9th FTSES 2024 Penghu, Taiwan

9th France-Taiwan Symposium in Earth Sciences
Session: Neotectonics/ Structural Geology/ Geomorphology

Near-offshore fault structures in SW Taiwan and their tectonic implications

Chin-Yeh Chen[1], Yunung Nina Lin[1], Ho-Han Hsu[2], Yu Wang[3], Yin-Hsuan Liao[4]

[1] Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan
[2] Institute of Oceanography, National Taiwan University, Taipei, Taiwan
[3] Department of Geosciences, National Taiwan University, Taipei, Taiwan
[4] Ocean Center, National Taiwan University, Taipei, Taiwan

Escape tectonics, characterized by crustal-scale blocks with discrete kinematic movements along large strike-slip faults, has been proposed as the model to explain the ongoing crustal motion in SW Taiwan for the last three decades. Earlier studies utilized GNSS observations, seismic information, geological microstructures, and sandbox experiments to support the occurrence of escape tectonics in this region. Subsequent research employing numerical modeling and a dense GNSS network has however posed challenges to this idea. Since most of the former investigations are based on onshore observations, this study seeks evidence or counterevidence in the near-offshore region. The approach involves reprocessing a collection of vintage marine reflection seismic data, analyzing interferometric synthetic aperture radar (InSAR) time series, and interpreting the bathymetry and sub-bottom profiler (SBP) data along with the reprocessed seismic data. The seismic profiles are strategically selected to cross the major onshore strike-slip faults such as the Chishan-Youchang fault, Kaoping River fault, and the Chaochou fault, which are believed to delineate the block boundaries. A loop correlation among all the seismic profiles reveals a set of the small-scale strike-slip faults on the crest of Liuchiu anticline, with one of them creeping at a rate of 5-7 mm/yr based on InSAR observations. High-resolution bathymetry around Liuchiu Island further depicts fault scarps and sigmoidal patterns along the faults. To the west of Liuchiu anticline, a large flower structure develops on top of the Fengshan anticline but without clear stratigraphic offsets or difference in layer thickness across the faults. All these features suggest continuous deformation within the accretionary wedge through small-scale strike-slip faulting in the Upper Kaoping Slope domain. Further westward into the Lower Kaoping Slope, discrete deformation can be observed with clear offsets along major faults, one of them being the Youchang fault. Our result suggests that offshore SW Taiwan does not perform block extrusion as a whole. Instead, strike-slip motion is distributed extensively within the medium, possibly due to the weak mudstone layers covering most of offshore SW Taiwan.

Keywords: tectonic escape; vintage seismic data processing; short-offset seismic data; continuous and discrete crustal deformation