

Metamorphic Evolution of Nagaland Oceanic Eclogites: New Insights into Neo-Tethyan Subduction Tectonics

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Eclogite-facies oceanic crust often records the entire thermal history of burial and exhumation cycles in fossil subduction zones. Oceanic high-pressure/low-temperature metamorphic rocks, including eclogites are rather rare in the Himalayan segment of the Alpine-Himalayan mountain chain.

Although, eclogites were previously reported from the Nagaland Ophiolite Complex, NE India, considered to be the south-eastern extension of the Yarlung-Tsangpo Suture Zone, their metamorphic evolutionary history and relationships with other high-pressure metamorphic rocks in the terrane are not well understood at present.

In this study, we establish the thermal history of eclogites from two new locations near Mokie (25°39'11.2"N, 94°46'18.6"E) and Thewati (25°33'20.2"N, 94°46'57.5"E), and corresponding to two different structural levels in the Nagaland accretionary complex. In both the locations, the eclogites occur as ~10-50 m long and ~3-5 m wide lensoidal bodies within a lawsonite blueschist facies metamorphosed package of oceanic basalt-limestone-radiolarian chert. Using textural, mineral compositional zonation, mineral reaction history, results of conventional geothermobarometry and calculated pseudosections, we establish an epidote to dry eclogitic facies, transitional to ultra-high-pressure metamorphic conditions ($T_{\text{Max}} \sim 630$ °C at ~26-28 kbar) for the Thewati eclogite and epidote eclogite facies metamorphism ($T_{\text{Max}} \sim 550-660$ °C at ~24 kbar) for the zoned Mokie eclogite body. The Thewati eclogite additionally records a near complete clockwise metamorphic P-T path of evolution involving an epidote blueschist facies prograde metamorphic stage and multiple phases of exhumation with cooling, the final one being in the lawsonite blueschist facies.

These findings from Nagaland provide the first comprehensive documentation of a cool apparent thermal gradient (~7-8 °C/km) at metamorphic peak, a cold mature stage of an intra-oceanic subduction system and the deepest exhumed section of subducted Neo-Tethys among the Yarlung-Tsangpo Suture Zone, Indo-Myanmar Ranges and the Central Ophiolite Belt of Myanmar.