Geophysical Research Abstracts
Vol. 20, EGU2018-6909, 2018
EGU General Assembly 2018

Faulting transition processes of Pearl River Mouth Basin, South China Sea, and its implications on the regional tectonic events

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The Pearl River Mouth Basin (PRMB) is a Cenozoic passive marginal rift basin, which is located on the northern continental margin of the South China Sea (SCS). Faults are main deformation in the upper crust of PRMB under the Cenozoic tectonic movements, which are caused by the interactions of plates and deep mantle process. A regional study of PRMB, involving 2-D and 3-D seismic dataset and drilling cores, has been undertaken in order to document the faulting transition processes of PRMB. Both seismic profiles and coherence slices reveal that four groups of faults, including NE-, ENE-, EW- and WNW-trending faults, can be distinguished and control the formation of narrow half-grabens in the northern PRMB (located on the continental shelf) and wide grabens in the southern PRMB (located on the continental slope). Except the pre-existing NE- and WNW-trending faults, the other two groups of faults are developed in Cenozoic. Comprehensive analysis of fault active rates, balanced cross-section restoration, structure-contour and isopach maps indicates that the evolution of fault system in PRMB can be divided into four stages: 1) Early syn-rift stage (65-38Ma), the intensive reactivation of pre-existing NE- and WNW-trending faults and the formation of ENE-trending faults, induced the formation of the PRMB. These features were probably caused by the roll-back of subduction zone of Pacific Plate. 2) Late syn-rift stage (38-30Ma) is typified by the decrease of NE-trending fault active rates and the increase of ENE- and EW-trending fault active rates, which indicated that the regional stress direction changed from NW-SE-directed extension to N-S-directed extension. And this transition was probably related to the southeast-ward migration of mantle convection which was caused by Indian–Asian collision. 3) Post-rift stage (30-10.5Ma), the whole fault system decreased its fault active rates sharply and even stopped active, then the whole basin went into the thermal subsidence stage, which was caused by the seafloor-spreading of SCS. 4) Post-rift faulting stage is characterized by the activities of large population of EW-trending faults (right-lateral left-stepping overlap on the plane) and WNW-trending faults (left-lateral right-stepping overlap on the plane), indicating that PMRB was in a NE-trending right-lateral strike-slip stress filed which was derived from the collision between the Taiwan Island with the Philippine plate.