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Revealing the crustal architecture of the least understood composite craton on Earth: East Antarctica

East Antarctica hosts one of the largest Precambrian cratons on Earth. Meager coastal exposures and sediment provenance studies provide glimpses into up to 3 billion years of its geological history. Extensive ice sheet cover hampers however our knowledge of crustal architecture, and consequently the geodynamic processes responsible for the growth and amalgamation of East Antarctica have remained elusive. Here we exploit recent aerogeophysical exploration efforts to help unveil the large-scale crustal architecture of East Antarctica. We focus on three sectors of East Antarctica: the Transantarctic Mountains and Wilkes Basin area; the Recovery/Dronning Maud Land area and the Gamburtsev Province. These areas provide new insights into both the margins of the so called Mawson craton and the processes that affected its interior. A 1,900 km-long linear magnetic and gravity boundary is imaged along the western flank of the Wilkes Basin and interpreted here as a crustal-scale Paleoproterozoic suture zone (ca 1.7 Ga) that inverted a former passive margin. Two ribbon-like Archean and Paleoproterozic microcontinents were assembled during this stage, resembling modes of amalgamation of Paleoproterozoic microcontinental ribbons in Australia. The proposed Proterozoic sutures and microcontinent boundaries also influenced Neoproterozoic rifted margin and early Cambrian back-arc basins in the Wilkes Basin/Transantarctic Mountains region. In the Recovery/Dronning Maud Land region our new potential field compilations reveal a wide tract of anastomising crustal-scale shear zones, likely of Pan-African age that flank and variably deform the margins of several distinct Archean, Paleo-Mesoproterozoic and Grenvillian age crustal blocks. In the Gamburtsev Province new magnetic and gravity models provide insights into the Gamburtsev Suture (Ferraccioli et al., 2011, Nature) that separates the Ruker Province from an inferred Grenvillian-age orogenic Gamburtsev Province with remarkably thick crust (up to 60 km thick) and thick lithosphere (over 200 km thick). We suggest that a recently inferred Tonian-age accretionary belt identified in the Sor Rondane region continues further inland in the Gamburtsev Province and was likely also reactivated during Pan-African age transpression linked to Gondwana assembly.