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Geological evolution of the West Luzon Basin (South China Sea, Philippines)

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Interpretation of new multichannel seismic data sheds insights into the geologic evolution of the West Luzon Basin (WLB), Philippines. The basin stretches for about 200 km in north-south direction and for up to 50 km in east–west direction. The West Luzon Basin is a sediment-filled trough that is located between the island of Luzon and the outer arc high of the eastward directed subduction of the South China Sea oceanic crust at the Manila Trench. However, at the southern end of the Manila Trench, where its trend changes from N-S to NW-SE and projects towards Mindoro, continental collision occurs (e.g. Lewis & Hayes, 1985).

In 2008 approximately 1000 line-kilometres of regional multichannel seismic (MCS) data were obtained in the area of the WLB during a cruise with the German research vessel SONNE.

In our MCS data six major unconformities in the WLB separate major stratigraphic units. We interpret high-amplitude, low-frequency reflection bands as acoustic basement that is dissected by normal faults. In the deep parts (4.5-5 s; TWT) of our E-W running seismic profiles we can trace a major fault system with a fault offset of 1-1.5 s (TWT). We suggest an initial development of the structure as a normal fault system, which later was inverted locally. A major change in the depositional regime occurs in the lower part of the sedimentary infill. A distinct bottom simulating reflector (BSR) is commonly observed.

Grid calculations of the sediment thickness of the lower stratigraphic units give detailed values of deposition shifts and reveal variations in subsidence of the basin. Based on the depth of bottom simulating reflectors (BSR) heat flow values of 35-40 mW/m^2 were calculated, which are typical for forearc basins.

Two peculiarities of the WLB are not well in accordance with a forearc setting:

The acoustic basement was affected by extensional deformation resulting in normal faulting with fault offsets up to 400 ms (TWT) but extension did not affect sedimentary layers above the acoustic basement. In E-W trending seismic profiles we can track the subducting oceanic crust under the acoustic basement of the forearc basin for up to 11 km landward of the outer arc high. There is only 1 s (TWT) thick material between the top oceanic crust reflection and the basement of the WLB.

As the northern boundary of the continental fragments South of the WLB is unclear we speculate that the basin may be (partly) underlain by continental crust. This area was affected by rifting prior and during the opening of the South China Sea and the basin was overprinted at a later stage by a forearc structural setting when subduction was initiated.