East Antarctica is the least understood continent on Earth due to its vast size, major ice sheet cover and remoteness. Coastal outcrops and glacial erratics have yielded cryptic but nevertheless fascinating clues into up to 3 billion years of East Antarctica's geological and tectonic evolution. These geological constraints represent in turn the pillars to address global geodynamic linkages between East Antarctica, Australia, India, South Africa and Laurentia in the growth, assembly and dispersal of Gondwana, Rodinia and Nuna during the complex evolution of Earth's supercontinent cycles. However, due to the lack of drilling, our ability to project, test and augment such supercontinental linkages and several speculative geological interpretations in the interior of the continent beneath the East Antarctic Ice Sheet remains very limited.

While airborne and satellite gravity data and seismology are providing key new constraints on crustal and lithosphere thickness and help unveil large-scale heterogeneity in the East Antarctic lithosphere, detailed imaging of the architecture of individual crustal domains and their tectonic boundaries relies critically on magnetic anomaly data interpretation.

Here we exploit ongoing analyses of a recent continental-scale magnetic anomaly compilation (ADMAP 2.0) (Golynsky et al., 2018, GRL) augmented by major new datasets we recently collected, processed and compiled over the Recovery and South Pole frontiers and enhanced satellite magnetic imaging to:

1) reveal a more complex mosaic of distinct but in several places still cryptic Precambrian crustal provinces that represent the building blocks of interior East Antarctica;

2) provide new geophysical constraints that can be used to test different hypotheses of East-West
Gondwana amalgamation along several candidate suture zones, including in particular the Shackleton suture zone, which provides a unique window on several distinct Precambrian terranes at the inferred leading edge of the composite Mawson Continent, as well as unique occurrences of Pan-African age rocks of ophiolitic affinity and

3) re-assess potential paths and the significance of the Kuunga suture zone between Greater India and East Antarctica and re-evaluate the tectonic origin of a major magnetic and gravity lineament previously thought to delineate the Indo-Australo-Antarctic suture and finally

4) propose new surveys in other frontier regions including in particular the under-explored interior of Princess Elizabeth Land and Recovery Subglacial Highlands that are critical in order to test the possible connectivity of the Kuunga, Gamburstev and potentially also Shackleton suture zones.

Finally, we showcase examples of how we are combining aeromagnetic and gravity interpretations for East Antarctica with global magnetic and gravity datasets, geochronology, geochemistry, geology, tectonics and palaeomagnetic data in an evolving plate kinematic framework (in GPlates) to re-assess supercontinent reconstructions with particular emphasis so far on Nuna and Gondwana.