Hybrid long-period volcanic events observed in off Nicobar region, the Andaman Sea from a passive OBS experiment

Karanam Kattil Aswini¹, Pawan Dewangan¹, Kattoju Achuta Kamesh Raju¹,², Yatheesh Vadakkeyakath¹, Pabitra Singha¹, Ramakrushana Reddy¹, and Lalit Arya¹

¹CSIR-National Institute of Oceanography, India, Geological Oceanography Department, Dona Paula, Goa 403004, India (aswini.kk5@gmail.com)
²ESSO-National Centre for Polar and Ocean Research, Vasco-da-Gama, Goa 403804, India

The off Nicobar region in the Andaman Sea is witnessing frequent earthquake swarms after December 2004 Tsunamigenic earthquake in January 2005, March and October 2014, November 2015 and April 2019. In this study, we present the geophysical evidence of active volcanism in the Off Nicobar back-arc region on 21st and 22nd March 2014 based on a passive Ocean Bottom Seismometer (OBS) experiment. We detected a series of hybrid earthquake events characterized by the onset of high-frequency signal (1-10 Hz) which is followed by a long period waveform of up to 600s having a range of 0.1-1 Hz. The waveforms appear to be emergent and lack the onset of a distinct S-phase. We also observed a very high frequency (10-40 Hz) hydro-acoustic phase in the coda of long-period events. These hybrid events are considered to be volcano-tectonic (VT) events that may trigger magmatic activities in the Off Nicobar region. We have identified and located 141 high-frequency events on 21st and 22nd March 2014 using hypocent v.3.2 program and they are distributed along NW-SE direction aligning with the submarine volcanoes defining the volcanic arc as observed in the high-resolution bathymetry data. The fault plane solution of the major high-frequency events suggests strike-slip faulting with the strike, dip and rake values of 334°, 89° and 171°, respectively along the direction of the prevalent sliver strike-slip faulting in the Andaman back-arc region. We propose that the upward movement of magma is a plausible mechanism which can explain the frequent occurrence of earthquake swarms in the off Nicobar region. The stress generated from magma movement may initially trigger shallow VT events such as faulting or dike intrusions and later generate long period ringing associated with the resonance of the magma chamber. The shallow nature of the events also generates a hydroacoustic wave which is detected in the OBS experiment as the source region is in the SOFAR channel.