

Tectonic Implications from the Subduction Structure at the South Shetland Trench, Antarctica

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New multichannel seismic data characterize the northern South Shetland Trench as the low stress type with a horst and graben structure and relatively thin accretionary wedge above the overriding plate. The oceanic basement seaward of the trench is highly irregular and deformed by numerous faults. Numerous high angle faults form a horst and graben structure near the trench. The seabed deepens from the northwest and becomes flat above the trench.

The trench sediments consist of flat trench-fill sediments which onlap the oceanic sediments dipping with basement. The maximum thickness of trench sediments is 900 m under the toe of the trench. The oceanic sediments within the trench become thin landward because of the weight of overlying sediments. A series of landward dipping reflectors is seen in the upper part of accretionary wedge. These are thrust faults and merged into a strong and low-frequency reflector below. This strong reflector is a basal decollement and can be traced 10 km landward below the accretionary wedge.

Thick accumulation of trench sediments is not expected in the active subduction zone with a horst and graben structure since the structure effectively carries trench sediments down into the trench. Relatively thick trench sediments may indicate that subduction process was stopped at present along the South Shetland Trench. Absence of moderate-sized earthquakes along the thrust zone in the South Shetland Trench strongly supports the view of subduction stoppage. However the frontal thrust which deforms the trench sediments all the way to the top suggests that the trench is under crustal shortening. Compressional stress which causes crustal shortening presumably comes from the Bransfield extension behind the South Shetland Islands arc. Current Bransfield extension generates compressional stress toward Drake Passage and this stress causes diffuse intraplate deformation in the South Shetland Trench.

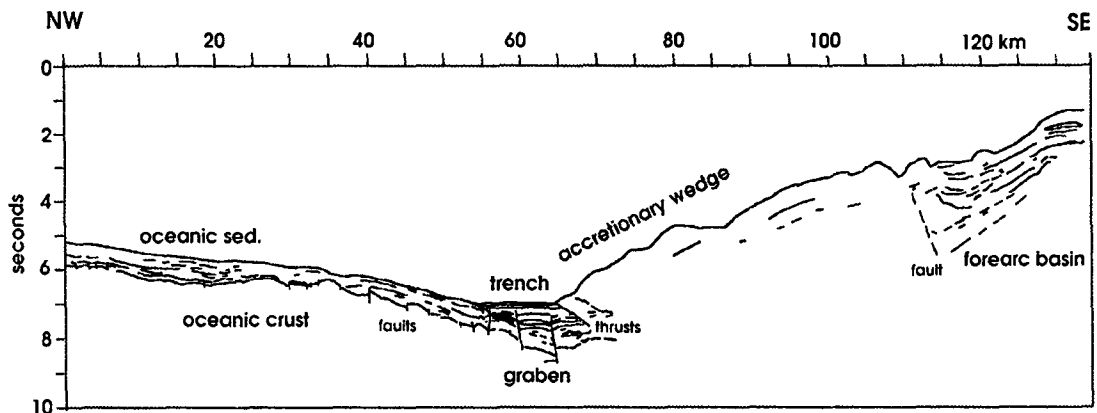


Fig. 1. An interpreted seismic profile obliquely crossing the axis of the South Shetland Trench.