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The break-up of eastern Gondwana revealed from northern Zealandia

Brian Boston (1), Flora Gallais (1), Yasuyuki Nakamura (1), Gou Fujie (1), Shuichi Kodaira (1), Seiichi Miura (1), Ron Hackney (2), Yuka Kaiho (1), Kan Aoike (1), and Saneatsu Saito (1)

(1) Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan (bboston@jamstec.go.jp), (2) Geoscience Australia, Canberra, Australia

The widespread submerged continental crust in the southwest Pacific, now known as Zealandia, records the continental rifting and thinning during the Late Cretaceous that proceeded break-up of the eastern Gondwana supercontinent. Due to asymmetrical break-up, uplift events, and intraplate volcanism along the conjugate eastern Australia margin, northern Zealandia provides the primary record of the rifting and the break-up of the eastern Gondwana margin. However, because of its remoteness from continental landmasses, northwestern Zealandia remains one of the least understood continental margins. This project uses both pre-stack depth migrated multi-channel seismic reflection data and wide-angle seismic velocity constraints to examine a profile across the northwestern Zealandia margin. Collected in 2016, this dataset provides evidence that oceanic crust is located within the Middleton Basin between the continental Dampier Ridge and Lord Howe Rise. The presence of oceanic crust in the Middleton Basin implies two stages of seafloor opening during the break-up of eastern Gondwana, starting in the Middleton Basin and later jumping to the west of the Dampier Ridge to open the Tasman Basin. This scenario generates new interest in the deformational processes of the Dampier Ridge, which has experienced rifting and break-up from both the east and the west, as a key to better understanding the break-up of eastern Gondwana. An additional survey conducted in late 2017 provided broader, more detailed bathymetric coverage of the Dampier Ridge. These new data reveal a range of seafloor features that contrast the largely buried Lord Howe Rise. Seismic constraints from the Dampier Ridge show that basement features do reach the seafloor as NW–SE-striking ridges that are approximately perpendicular to the opening direction of the Tasman Basin. However, previous work has shown that many structures on the Lord Howe Rise strike north-south, which indicates a regional stress change during the second stage of seafloor opening in 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 basin. These results suggest that the two-stage break-up history of eastern Gondwana may be related to a regional stress reorientation.