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Sedimentary Basins in Ross Sea, Antarctica

The Ross Sea lies in the Pacific sector of the Antarctic continental margin. Three major sedimentary basins (from east to west, the Eastern, Central, and Victoria Land basins) lie beneath the broad, deep (400-1,000 m) continental shelf of the Ross Sea. These north-south-trending basins occur in the extensionally deformed region between East and West Antarctica. Multichannel seismic reflection (MCS) surveys have been conducted over these basins since 1980 by West German, French, Japanese, and U.S. expeditions.

The MCS and previous geophysical surveys have shown that the three basins contain 5-6 km of sedimentary rock, possibly Late Cretaceous and younger. An additional 6-8 km of sedimentary and volcanic rock lies within the deeper parts of the Victoria Land basin. The basins are separated by uplifted and eroded basement ridges covered by thin sedimentary sections. Each basin has distinct characteristics, commonly related to its extensional origin. The Eastern basin, a 300-km wide basement trough, is deepest along its west flank and structurally opens into the Southern Ocean. This basin is filled, in part, by an upper sequence of seaward-prograding Miocene(?) and older(?) layered sedimentary rock. The Central basin, a 100-km wide depression, is bounded by high-angle basement faults and, like the Eastern basin, is filled with a nearly flat sedimentary section. A positive gravity anomaly, possibly rift related, coincides with the axis of the basin.

The Victoria Land basin (VLb) is structurally the most complex. MCS data, collected by the U.S. Geological Survey in 1984, show extensive deformation (faulting, uplift, intrusion) of the layered sedimentary section within the 150-km wide asymmetric basin. An axial rift zone, possibly Paleogene to Holocene in age, comprises a sediment-filled graben and an adjacent magmatically intruded arch. The rift is superimposed upon older basin structures and deeply buried rocks of possible late Mesozoic and older age. The VLb and rift zone parallel the Transantarctic Mountains for nearly 300 km from northern Victoria Land to Ross Island, an active volcanic center, and possibly farther southward.

Petroleum hydrocarbons are unknown from the Ross Sea region, with the possible exception of ethane gas recovered by the Deep Sea Drilling Project. Previous model studies, based on estimated sediment thickness, assumed temperature gradients, and postulated seismostratigraphy, indicate that hydrocarbons could be generated at depths of 3.5-6 km within the sedimentary section. However, this hypothesis cannot be verified without further geologic and geophysical data from the Ross Sea region.