The break-up of eastern Gondwana as viewed from northern Zealandia

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Zealandia, a submerged block of continental crust in the southwest Pacific, records the Late Cretaceous continental rifting that preceded the break-up of eastern Gondwana. Northern Zealandia provides the main record of this break-up because it represents the extended upper plate of an asymmetrical rifted margin. The tectonic record of break-up is provided by both intraplate volcanism and multiple subsidence and uplift events found on what is the wide conjugate margin to eastern Australia. Given that Zealandia is 95% submerged, seafloor geophysical observations are essential to studies of eastern Gondwana break-up. We use wide-angle seismic velocity constraints from OBS recordings and pre-stack depth-migrated multi-channel seismic reflection data to examine a profile across poorly-studied northwestern Zealandia. These data provide evidence that oceanic crust lies beneath the Middleton Basin, an enigmatic basin that separates the Dampier Ridge and Lord Howe Rise. The presence of oceanic crust between these two known continental blocks implies two-stage break-up of eastern Gondwana, starting first at the Middleton Basin and later jumping to the west to open the Tasman Basin. Thus, the Dampier Ridge, which has experienced rifting and break-up from both the east and the west, is a key to understanding the break-up of eastern Gondwana. Bathymetric analysis of the Dampier Ridge reveals a range of previously unknown seafloor features that contrast the relatively featureless seafloor of the largely buried Lord Howe Rise. Seismic data from the Dampier Ridge show that basement features do reach the seafloor as NW–SE-striking ridges that are approximately perpendicular to the presumed opening direction of the Tasman Basin. However, the Middleton Basin is oriented north–south and previous work has shown that many structures on the Lord Howe Rise also strike north–south. This indicates a regional stress change during the second stage of seafloor opening to form the northern Tasman Basin. Much of the continent–ocean transition on the west side of the Dampier Ridge is characterized by a steep and linear NE–SW-trending scarp with potential indicators for transform faulting arising from the largely oblique opening of the Tasman Basin. This contrasts with the continent–ocean transition on the east side of the Dampier Ridge, which has largely been buried by post-rift sediments. These observations suggest that the two-stage break-up history of eastern Gondwana was controlled by a reorientation of regional stress from E–W to NE–SW.

Keywords: Zealandia, Continental Break-up, Tectonics, Southwest Pacific

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