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Forced sea-level change in a forearc basin related to subduction of a spreading ridge: the Fossil Bluff Group (Jurassic-Cretaceous), Alexander Island, Antarctic Peninsula

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During the Mesozoic, the Antarctic Peninsula was the site of an active volcanic arc related to the eastwards subduction of proto-Pacific oceanic crust. Alexander Island is the largest of the many islands that lie on the western (fore-arc) side of the Antarctic Peninsula; it forms one of the best-exposed ancient fore-arcs in the world. The pre-Tertiary rocks can be divided into two main units. The LeMay Group (Jurassic-Tertiary) forms the structural basement to Alexander Island and comprises greenschist-facies metasedimentary rocks. It is interpreted as a Mesozoic accretionary prism. The Fossil Bluff Group unconformably overlies and is faulted against the LeMay Group; it represents the sedimentary fill of a coeval fore-arc basin.

Subduction ceased due to a series of Cenozoic ridge-trench collisions which began off Alexander Island at 50 Ma and got progressively younger to the north. However, the approach of the ridge can be inferred from the Mesozoic deposits of the Fossil Bluff Group (Jurassic-Cretaceous) in Alexander Island. In this paper, I will show that the ocean floor being subducted became progressively shallower through Jurassic and Cretaceous time (by at least 1,000 m). The result in the forearc basin was a sudden shallowing in water depths from at least 1,000 m at 125 Ma, to emergent at 100 Ma. This forced shallowing ended sedimentation in the basin and resulted in considerable topography on Alexander Island that persists to the present day.