

Volcanology and eruptive styles of Barren Island: an active mafic stratovolcano in the Andaman Sea, NE Indian Ocean

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Abstract Barren Island (India) is a relatively little studied, little known active volcano in the Andaman Sea, and the northernmost active volcano of the great Indonesian arc. The volcano is built of prehistoric (possibly late Pleistocene) lava flows (dominantly basalt and basaltic andesite, with minor andesite) intercalated with volcanoclastic deposits (tuff breccias, and ash beds deposited by pyroclastic falls and surges), which are exposed along a roughly circular caldera wall. There are indications of a complete phreatomagmatic tephra ring around the exposed base of the volcano. A polygenetic cinder cone has existed at the centre of the caldera and produced basalt-basaltic andesite aa and blocky aa lava flows, as well as tephra, during historic eruptions (1787–1832) and three recent eruptions (1991, 1994–95, 2005–06). The recent aa flows include a toothpaste aa flow, with tilted and overturned crustal slabs carried atop an aa core, as well as locally developed tumuli-like elliptical uplifts having corrugated crusts. Based on various evidence we infer that it belongs to either the 1991 or the 1994–95

eruptions. The volcano has recently (2008) begun yet another eruption, so far only of tephra. We make significantly different interpretations of several features of the volcano than previous workers. This study of the volcanology and eruptive styles of the Barren Island volcano lays the ground for detailed geochemical-isotopic and petrogenetic work, and provides clues to what the volcano can be expected to do in the future.

Keywords Volcanism · Barren Island · Andaman and Nicobar Islands · India · Indian Ocean · Andaman Sea

Introduction

The Barren Island active volcano lies in the Andaman Sea, northeastern Indian Ocean. It is situated ~70 km east of India's Andaman Islands chain, where sequences of oceanic volcanic and metavolcanic rocks (pillow basalts, ultramafics, serpentinites, greenstones) as well as flysch sediments are exposed (e.g., Allen et al. 2007). The Andaman Trench, along which the NE-moving Indian Plate currently subducts beneath the Burmese Plate, is 250 km west of the volcano. The tectonic scenario is complicated by the presence of active back-arc spreading in the Andaman Sea ESE of Barren Island (Fig. 1; Curray et al. 1979; Kamesh Raju et al. 2004; Khan and Chakraborty 2005; Subba Rao 2008). Barren Island is the only active volcano in Indian territory, and the northernmost active volcano of the great Indonesian arc. To the north of Barren Island are two important dormant volcanoes: Narcondam (India) and Popa (Myanmar). Narcondam, an island volcano ~140 km NNE of Barren Island, may have erupted in the Holocene (Simkin and Siebert 1994; Siebert and Simkin 2002). If so its name (from the Sanskrit "Narak kundam", hell pit) may well be

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