Strain localization in accretionary prisms.

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Plate motion varies smoothly (over ~100 km) but results in localized (m to km scale) deformation near plates interface. Strain localization is caused by local stress variations and/or the response of the material to it. Generally, the localization of strain can have two different causes:
(1) A rheological cause, here termed dynamic strain localization. Thereby, strain in a homogeneous material becomes localized because the material softens in certain regions during the deformation (strain softening) due to processes such as grain size reduction, brittle precursor controlled fluid-rock interaction or shear heating.
(2) A structural cause, here termed kinematic strain localization. Thereby, the initial strength of the deformed region is heterogeneous and strain localizes due to initial differences in mechanical strength and/or due to particular geometries. Such localization of strain can occur in linear viscous materials.
Kinematic strain localization is still incompletely understood and may have a major importance (1) in subduction zones, where high sea floor topography is correlated with low plate coupling, i.e. large magnitude earthquakes are less likely to happen; (2) in fold-and-thrust belts where the geometry of the former margins can control the distribution and emplacement of tectonic nappes.
Here I present the results of 2D numerical simulations that demonstrate the importance kinematic strain localization on the structure of fold-and-thrust belts and accretionary prism. Early results towards a scaling law between sea floor topography, stress concentration and strain evolution are also presented.

Keywords: strain localization, accretionary prism

Stress and Kinematic Evolution of the Hoping Area, northeastern Taiwan

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Taiwan is an active mountain belt located at the conjunction between the Eurasian Plate and Philippine Sea Plate. Due to the subduction flip and the southwestward propagation of Okinawa Trough, the northeastern Taiwan is also influenced by the back-arc extension, besides convergence. Therefore, the study at NE Taiwan provides insights into understanding the stress, kinematic and structural evolution of mountain building processes.
According to fault slip inversion and cross-cutting relationship on the core examination of 600m metagranite and field observation, the sequence of structure development associated with stress change in Hoping region is identified as: (1) regional foliation and early quartz veins in reverse faulting stress regime with SE-NW compression; (2) pseudotachylyte in normal faulting stress regime; (3) flattened structure; (4) kink in strike-slip faulting stress regime with N-S compression; (5) fault slip in strike-slip faulting stress regime with SE-NW compression; (6) open filling fluid conduits and calcite veins in normal faulting stress regime with NE-SW extension. Synthesizing the structure characteristics associated with stress field, tectonic meanings of each structure in terms of structural evolution in the Hoping region can be interpreted. The stress field of regional foliation is reflective of oblique compression between Eurasian and the Philippine Sea Plates. Pseudotachylite and flattening structure may represent evidence of syn-tectonic extension. SE-NW compression inferred from kink bands may correspond to the back-arc extension of Okinawa Trough but the compression of oblique collision still can not be ruled out. NE-SW extensional environment of normal faulting stress regime is appeared, consistent with in-situ stress assessment. The finding of pattern of kinematic and stress evolution of structural development compatible with focal mechanism results from local seismic network shed lights on evaluating the stress evolution with time.

Keywords: stress evolution, kinematics, mountain belt, Taiwan

Evolutionary model of oblique-rifting basin : Insights from discrete element method

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The geometry of oblique-rifting basin is strongly related with the angle (α) between the trend of rift and that of regional major extensional stress. The main purpose of this study is to investigate characteristics of geometry and kinematics of structure and tectono-stratigraphy during the evolution of oblique-rifting basin. In this study, we simulated the oblique-rifting basin model of various $\alpha$with Particle Flow Code 3-Dimensions- (PFC-3D). The main theory of PFC-3D is based on the Discrete Element Method (DEM), in which parameters are applied to every particle in the models. We applied forces acting on both sides of rift axis, whichα are 45 , 60 , 75 and 90 degrees ,respectively, to simulate basin formation under oblique-rifting process.
The study results of simulation models indicated that:1. the en echelon faults in the rifting basins are sub orthogonal to the trend of major extensional stress; 2. the density of en echelon faults in rift basins decreases gradually when αis close to 45 degrees ; 3. in these models, the α angles, which are 45 , 60 , 75 and 90 degrees, correspond to the angles of 0, 15 -20 , 25 -30 and 50 -60 degrees between the rift trend and en echelon faults trend. According tothe simulation results, the possible dircetions of major extensional stresses during the formation of oblique-rifting basin can be speculated.

Keywords: oblique-rifting basin, discrete element method, PFC-3D

