



A Petrographic Atlas of Ophiolite: An Example from the Eastern India–Asia Collision Zone. Naresh Chandra Ghose, Nilanjan Chatterjee and Fareeduddin. Springer India, New Delhi. 2014, 234 pp. Price: €199,95.

The states of Nagaland and Manipur are known for lush green picturesque landscape with jagged hills, bereft of birds. The sun shines here earlier than most of the Indian Republic. The foggy valleys, jhum cultivation, music and dance blend well with an assembly of rocks that have drawn attention of tourists and scientists alike across the world. The hills bordering Myanmar (Burma) within the Indian territory are lacerated with many strategic (chromite, nickel, copper and molybdenum), and precious metals (platinum, native gold and silver), besides gemstones (amber, rondingite and peridot), limestone and serpentinite in abundance.

The book emerges from an intensive study by authors of a region lying in the zone of collision between two supercontinents called the Laurasia and the Gondwana. The area exhibits a segment of exhumed oceanic crust and mantle of the Tethyan Sea in Southeast Asia at converging tectonic settings or colliding boundaries between the Indian plate and the Burmese microplate in Late Cretaceous. The event synchronizes with the uplift of the Himalayan Mountains and the Indo-Burman Ranges (IBR) in the northern and eastern continental margins of the Indian continental plate respectively.

The zone of collision representing a geosuture, exposes vestiges of the exhumed Tethyan lithosphere (accretionary prism/fragments called ophiolite), along the Indian plate bordering Tibet to the north, and the IBR to the east. Detached outcrops of ophiolites of the Naga Hills

are exposed along the NNE–SSW direction of the IBR, and extend through the Chin Hills in Myanmar to Andaman–Nicobar Islands forming an arc, known for active volcanism in Barren Islands in the Bay of Bengal. This belt further extends in the southeast to join the Sunda arc, off the coast of Sumatra and Java, known as tectonically one of the most active regions in the world with frequent occurrence of earthquakes and volcanism due to subduction of Indo-Australian plate against Eurasia. The ophiolites or the remnants of a segment of the oceanic crust and the mantle exposed in the northern part of IBR, between the states of Nagaland and Manipur in northeastern India adjoining Myanmar in the east is called the Naga Hills ophiolite (NHO).

The NNE–SSW trending, narrow sigmoidal belt (200 km long and 2–15 km wide) of mafic–ultramafic rocks are exposed as imbricated sheets, comprised of tectonic peridotites/serpentinite, layered magmatic rocks represented by peridotite–pyroxenite–gabbroid–anorthosite, along with plagiogranites, minor dolerites, basalts (sub alkaline–alkaline), spilite, pyroclastic rocks and pelagic (oceanic) sediments containing radiolarian cherts. These together with the occurrence of very-low (zeolite and prehnite facies) to low-grade (greenschist facies) and high-pressure (glaucofane schists and barroisite eclogite), confirm that a complete assembly/sequence of ophiolite existed similar to those of Semail massif (on land) in Oman ophiolites, in the Tethyan domain prior to collision of the Indian plate with Eurasia. These rocks have undergone polyphase tectonism, metamorphism and metallogeny, correlatable with the Himalayan orogeny during the closure of the Tethyan Sea.

The most significant contribution of NHO is the occurrence of lenses of high-*P*/low-*T* assemblages of glaucofane schists and barroisite eclogite at the western tectonic margin in contact with the oceanic sediments (Disangs). Textural fingerprinting of S–C mylonites in lherzolites and blueschist supports ductile deformations in the shear zone along which the ophiolite was emplaced. The common basaltic protoliths of high-pressure glaucofane schists and eclogite are genetically related to a depleted mantle source. Metamorphosed through a clockwise *P–T* path, with peak *P–T* at ~2 Gpa/580–610°C, the eclogite underwent exhumation leading to transforma-

tion of barroisite and omphacite to glaucofane and other low-*T* minerals at ~1.1 GPa/540°C. The eclogite was possibly formed near the top of the crust which was subducting at 5–10 cm/year.

The atlas is first of its kind in scientific literature. The authors must be congratulated for bringing out the history of a vanishing (Tethyan) sea and documentation of each vicissitude of exhumation of the past as a chronicle. The senior author must be credited for putting together all facts collected by his team of research scholars over two decades of work in the region. The culmination of the stupendous effort is the patient examination of about 1500 thin sections under microscope for a period of four years. The authors have deftly organized the book by introducing the subject with an outline of the Oman and Troodos ophiolites, followed by a lucid account of the ophiolite occurrences along the northwestern, northern and eastern boundaries of the Indian plate together with their salient petrographic features. Details of the NHO, known for the occurrence of complete litho-assemblages of ophiolites, are well documented (chapters 3–8). Presentation of geological maps, field photographs and sketches showing relationship of different litho-units makes the complex subject easy to understand even for beginners. Tables containing EPMA data of minerals of representative samples, texture and mineralogical features of spinel-bearing peridotites and high-*P* assemblages and geological map depicting the occurrences of glaucofane schists and eclogites are distinctive features of the atlas. The second part of the book pertains to a pictorial presentation of ‘photomicrographs’ of a spectrum of rock types recorded in the NHO and associated economic mineral occurrences first time. The book is only one of its kind as a guide to study one of the most fascinating rock types in earth science, not only in the context of India but occurrences of such rocks elsewhere as well. The book is strongly recommended for students, research scholars, prospectors and also to concerned authorities in the Government.

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