Geophysical Research Abstracts
Vol. 12, EGU2010-2457, 2010
EGU General Assembly 2010

The continent-ocean transition at the southern margin of the South China Sea

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The South China Sea is surrounded by magma-poor or non-volcanic rifted margins like Iberia, Newfoundland and southern Australia. Seafloor spreading started in the Early Oligocene. The area thus is at an evolutionary stage in between the Late Miocene Woodlark Basin and the Cretaceous Iberia/Newfoundland margins or the ancient Mesozoic margins preserved in the Alps. We focus on the southern margin of the South China Sea and the transition area from oceanic crust to extended continental crust between the continental blocks of Reed Bank and the islands of Palawan/Calamian Group. Several BGR surveys, the last one in 2008, have established a database of more than 5.000 km of regional multi-channel reflection seismic lines, accompanied with magnetic and gravity profiles.
One of the key issues of the 2008 survey was to investigate the structure and architecture of the transitional area between continental and oceanic crust (COT).

Our approach to define the COT was based on
• identification of the outermost fault-blocks defining stretched continental crust
• identification of typical high-frequency diffractive oceanic crust reflections in the stacked sections
• identification of seafloor-spreading anomalies and the transition to small-scale magnetic variation of presumably continental crust
• identification of the landward extent of the oceanic Moho reflection
• Lateral extent of the break-up unconformity
• Gravity modelling

The COT was found to be highly variable along the newly acquired lines. We distinguish between two types showing different styles of continent-ocean transitions.
One type of continent-ocean transition shows a distinct outer ridge at the COT. The recent seafloor relief is steep. The ridge is elevated for about 1-1.5 s (TWT) with respect to the rift-onset unconformity or top oceanic crust, respectively. A clear magnetic signal might imply a volcanic/magmatic origin for the ridge. However, we observe extensional faults at the rims and also within this ridge that are not expected for volcanic intrusions.
The other type is characterized by rotated fault blocks, bounded by listric normal faults that ramp down to a common detachment surface. Above the strongly eroded pre-rift basement half-grabens developed. Small-scale offsets in the basement are levelled out by the overlying sediments. The seafloor relief is smooth across this type of COT. There are examples of continuous listric extensional faults of more or less equal through and also equal block geometry from the continental to the oceanic crust. This results in a gradual deepening of the continental basement to the oceanic crust. Alternatively horst structures of varying size are located between the rotated faults blocks. A common observation here is a major listric normal fault that bounds the oceanic crust to the most seaward located fault block or local high.