

Erosional unconformity or non-deposition? An alternative interpretation of the Eocene seismic stratigraphy offshore Wilkes Land, East Antarctica

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Abstract

The sedimentary stratigraphy along the conjugate Australian-Antarctic continental margins provide insights into their tectonic evolution as well as changes in paleoceanographic conditions in the Southern Ocean. A comprehensive network of multichannel seismic reflection data as well as geological information from drill cores have been used to interpret the stratigraphic evolution of these margins. However, a number of alternative seismic interpretations exist for the Antarctic side, particularly due to sparse drill core information. A prominent high-amplitude reflector observed along the margin, extending from the continental shelf to the foot-of-slope, is at the centre of debate. Recently, two major hiatuses (from 33.6 - 47.9 Ma and 51.06 - 51.9 Ma) were recovered by the IODP drill core U1356A offshore Wilkes Land and correlated to this prominent reflector. Previous seismic stratigraphic investigations interpreted this structure as an erosional unconformity and proposed different events as a possible cause for this formation, including first arrival of the continental glaciation at the coast at about 34 Ma, increase in spreading rate between Australia and Antarctica at about 45 Ma and drastic global sea level drop of 70 m at about 43 Ma. However, such a large-scale erosion must consequently lead to a re-deposition of a significantly large amount of sediment somewhere along the margins, but, to date, no such deposition is observed in the seismic reflection data.

Here, we present an alternative seismo-stratigraphic interpretation based on correlation to the sedimentary structures along the Australian margin. We argue that the prominent unconformity is formed due to non-deposition of sediment between ~47.8 and ~33.6 Ma. The sedimentary units underlying this unconformity show strong similarities in structure, seismic characteristics and variation along the margin with sequences that are partly exposed to the seafloor at the foot of the Australian slope. On the Australian flank, the age of these exposed sediment sequences ranges from ~65 Ma to ~45 Ma. Low to no sedimentation from 45 Ma to the present-day offshore Australia has been interpreted to explain the exposure of these old sediment units. We propose that non-deposition occurred along both margins from ~45 Ma, until large-scale glacial deposition started at 33.6 Ma along the Antarctic margin.

Using our new interpretation, we create paleo-bathymetric reconstructions using the software BALPAL at ~83 Ma, ~65 Ma and ~45 Ma. The resulting paleo-bathymetric maps provide essential information, e.g. for paleoceanographic and –climatic investigations in the Southern Ocean.

Keywords: Seismic stratigraphy, paleobathymetry, Australian Antarctic margins, Eocene