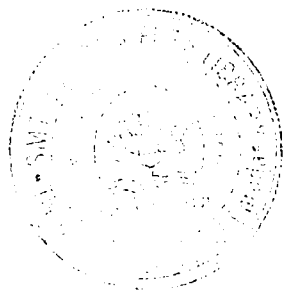

Abstract

The prime focus of the present study is to understand the evolutionary history of Andaman Subduction Zone by unravelling the evidences preserved in the sediments. For this, we studied ash deposits preserved in the sedimentary records and determined the timing of past major volcanic activities in the Andaman region. The oldest record of volcanism from the Andaman region comes from the tephra interbedded in the Eocene and Mio-Pliocene age sedimentary rocks on the Andaman Islands. From our study on seven discrete ash layers in the core raised from the Andaman Sea, we established that the ash layers are uniquely sourced from the nearby Barren Island Volcano. We reconstructed the eruptive history of this volcano by dating foraminifers (AMS ^{14}C dating) in sediment layers and found that the seven ash layers represent major eruptions at ~72, 71, 62, 24, 17, 12, and 8 ka. Isotopically correlating the precaldera volcanics exposed on the volcano to the uppermost ash layer (AL-1) in the core, we infer that the caldera of Barren Island volcano is younger than 8 ka. The sedimentary records preserved in the Andaman Islands (Late Cretaceous to present) and the Andaman Sea (Pliocene to present) are also studied in order to understand the tectono-sedimentary processes occurring in the subduction zone environment. The study of sedimentary rocks from the Andaman Islands clearly suggests that the Mithakhari Group sediments, deposited during the early to middle Eocene, were derived predominantly from mafic igneous sources comprising suprasubduction ophiolites and volcanic arc rocks with minor contributions from the Himalayan/Indian Shield sources. In comparison, the Andaman Flysch Group sediments appear to have been derived from mixed sources with dominance of Himalayan sources. The local arc/ophiolite sources possibly contributed >80% of sediments during the deposition of rocks of the Mithakhari Group, whereas the same sources contributed about 60-80 % during the deposition of the Andaman Flysch Group. We believe that the substantial increase in the sediment input from the rising Himalaya during the deposition of the Andaman Flysch Group was result of large scale weathering, erosion and transportation of sediments through the paleodrainage system developed along arc and suture zone. In order to understand the impact of climate on weathering and erosion, and supply of sediments in the past, sediments in the core (SK-234-60) from the Andaman Sea were also

studied. The study reveals that the western Andaman Sea show relatively higher contribution of sediments from mafic sources of the Indo-Burman Ranges, while sediments from the Irrawaddy river system dominate in the sediments deposited in the central and eastern Andaman Sea. The elemental and isotopic compositions of the sediments show significant variations in the relative supply of sediments from sources over glacial-interglacial timescale. The changes observed reflect influence of climate on erosion in source areas and relative supply of sediments to sea. Significant increases in the relative contribution of sediments from mafic Indo-Burman sources at ~8 kyr, ~20 kyr (LGM), ~36 kyr, ~44 kyr, ~52 kyr and ~58 kyr are related to the weakening of the Asian summer monsoon, which restricted material contribution from the Himalayan source. Also, at ~6 kyr, ~10 kyr, ~15 kyr, ~46 kyr, ~54 kyr and ~60 kyr and ~72 kyr there were higher sediment contributions from higher Himalayas and continental Myanmar sources through Irrawaddy and Ganga-Brahmaputra rivers. These could have been resulted from intensification of Asian summer monsoon, which in turn could be correlated to the global events of warm climate. The overall contribution of sediments derived from the Indo-Burman sources increased since the LGM. This is inferred to be related to the strengthening of the surface currents in the north-western Andaman Sea due to increase in the sea level after the LGM which resulted in reopening of "Preparis North Channel" through which substantial quantity of sediments from the NE Bay of Bengal entered into the Andaman Sea. From the study of uplifted coastlines of two islands, seismic history of the islands for past 9 kyr was reconstructed. Earlier reports and our results reveal that the Andaman region had experienced a major earthquake and associated tsunami event at ~500 (or ~600) cal yr BP. Combining our data with the available data on such events in this region we have been able to determine that there have been at least 14 major landscape changing seismic events between ~40 kyr BP to present, with a hiatus between ~19.5 and ~8.5 cal kyr BP. We propose that, in a similar fashion as observed subsequent to the 2004 earthquake, the Andaman Islands have been experiencing tectonic upliftments in the north and subsidences in the south, for the last ~40 kyr, along the so called "pivot line" proposed by Meltzner et al. (2006).

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