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Crustal architecture of the Gamburtsev Province in East Antarctica

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The Gamburtsev Subglacial Mountains in interior East Antarctica are underlain by 50-60 km thick crust imaged by gravity and seismic models (Ferraccioli et al., 2011; An et al., 2015). In contrast, the composite Archean to Mesoproterozoic Mawson craton that occupies the Wilkes and Terre Adelie sector of East Antarctica typically features only 40-45 km thick crust (Aitken et al., 2014). Over 200 km thick and seismically fast lithosphere underlies the Gamburtsev Province, as typically observed over Precambrian lithosphere that has not been substantially reworked during Phanerozoic subduction or collision. Satellite and airborne magnetic data indicate that the Gamburtev Province is sandwiched in between distinct Precambrian lithospheric blocks including the Ruker, Princess Elizabeth Land, Vostok, Nimrod (Goodge and Finn, 2010), South Pole and Recovery provinces.

Ferraccioli et al., (2011) proposed that a segment of a stalled orogen (i.e. an orogen where widespread orogenic collapse and root delamination has not occurred) is preserved in the Gamburtsev Province and further hypothesised that its origin relates to widespread accretionary and collisional events linked to the assembly of the Rodinia supercontinent. However, recent passive seismic interpretations (An et al., 2015) indicate that crustal thickening may relate instead to Pan-African age assembly of Greater India, East Antarctica and Australia within Gondwana.

Here we interpret a set of enhanced magnetic and gravity images, depth to magnetic and gravity sources and preliminary 2D and 3D forward and inverse models to characterise in detail the crustal architecture of the Gamburtsev Province. We use 3D flexural models to compute gravity signatures arising from Moho depth variations across interior East Antarctica and then derive residual intra-crustal gravity anomalies that are easier to analyse together with aeromagnetic signatures. We then contrast our new geophysical interpretations with previous findings in the Prince Charles Mountains (McLean et al., 2009), the Sør Rondane region (Mieth et al., 2014; Ruppel et al., 2015) and the eastern Dronning Maud Land province (Mieth and Jokat, 2014).

We conclude by hypothesising that the Gamburtsev Province may be part of a widespread 1000–900 Ma? accretionary belt in interior East Antarctica linked to the recently inferred Tonian Oceanic Arc Superterrane province, which was at least partially overprinted by 630-500 Ma metamorphism and granitoid magmatism (Jacobs et al., 2015). If this hypothesis holds true then the Gamburtsev Province was not an integral part of Rodinia and may have been affected by “Pan-African” age collisional processes responsible for juxtaposing Greater India and a collage of distinct East Antarctic blocks/terranes (e.g. Aitken et al., 2014).

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