Geophysical Research Abstracts
Vol. 19, EGU2017-17432, 2017
EGU General Assembly 2017

Multi-phase structural and tectonic evolution of the Andaman Sea Region

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We present a new regional tectonic interpretation for Myanmar and the Andaman Sea, built within the framework of global plate motions. In our model the Present Day Andaman Sea region has been subjected to multiple phases of extension, culminating in its mid-Miocene to Present Day opening as a rhomboidal pull-apart basin.

The Andaman Sea region is historically thought to have developed as a consequence of back-arc opening associated with plate convergence at the Andaman-Nicobar subduction system. We have undertaken detailed structural interpretation of potential field, Landsat and SRTM data, supported by 2-D crustal models of the Andaman Sea. From this analysis we identified several major north-south striking faults and a series of northeast-southwest striking structures across the region. We have also mapped the extent of the Andaman-Nicobar Accretionary Prism, a fore arc trough and volcanic arc, which we associate with a phase of traditional trench-parallel back-arc extension from the Paleocene to the middle Miocene. A regional tectonic event occurred during the middle Miocene that caused the cessation of back-arc extension in the Present Day Andaman Sea and an eastward shift in the locus of arc-related volcanism. At that time, N–S striking faults onshore and offshore Myanmar were reactivated with widespread right-lateral motion. This motion, accompanied by extension along new NE-SW striking faults, facilitated the opening of the Central Andaman Basin as a pull-apart basin (rhombochasm) in which a strike-slip tectonic regime has a greater impact on the mode of opening than the subduction process.

The integration of our plate model solution within a global framework allows identification of major plate reorganisation events and their impact on a regional scale. We therefore attribute the onset of pull-apart opening in the Andaman Sea to ongoing clockwise rotation of the western Sundaland margin throughout the late Paleogene and early Miocene, possibly driven by the opening of the South China Sea to the east. Consequently, the obliquity of plate convergence along this margin increased, ultimately resulting in a change from minor strain partitioning to hyper oblique convergence and full strain partitioning by the mid-Miocene.

Investigation into the effects of slab-steepening and dynamic subsidence in the Indochina region could be used as further tests of our proposed tectonic evolution of the Andaman Sea.