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Basement faults as a control on crustal architecture and topography at the transiton between Northern Victoria Land and the Wilkes Subglacial Basin (East Antarctica)

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Major terrane bounding and intra-terrane faults have been recognised from extensive geological investigations within the partially exposed basement rocks of Northern Victoria Land (NVL) in East Antarctica. These major fault systems were active during the Ross Orogen and are related to several phases of Cambrian to Ordovician age subduction and crustal accretion along the active paleo-Pacific margin of Gondwana. Here we compile and analyse enhanced aeromagnetic and gravity anomaly images from NVL to the eastern margin of the Wilkes Subglacial Basin (WSB) to image the subglacial extent and tectonic architecture of these major fault systems within the basement. Our two-dimensional magnetic and gravity models predict that linear and long-wavelength magnetic lows and residual Bouguer gravity highs over the central Wilson Terrane reflect several-km thick inverted sedimentary basins of early Cambrian(?) age. Tectonic inversion occurred primarily along major thrust faults, formed in a dominantly transpressional late stage of the Ross Orogen. Further west, a major fault system flanks the eastern margin of the Wilkes Subglacial Basin, and connects to the previously interpreted Prince Albert Fault System to the south. This fault system can now be recognised as lying west of the Exiles Thrust fault system, rather than representing its southern continuation (e.g. Ferraccioli and Bozzo, 1999, JGR). Relatively thin sheets of mylonitic sheared granitoids and possible ultramafic lenses are modelled as being associated with the late-Ross (ca 480 Ma) Exiles Thrust fault system, while significantly larger and thicker batholiths were emplaced along the Prince Albert Fault System. Recent zircon U–Pb dating over small exposures of gabbro-diorites within the Prince Albert Mountains to the south lead us to propose that this part of the magmatic arc was emplaced along a major pre-existing fault during an earlier phase of subduction (>520 Ma or older). This attests to a long-lived and composite magnatic arc system, which likely migrated in response to changes in the geometry and dynamics of the subduction system, much like several modern arc systems. Whether the Prince Albert Fault System was indeed a major arc-continent suture in early Cambrian times, as proposed by Ferraccioli et al., 2002 (GRL), or simply an arc to back-arc, or alternatively an arc to forearc transition, remains to be more fully understood. Irrespective of possible alternative models for the original tectonic setting of these faults during the Ross Orogen, we show by combining aeromagnetic interpretation and topographic lineament analyses that these major terrane bounding and intra-terrane basement faults exerted a key influence both on the tectonic segmentation of the Transantarctic Mountains into discrete Cenozoic fault-blocks and on the subglacial topography along the eastern margin of the WSB.