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## Evidence of Paleo ANF and crustal architecture beneath the Narcondam: Insights from High-Resolution Reflection Seismic Data and Gravity modeling

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The seismically active Andaman-Sumatra subduction zone hosts a prolonged back-arc basin, with the Andaman Sea encompassing several volcanoes, notably the active Barren volcano and the dormant Narcondam volcano. Metamorphic features like the Alcock Rise and Sewell Rise are prominent in this region, experiencing oblique subduction between the Indo-Australian and Eurasian plates alongside backarc seafloor spreading. This convergence has led to significant crustal-scale fault systems like the Great Sumatra Fault, the Andaman Nicobar Fault, and the Sagaing faults. Due to limited geophysical datasets, particularly offshore Narcondam, we utilized three reflection lines (Line 1: 30 km, Line 2: 36 km, and Line 3: 36 km) derived from industry and corresponding satellite gravity data to complete the objectives of this study. We employed F-K and parabolic Radon filtering methods on the seismic data, eliminating noise and seawater multiples from the lengthy east-west 2D seismic profile lines. Subsequently, semblance-based conventional processing techniques were applied to visualize the subsurface. The water depths in the basin range from 1262 to 1554 meters along the profile, with the thickest sediment (~2.35 km) observed at CDP-2877 on Line 1. Satellite gravity data aided in deciphering the crustal architecture of the study area using gravity modeling. The crust's nature beneath Narcondam remains a subject of debate, whereas below Alcock Rise, some authors suggest either oceanic or island arc crust. Our integrated geophysical approach, encompassing gravity modeling, seismic interpretation, and focal mechanism solutions, pivots in evaluating evidence related to the paleo ANF. This comprehensive method allowed for an in-depth examination of the crustal architecture and upper mantle structure beneath both Narcondam Island and the northern part of Alcock Rise. The interpreted seismic section along with the focal mechanism interpretation in the basin indicates the presence of the Paleo ANF, spanning the basin and extending to the Moho. Its significance lies in facilitating fluid migration and influencing depocenter variation during the basin's evolution.