

Geology of Ladakh Himalayas in northern India: Stratigraphy and age of the Shyok Suture Zone, northeast of Chang La Pass

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Ultrabasic-basic rocks and Mesozoic clastic-pyroclastic strata are widely distributed in the Shyok Suture Zone to the northeast of Chang La Pass, Ladakh, NW India, sandwiched by the Late Cretaceous-Paleogene granitic rocks. We surveyed the area to the northeast of Chang La Pass along the river running down from Tsoltak to the north to Darbuk (Durbuk) and divided the clastic-pyroclastic strata into the Tsoltak and Shyok Formations.

The Tsoltak Formation distributes about 6 to 7 km to the east of Tsoltak and mainly composed of black colored massive or laminated mudstone with thin sandy laminas. The lower part, about 200m thick, is associated with a few meters thick sandstones and thin alternating beds of sandstone and mudstone. The sandstones are medium- to coarse-grained quartzose wacke. A pebbly mudstone situated about 14 m above the base of the section contains granitic clasts. The lower part of the Tsoltak Formation apparently dips steeply (80-85 degrees) to the west, but the graded beddings in the sandstone beds show that these beddings are reversed. The upper part, a few hundred meters thick, consists mainly of black massive mudstone associated with laminated mudstone. The Tsoltak Formation is intruded by the gabbro of the Ultrabasic-basic rocks in its lowermost part. It is also intruded by dolerite, porphyrite or dacite dykes, and the lower (western) part of it changed into hornfels. The lower part yields such ammonoids as *Macrocephalites* sp. and *Jeanneticeras* sp. both indicating Early Callovian (Middle Jurassic) in age.

The Shyok Formation is subdivided into the lower and upper parts. The lower part is a conglomerate-sandstone unit: the lower part of it dominated in the alternating beds of quartzose sandstone and mudstone with minor amounts of conglomerate, while the upper part is occupied by conglomerate with sandstone and lenticular limestone. The lower conglomerate-sandstone unit gradually changes upward into thick pyroclastic rocks such as siliceous tuff, basic lapilli tuff and tuff breccia of the upper part. Thin limestone beds also exist in the lower part of the upper pyroclastic facies. Conglomerate and tuff breccia include large and many granitic clasts. The mudstone in the lower part yields molluscan fossils and limestone contains *Orbitolina*. This formation is probably middle Cretaceous in age. The relationship between the Tsoltak Formation and the Shyok Formation is unknown because of the absence of any outcrop showing the contact relationship.

The Jurassic Tsoltak Formation and Cretaceous Shyok Formation are both considered to have deposited on the continental shelf probably having matured continental hinterland, because they comprise the terrigenous clastic rocks, including quartzose sandstone and granitic clasts-bearing conglomerate/tuff breccia, and yield shallow marine molluscs and land plants.