Structural analysis in the actively deforming Erhjen River Basin, southwestern Taiwan with insights on shale tectonics

Presenter: Hassan Aleem
Advisor: Prof. Maryline Le Beon
Date: 2023/03/03

Abstract

The Erhjen River Basin is an actively deforming basin located in southwestern Taiwan, occupied by a remarkably thick (>4000m) late Miocene to early Pleistocene Gutingkeng Mudstone (Gtk). Major faults located in the Erhjen River Basin include the Lungchuan Fault, Gutingkeng Fault and Hsiaokangshan Fault (reverse faults), which all dip to the east. Based on geodetic data, the midstream of the Erhjen River Basin is absorbing compression at a rate of ~30 mm/yr. InSAR imagery leveling benchmarks and Holocene incision rates also indicate a significant uplift. Based on the kinematics of reverse faults, we expect to see high deformation rates in the hanging wall, however, in the case of Erhjen River Basin, high deformation is clustered in the footwall side. Hence, I aim to determine whether the zone of high deformation contains more faults or if they are branched from the mapped faults. Firstly, I drew a geological cross-section to understand the structural geometries regionally. The data utilized includes four deep boreholes, seismic data, surface data (bedding dip and strike) and gravity data. Using nannofossils data from our study and previous published data, I classified the Gutingkeng Formation into three units, the Miocene Gtk, Pliocene Gtk and Pleistocene Gtk. Based on my interpretation, the Gutingkeng Fault lies on a ~6km deep detachment and the deepest detachment in the basin is ~7-8 km deep. Furthermore, the Mucha Fault and the Lungchuan Fault originate on the same detachment at a depth of ~4km. Secondly, I conducted field work in the highly deforming footwall of the CPC mapped Gutingkeng Fault to identify structures responsible for high deformation and update my cross-section accordingly. I observed a major shear zone with at least 10s of meters of displacement across it. I measured its orientation (080°/51°S) and identified it as a reverse fault. I propose that this fault might be a branch of Gutingkeng Fault or the continuation of Gutingkeng Fault. In the future, I plan to survey further outcrops in proximity to high deformation zones to account for more active structures. Regarding the shale tectonics, since the Gutingkeng mudstone is a silt-rich mudstone, the

overpressure at depth can be dissipate because of higher permeability of siltstone compared to the claystone. We will try to acquire more comprehension on this problem in the near future.

Keywords: Southwestern Taiwan, regional cross-setion, nannostratigraphy, shear zone, active faults, shale tectonics