Thermo-rheological structure of the northern margin of the South China Sea: structural and geodynamic implications

Jie Hu$^{1,2,3}$, Yuntao Tian$^{4,5}$, Zulie Long$^6$, Di Hu$^{1,2,3}$, Yuping Huang$^6$, Yibo Wang$^{1,2,3}$, and Shengbiao Hu$^{1,2,3}$

1State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China
2University of Chinese Academy of Sciences, Beijing 100049, China
3Innovation Academy for Earth Science, Chinese Academy of Sciences, Beijing 100029, China
4Guangdong Provincial Key Laboratory of Geodynamics and Geohazards, School of Earth Sciences and Engineering, Sun Yat-sen University, Guangzhou 510275, China
5Southern Marine Science and Engineering Guangdong Laboratory, Zhuhai 519082, China
6Shenzhen Branch of China National Offshore Oil Corporation, Shenzhen 518000, China

Rheological properties of continental lithosphere are key controls on the behavior of continental deformation. Using thermal structure, constrained by surface heat flow data and measured thermal properties of rocks, the present study calculates different thermo-rheological structure scenarios for the ocean–continent transition (OCT) at the northern margin of the South China Sea, using two different models: a conventional model, taking into account frictional sliding and power-law creep, and a model that additionally includes a high-pressure brittle-fracture mechanism. Two compositions of the lower part of the lithosphere are considered: a soft case with felsic granulite lower crust and wet peridotite lithospheric mantle, and a hard case with mafic granulite lower crust and dry peridotite lithospheric mantle. The former scenario shows a major rheological change from a “jelly sandwich” to a “Christmas tree” type of rheology from north to south along the margin. This complex rheological structure explains lateral changes in earthquake distribution and geometries of extensional faults of the OCT at the northern margin of the South China Sea. Further, our analyses indicate that the initial lithospheric rheology profile probably has only one ductile layer in the lower part of upper crust. Such an initial lithospheric rheology model predicts focused extension to form asymmetric margins, which is the case for the SCS.

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