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Prebreakup Sedimentary and Volcanic Sequences on Rifted Continental Margin of Wilkes Land, Antarctica

The transition zone from continental crust to oceanic crust on the Wilkes Land, Antarctica, margin was surveyed with 24-fold multichannel seismic reflection along 1,800 line-km in 1984. The northward transition from extended continental crust to normal oceanic crust is characterized by a progression through three distinct volcanic sequences. The first, deposited on extremely thin continental crust, is interpreted to be a flood basalt, presumably deposited during the late rifting stage. The second, which overlaps the

first at its northern end, is a seaward-dipping reflector sequence that forms anomalously thick oceanic crust. The third, which in turn onlaps the second, is normal oceanic crust with a rough upper surface and no internal reflectors.

A deep marginal basin, containing synrift deposits and topped by a breakup unconformity, lies landward of these volcanic sequences in the region of attenuated continental crust. These synrift deposits have a seismic velocity of 3.6 ± 0.5 km/sec, and are as thick as 4 km in the deepest part of the basin adjacent to the edge of oceanic crust. Because the breakup that culminated the rifting phase between Antarctica and Australia occurred at about 96 Ma, the synrift deposits are Early Cretaceous and perhaps Late Jurassic in age. The deepest sequence on attenuated continental crust is a highly stratified, block-faulted unit of 4.2 ± 0.4 km/sec seismic velocity as much as 4 km thick that is bounded below by shallow-dipping faults or decollements. The fault blocks are back- and fore-rotated, and the offset of marker horizons indicates extension not exceeding 25%. Whether this deepest stratified unit is prerift or synrift is debatable. Its relatively high seismic velocity, erosional upper surface, and lack of syndepositional faulting indicate prerift. However, the relatively mild extension to which it was subjected, with block rotations rarely exceeding 10°, makes it less likely to be a prerift depositional unit, as studies in known extensional regions normally show block rotations that produce steep dips and extension commonly exceeding 25%.

Moho reflectors can be followed from beneath oceanic crust landward to a depth of 20 km beneath attenuated continental crust. Steps in the Moho along its descent beneath the continent suggest subcropping crustal shear zones or faults that accommodated the thinning of the overlying attenuated continental crust.