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The metamorphic sole of the Andaman-Nicobar Islands: insights from petrology geochemistry and geochronology.

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Metamorphic soles occur as thin (<500 m) slivers of rock typically found below supra-subduction zone ophiolites. Their climax pressure-temperature conditions orange from 5 kbar and 500°C for the lower parts to 10-12 kbar and >800°C for the upper parts welded to the ophiolite. They are thought to witness the first stages of subduction initiation in an intra-oceanic setting, when the thermal regime of the nascent oceanic underthrusting is abnormally warm for subduction zones. Metamorphic soles provide then the record of the in-situ condition and dynamics of the plate interface during early subduction and are of interest to understand subduction initiation processes.

The Andaman and Nicobar Islands represent the central part of the Sunda-Sumatra-Burma subduction system. They expose an oceanic plate stratigraphy made of ophiolite as basement on which fore-arc sediments are deposited. The ophiolite of the Andaman Islands shows a supra subduction zone affinity and was formed around ca. 95 Ma, presumably during initiation of the modern western Sunda subduction zone.

We present here the petrological study of samples from a metamorphic sole locality on Middle Andaman Island. We collected the samples at the contact with the overlying Andaman ophiolite. The samples are fine grained amphibolite mainly made of amphibole and plagioclase with minor clinopyroxene, Ti-bearing phases (titanite, rutile and rare ilmenite) and epidote. An adularia retrograde event is seen in most samples, and associated to brittle small-scale normal faults. Yet, trace element mobility is deemed minimal, allowing fingerprinting of the protolith geodynamic affinity. The trace element content of the Middle Andaman Island metamorphic sole indicates that it was derived from both MORB-like basalts and from supra-subduction zone basalts coming from a variably depleted mantle source. We used the mineral chemistry to constrain peak temperature of 565°C to 695°C. Pseudosection modelling in the NCKFMASHTO system using Perple_X further constrain these conditions to 8 $\pm$ 2 kbar and 700 $\pm$ 100°C. We will also provide the first Ar-Ar step heating plateau ages and will interpret them in light of our petrographic study.

Recent kinematic reconstruction suggested that the Andaman ophiolites formed southwest of the intra-oceanic Woyla arc of Sumatra, upon its collision with Eurasia. We postulate that that the Andaman ophiolites and soles formed due to subduction polarity reversal upon Woyla arc-continent collision, southwest and oceanward of the Woyla arc.