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The offshore Red River Fault and its impact on the Yinggehai Basin, South China Sea

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The Red River Fault (RRF) is a major NW-trending strike-slip fault that may be followed from the east margin of the Tibetan Plateau to the South China Sea, separating the South China Block to the north and the Indochina block to the south. The RRF experienced three stages, including left-lateral strike-slip stage (44-23Ma), slip reversal stage (23-5.5Ma) and right-lateral strike-slip stage (5.5-0Ma), and its offshore part controls the evolution of Yinggehai Basin (YB). A regional study, involving high-resolution 2-D and 3-D seismic dataset and drilling cores, has been undertaken in order to document the characteristics of offshore RRE and its impact on the evolution of YB. The results show that the offshore RRF mainly consists of two branches, namely Yingxi Fault (west branch, strike NS direction in north part and NW direction in south part) and Yingdong Fault (east branch, strike NW direction). Yingxi Fault, dipping to NE, is a narrow negative flower structure on the seismic profiles. Yingdong Fault, dipping to SW, consists of several faults arranged in right-stepping form on the plane and is a steep normal fault on the seismic profiles. The combined analysis, including seismic profiles, drilling cores, subsidence history, structure-contour and isopach maps, demonstrates that: 1) YB is a simple left-lateral pull-apart basin associated with left stepping of Yingxi Fault and Yingdong Fault. 2) YB experienced three stages of tectonic evolution, including left-lateral pull-apart stage (44-23Ma), depression stage (23-5.5Ma) and rapid subsidence stage (5.5-0Ma). 3) Slip reversal of RRE caused uplift of northwest part of YB where erosion occurred on the top of Nsy sequence (23-15.5Ma) and Nms sequence (15.5-10.5Ma), and accelerated subsidence of southeast part of YB, which is evidenced by the southeastwards migration of sedimentation center from the hanging wall of Yingxi Fault in left-lateral pull-apart stage to the hanging wall of Yingdong Fault in depression stage.