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Editorial: Episodic plate destruction and construction in Southeast Asia: observations, modeling, and case studies

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Editorial on the Research Topic
Episodic plate destruction and construction in Southeast Asia: observations, modeling, and case studies

Episodic crustal thickening in orogenic belts

Episodic crustal shortening and thickening is geophysically revealed in the Himalayan orogenic belt. Whether brittle or ductile behavior dominates lower crustal deformation remains debated. Gu et al. obtained the first electrical structure in the western Himalayan orogenic belt (i.e., the western Qiangtang terrane and its surrounding area) using magnetotelluric (MT) data and suggested that ductile deformation dominates the mid-lower crustal deformation through N-S directed viscous deformation zones. The viscously deformed region may be formed by mantle upwelling in the mid-lower crust, which contributes to the regional development of surface normal faults. Furthermore, the study suggested that the major regional deformation boundary, i.e., the Longmu Co-Gozha Co fault, does not cut through the entire crust due to the ductile rheology of the lower crust. Wang et al. studied the detailed crustal structures of the Northeast Tibetan Plateau using the receiver function method, and reported episodic crustal shortening and thickening that occurred due to the far-field compression from the Himalayan orogenic belt. The results revealed brittle upper crustal shortening with intensive faulting and ductile lower crustal thickening featured by duplexes. Lei et al. further investigated the crustal and mantle lithospheric structures in the central Himalayan orogenic belt using 3D MT data. The study suggested ductile mid-lower crustal deformation with the possibility of local crustal flow based on the estimated high Moho temperature. They further proposed the mode of Indian plate subduction with lateral variation in the slab dipping angle, i.e., from flat subduction in the west to steep subduction in the east.

Episodic crustal thinning in orogenic belt

Continental rifting may occur along orogenic belts and the driving mechanism of rifting remains debated. Imaging the detailed crustal structures is the key to understand the rifting dynamics in the context of collision. Xiang et al. revealed the crustal structures of the youngest Cona rift in southeastern Tibet and highlighted the importance of the decollements developed along the upper-lower crustal interface on the depth-dependent extension of the Cona rift. In the Yardong-Culu rift located to the northwest of the Cona rift in the southeastern Tibet, Xiang et al. further imaged a mid-crustal detachment layer that displaced the overlying crust eastward by 100 km.

Episodic lithospheric deformation along orogenic margins

Large lithospheric heterogeneities (both vertically and laterally) are commonly present along the orogenic margins and can affect lithospheric deformation of the orogenic belts and the surrounding tectonic units, e.g., cratons. In this Research Topic, Ji et al. investigated the lithospheric structures of the western and eastern North China Craton blocks separated by the Trans-North Chian Orogen using the magnetotelluric data. The heterogenous lithospheric structures from west to east are imaged and explained as a consequence to episodic plate motion. Using a joint inversion technique, Zhang et al. revealed the horizontal and vertical lithospheric heterogeneities in the Tien Shan orogenic belt, and suggested the underlying mantle flow erosion and episodic plate destruction. Sun et al. studied lithospheric deformation during collision by employing 2D thermo-mechanical numeric modeling. They found that lithospheric deformation is affected by lateral rheological contrast and suggested that the lateral transition of convergent strain leads to the activation of new orogens resulting in episodic orogenic events.

Episodic lithospheric deformation along passive margins

Extensional lithospheric deformation dominates the evolution of passive margins. The South China Sea passive margins experienced episodic tectonics since Cenozoic. Using high-resolution 3D seismic data, Liang et al. studied the faulting activities in the rifted basins along the northern margin of the South China Sea and revealed a series of episodic faulting events that shaped the basin geometries. Using geochemical methods, Chen et al. presented new analyses of *in situ* major element, trace element and Sr isotopic compositions of basaltic rocks in the Hainan island and concluded the influence of the Hainan plume on the enriched mantle-2 type reservoir and South China Sea spreading.

Episodic arc volcanism along subduction zones and oceanic plateau

Episodic arc volcanism is common in subduction zones and a thorough understanding of the underlying mechanisms requires various geophysical techniques. In this Research Topic, Yang et al. proposed a gravity inversion method using ocean bottom seismometer (OBS) to obtain the fine crustal structures of the Ryukyu trench and revealed the lateral variation in crustal thickness of the overriding plate influenced by arc volcanism, providing important insights from fore-arc to back-arc evolution. Bai et al. investigated the volcanic eruption in the Tonga volcanic arc using the infrasound wave data and numerical simulation method. The released sulfur dioxide during the volcanic eruption is estimated in this study. Xu et al. studied the crustal structures of the Tamu Massif using P-wave coda auto-correlation methods and hydrophone waveform data and revealed a shallow rock layer with alternating eruption of dense massive lava and sparse pillow lava flow that illustrate the complex dynamics of magma eruption.

Author contributions

JL: Writing–original draft, Writing–review and editing. ZL: Writing–original draft, Writing–review and editing. PH: Writing–original draft, Writing–review and editing. TX: Writing–original draft, Writing–review and editing. LZ: Writing–original draft, Writing–review and editing. XZ: Writing–original draft, Writing–review and editing. JW: Writing–original draft, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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