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# New Constraints for the Neogene Tectonic Evolution of Southeast Asia from Geodesy and Tomography

Speaker
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ABSTRACT

Southeast Asia is located at the triple junction of convergent major lithospheric plates, and is presently affected by important shortening processes. Within this geodynamic setting most of the sedimentary basins in this area, are tectonically inverted during the Neogene.

Recent developments of the geodetic (GPS) and tomographic techniques offer new tools to precisely quantify the present and recent tectonic processes. The GEODYSSEA project combining these tools with tectonic interpretations was conducted in the past 5 years in Southeast Asia, in cooperation with local agencies of the ASEAN countries.

GPS measurements acquired in 1994 and 1996 show that among the stations installed in SE Asia, those located in Vietnam, Malaysia, Thailand, West Borneo, Eastern Sumatra and most of Java belong to a rigid « Sundaland Block » moving with respect to the surrounding plates. This block includes the South China Sea oceanic floor, most of the Indochina peninsula, West Borneo, the Sunda shelf and part of Indonesia. This Sundaland Block is presently rotating clockwise with respect to Eurasia (South China), around a pole located south of Australia; its motion is toward the ENE and ranges from 14 to 25 mm/yr from East Java to North Sumatra.

Wide deformation zones fringe the block.

- to the east, the GPS measurements reveal the active convergence with the Philippine Sea plate, which is absorbed across a 600 km wide zone, involving east Borneo, the Makassar Strait, the margins of the South China, Sulu and Celebes seas, the Philippine Mobile Belt (extending from Luzon to the Molucca Sea), and the mosaic of continental blocks jammed into the Philippine Sea Plate / Australia / Sundaland triple junction.
- to the north, the South China continental margin is also an active 500 km-wide dextral shear zone extending along the Sundaland/South China blocks boundary. This wide deformation zone is reactivating most of the faults along the Chinese continental borderland.
- to the west, the Central Basin of Myanmar and the Sagaing fault both accommodate the 3.5 cm/yr northward motion of India across a 300 km-wide deformation zone.

Using these GPS results we are able to quantify the amount of active shortening absorbed along each of the major tectonic boundaries of the complex deformation zones surrounding the Sundaland block.

The new tomographic model, also developed in the frame of the GEODYSSEA project, revealed the presence in the upper mantle of velocity anomalies interpreted as the trace of the subducted oceanic crust slabs. This allows precise estimation of the amount of subduction that has occurred along the margins of the Sundaland block.

If we assume that rates of convergence of the major plates have remained constant during the Neogene, we can extrapolate the amount of active shortening provided by GPS over the last 15 or 20My using the length of the slabs projecting into the mantle. The result is a precise reconstruction of the active margins history around the Sundaland Block.

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Preliminary results of this study indicate Neogene kinematic reconstruction of Southeast Asia can now be well constrained using geodesy and tomography. This reconstruction needs to take into account the very wide distributed deformation zones present along the tectonic boundaries of Sundaland, where most of the Southeast Asia sedimentary basins were inverted during the Neogene.

**About the author**

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He had received his PhD in Structural Geology in 1982 from the University of PARIS Sorbonne for a work on the Franciscan belt in Baja California (Mexico).
His experience is two folds: Field work in structural Geology in various types of orogenic belts around the world (SE Asia, Mexican Pacific Cordilleras and the Tethyan belt in Europe), and marine geology.