench gap). The Karakoram suture is found between the Hindukush-Karakoram belt of Asian (Eurasian/Laurasian) continental plate (in the north) and Kohistan-Ladakh block of Tethys sea plate (in the south). Kohistan Ladakh block was part of Tethys sea plate and being weak subducted under the Hindukush-Karakoram block during Late Cretaceous by the northward movements and primary collision of Indo-Pakistan subcontinental plate and consequently the ophiolites were preserved along Karakoram suture line and magmatism in Hindukush-Karakoram block resulted. The preserved ophiolitic melanges are at Mirkani locality (found between Mirkani and Lowari pass), Drosh locality (found in Shishi stream of Chitral area), Sor-Laspur locality (found southwest of Shandoor pass), Yasin Valley, Chatorkhand locality (found in Ishkuman region), Chalt locality (found in Hunza region), Hispar locality, Panmah area, Shigor region, Hushe and Machelu localities. These ophiolitic melanges obducted during the late Cretaceous when the Kohistan-Ladakh block of Tethys Sea was sandwiched by tectonic collision of Indo-Pakistan subcontinental plate with Asian continental plate. The Northern Indus suture is located between the Kohistan-Ladakh block (in the north) and Khyber-Hazara-Neelum basin (Uppermost Indus/North most Indus basin; in the south). Just after the development of Karakoram suture, then the sandwiched block of Tethys subducted under the Kohistan-Ladakh block during the Late Cretaceous (by continuous compression and northward movement of Indo-Pakistan plate which created northward movement of Sandwiched Tethys block) and which resulted the magmatism in Kohistan-Ladakh block and also preservation of Ophiolitic melanges of northern Indus Suture. These ophiolites and igneous complexes are represented as Mohmand, Dargai (Malakand), Shangla, Besham (Jijal), Chilas, Sapat, Burzil (east of Astore; pass between Deosai and Taobat Neelum) and Dras (east of Burzil, SW of Kargil) ophiolitic complexes. Western Indus suture is located between the Indus Basin (in the east) which is part of Gondwanan fragment and Balochistan Basin (in the west) which is part of Tethys Sea. This suture is represented by Bela, Muslimbagh, Zhob and Waziristan ophiolitic complexes and obducted by the transpression of Indo-Pakistan subcontinental and Balochistan basin a part of Tethys during the northward movement of Indo-Pakistan plate. In Balochistan basin there are two ophiolitic complexes namely Raskoh and Washuk ophiolites. The Raskoh ophiolite is resulted during the subduction of Arabian Sea plate (northward movement during Paleocene-Eocene) under Chagai block of Tethys Sea. These subducted materials created the Chagai arc (Balochistan magmatic arc). This is the first arc trench gap. Later on arc trench gap was shifted southward at southern base of Washuk-Palantak-Zurati (Siahn Range, northern Makran Range) and resulted

Washuk ophiolite. This ophiolite is resulted by northward movement of Arabian Sea plate during Eocene-Oligocene. These ophiolitic complexes are potential sources of significant chromite, magnesite, asbestos, copper, manganese, construction materials and gemstones. Ophiolites of Pakistan and its mineral resources act as milestone for the development of Provinces and Pakistan.

**Keywords:** Ophiolites, Tethys; Arabian sea plate; Indian Plate; Asian Plate