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Aeromagnetic evidence for a major strike-slip fault zone along the boundary between the Weddell Sea Rift and East Antarctica

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The >500 km wide Weddell Sea Rift was a major focus for Jurassic extension and magmatism during the early stages of Gondwana break-up, and underlies the Weddell Sea Embayment, which separates East Antarctica from a collage of crustal blocks in West Antarctica. Here we present new aeromagnetic data combined with airborne radar and gravity data collected during the 2010-11 field season over the Institute and Moeller ice stream in West Antarctica. Our interpretations identify the major tectonic boundaries between the Weddell Sea Rift, the Ellsworth-Whitmore Mountains block and East Antarctica. Digitally enhanced aeromagnetic data and gravity anomalies indicate the extent of Proterozoic basement, Middle Cambrian rift-related volcanic rocks, Jurassic granites, and post Jurassic sedimentary infill. Two new joint magnetic and gravity models were constructed, constrained by 2D and 3D magnetic depth-to-source estimates to assess the extent of Proterozoic basement and the thickness of major Jurassic intrusions and post-Jurassic sedimentary infill. The Jurassic granites are modelled as 5-8 km thick and emplaced at the transition between the thicker crust of the Ellsworth-Whitmore Mountains block and the thinner crust of the Weddell Sea Rift, and within the Pagano Fault Zone, a newly identified $\sim$75 km wide left-lateral strike-slip fault system that we interpret as a major tectonic boundary between East and West Antarctica. We also suggest a possible analogy between the Pagano Fault Zone and the Dead Sea transform. In this scenario the Jurassic Pagano Fault Zone is the kinematic link between extension in the Weddell Sea Rift and convergence across the Pacific margin of West Antarctica, as the Dead Sea transform links Red Sea extension to compression within the Zagros Mountains.